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Examining Female Students' Motivation and Preferences for Course Choices in an Undergraduate ICT Program in a Californian University

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Abstract

This paper reports on a study of female students' motivations and preferences for course and career choices in an Information Communications and Technology (ICT) undergraduate program. Descriptive-interpretive phenomenology was adopted to investigate the phenomenon. Bandura's self-efficacy framework was influential in interpreting participants' motivation toward course choices and preferences. Findings revealed intrinsic and extrinsic motivation as significant influences on participants' decisions to go into either technical or design majors of the ICT field. Extrinsic motivation came from influences such as stereotyping of gender abilities, prior computing skills, and role models while intrinsic motivation was based on individuals' career interests and self-efficacy in specific sectors. Findings reflected that the majority of female participants preferred the design track within the ICT career field (web design, computer animation, and instructional design), with interest in self-employment. A very small number of female participants enrolled in the technical track involving computer programming, networking, and database administration, indicating female students' preference for the design aspects of ICT.

Introduction

Despite the growing increase in women's use of word processors, the Internet, and the World Wide Web giving the perception that the gender gap in ICT has narrowed, the literature reviewed reflects women's skewed interest in the design aspects of ICT careers as opposed to the more technical aspects (Gatta & Trigg, 2001; Lang, 2003; Lanius, 2003; Thom; 2001; Wijcman, 2000). Questions explored in this study examined the extent to which specialization in design reflects women's areas of interest and perceptions that their only employable ICT skills are design-related. Additionally, this study considered the ways in which women's interests and program choices position women within the larger ICT labour market. The design aspect of ICT in this study refers to desktop publishing, web design, graphic design, computer animation, instructional design, and word processing. On the other hand the technical aspect of ICT refers to computer programming, telecommunication, network engineering, and database administration. Design and technology were the specific areas of specialization provided in the different tracks of the Information, Communications, and Technology (ICT) undergraduate program under study.

Therefore, the purpose of this study was to determine women's course and career preferences in the ICT program, identifying those experiences that influenced or motivated their choices into specific fields of interests. This was necessary to determine how participants perceived the implications of these preferences on their future employment opportunities in the current ICT labour market. Bandura's (1997) self-efficacy theory is used in the study to explain how women as agents proactively engage in their own career development. Self-efficacy theory in this study provides an understanding that, among other personal factors, women possess self-beliefs that enable them to exercise a measure of control over their thoughts, feelings, and can take actions that benefit their career development in the ICT field.

Gender Preferences in ICT Courses and Careers

Although studies show that women make up fifty percent of the overall United States of American (USA) workforce (Fountain, 1999; Gatta & Trigg, 2001), the majority of women in the ICT workforce remain predominantly users rather than developers, such as with design and construction (Fountain, 1999; Gatta & Trigg, 2000; Lang, 2003; Lanius, 2003; Wajcman, 2000). Studies by Holzberg (1997) and Gatta and Trigg (2001) indicate that women were less likely than men to major in computer science, programming, and network engineering. Even the few who transcend societal barriers that limit women to traditional careers and enter ICT courses are still not likely to seek highly technically related jobs in ICT or often leave these careers in the end. Studies by Gatta and Trigg (2001) showed that only 1.8% of freshmen women from 434 colleges and state universities in California, in the fall of 2000, had interest in computer programming compared to 9.3% of their male counter parts.

The National Center of Education (NCES) (2004) confirms female under-representation in the technical aspects of ICT in the USA work force. Their statistics show the distribution of women in ICT employment in 2004, when the report was compiled, as being 79% in word processing and desktop publishing, 34% in graphic design, and 14% in computer programming. Wajcman (2000) reiterated that the absence of women in the technical aspects of ICT, such as computer programming, is partly due to their concentration on the design aspects of ICT. This depicts the technical aspect of ICT as a preserve for men, restricting the majority of women to narrower job experiences in the current Technology work environment (Fountain, 1999; Lanius, 2003). However, Mitter (1995) warns about the paradigm shift in technology work environments such as ICT that requires employees to obtain multiple skills in order to adapt to organizational changes. This shows the urgency for women to advance their skills in all aspects of ICT if they are to broaden their employment opportunities in the labour market.

Fountain (1999), in his study of women in ICT, concluded that encouraging women to become both designers and technical experts through an integrated program is one way of exposing them to all aspects of ICT, and therefore creating new economic opportunities in the IT industry. However, Lanius (2003) cautioned against assumptions that exposure is a likely factor to motivating women into all aspects of ICT. Lanius argues that although the exposure may be necessary, it is not sufficient to influence women's decisions to take up careers in the technical aspects of ICT given other intersecting factors such as societal stereotypes of gender roles. Still, according to the same author, design aspects of ICT are often perceived to respond to women's interest on self-employment since it is assumed to provide consultancy-type jobs. The nature of such an employment is viewed as likely to support women's dual roles of family responsibilities and employment because of the flexibility. Yet findings showed that women in the Lanius study were still not attracted to self employment in ICT fields.

Reasons often given for women's attraction to the design aspects of ICT are its creative, aesthetic, and explorative nature (McLester, 1998; Holzberg, 1997), which is assumed to resonate with women's interests in the field. As stated by Holzberg, "while research shows that men are contented to study computers as stand alone artifacts or "cool" tools, women are more likely to want to know how computers can be used in practical and relevant ways" (p. 42). This reflects women's interest in the instrumental use of ICT, hence the likelihood that they would be motivated towards those aspects of its applications that can help them achieve specific practical needs in the workforce. On the other hand, the technical aspect of ICT is often associated with masculinity given the male dominance of the sector (Lanius, 2003; Siann & Callaghan, 2001; Wajcman, 2000) and media representation of male role models in ICT work environments.

Cockburn (1988) reiterated that the underrepresentation of women in the technical aspect of ICT is not only due to perceived male domination but also by their internalized views of societal gender roles and expectations. This indicates how society's perceptions continue to appropriate gender careers shaping women's course choices in ICT training. Although, some studies found women's perceptions of accrued benefits of ICT careers to be powerful incentives in influencing their course choices and subsequent engagement in the job market (Siann & Callaghan, 2001; Thom, 2001). Research has also shown that barriers to the technical aspect of ICT careers for women can be overcome by early intervention programs and mentoring (AAUW, 2000; Linkard, 2003; Thom, 2001). Thom (2001) and Lankard (2003) indicated how they were successful with such programs in increasing female enrolment and ensuring retention in their ICT programs. The authors indicated how such programs helped in building women's self-esteem, encouraging their participation into higher levels of ICT courses in which they were underrepresented.

Thus, the purpose of this study was to illuminate women's motivation and preferences into the different aspects of ICT. Findings of this study provide understanding as to why women are concentrated in the design aspect of ICT, and reasons for individual preferences despite the notion that the technical aspect of the field provides better employment prospects in the job market.

Theoretical Framework

In this study, Bandura's (1997) self-efficacy theory is adopted as a lens to inform the understanding of women's decision-making behavior in ICT course and career selection. Bandura's self-efficacy theory provides an enriched insight in understanding women's decision-making protocol in technological careers such as ICT, which are perceived as being male-dominated (Thom, 2001; Wijcman, 2000). As defined by Bandura, self-efficacy refers to "people's judgment of their capabilities to organize and execute the courses of action required to attaining designated types of performances" (p. 391). Self-efficacy is a major determinant in self-regulation of individual behavior and enhances coping ability with perceived difficult situations, especially for women in this case when making choices into careers deemed to be dominated by men.

Bandura (1997) explains how the concept of self acts as a basis for non-cumulative explanations of behavior that is underpinned by intrinsic motivating factors, thus influencing an individual's decisions and actions. Therefore, higher-level attributes, such as women's beliefs in their capabilities in ICT courses, exhibit higher self-perception of their choices into these programs. This is likely to support women in gaining control over their career decisions in ICT, as they become motivated by their conceptualized abilities and perceived benefits of these choices. Bandura, however, cautions that despite the intrinsic motivations, individuals are also influenced by extrinsic factors in their social settings. He argues that people often conform more to societal expectations than to their inner attributes such as interest, commitment, and determination. Societal expectations are often expressed or implied as feedback through socialization processes or modeled behavior. The influences of role models in determining women's decisions into male-dominated careers, such as the technical aspect of ICT, have been echoed in literature (Fountain, 1999; Siann & Callaghan, 2001; Wijcman, 2000). Therefore, self-efficacy theory may explain how observing success or failure of modeled behavior determines the level of influence of efficacy of the observer.

According to Lanius (2003) and Cockburn (1988), belief that men are more skilled in the technical aspects of ICT continues to be internalized by some women and is likely to shape their career choices. Such a belief is perpetuated by the media representation of male role models, and the continued male-dominance of the technical aspect of ICT depicting the masculinity of the field. As well, these are features identified by studies (Fountain, 1999; Holzberg, 1997; McLester, 1998) as discouraging girls from taking courses in the technical aspects of ICT in spite of strong beliefs in their capabilities.

As such, despite the increased need for workers in all aspects of the ICT labour market, studies indicate that women are more underrepresented in the technical aspects of the field. Yet as stated by Mitter (1985), employment in today's workplace requires multiple ICT skills indicating the need for postsecondary ICT training institutions to develop programs that can attract women in all aspects of the field. One way of retaining women in technical ICT courses and subsequent work environments is to make them aware of the intellectual benefits and emotional commitment to the work in all aspects of ICT careers and by indicating the personal relevance to their lives (Holzberg, 1997). Therefore, the focus of this study is to highlight female students' motivations and preferences for courses and careers in the different aspects of ICT undergraduate programs. The purpose is to reveal reasons for women's underrepresentation in the technical aspects of ICT programs and to pose possible solutions to closing the gender gap.

Methodology

A mixed methodology of descriptive and interpretive phenomenologies was used in this research study. The choice of this methodology was guided by the research questions (Boulton-Lewis & Wills, 2004; Creswell, 2003; Tashakkori & Teddlie, 2003). Phenomenological approaches to research seek to illuminate the phenomenon through personal experiences of participants. It is based in the paradigm of personal knowledge and subjectivity, emphasizing the importance of understanding experiences that influence individuals' perspectives and

interpretations. Heidegger (1982) and Merleau-Ponty (1967) argue that human behavior is a social construct embedded with other people. Hence, decisions about individuals' actions are strongly influenced by their understanding of the meaning presented in a situation. The meanings constructed are often influenced by their cultural, political, historical, and economic orientation, and determine interpretations, direct their intentions, and affect subsequent action. A phenomenological approach to the study facilitated the examination of patterns in women's experiences and the identification of factors that shaped their beliefs and motivation in the decision-making process related to ICT course selection.

Differences between interpretive and descriptive phenomenology arise in the focus on exploration of lived experiences, philosophical orientation, issues of rigor in research, positioning of the researcher, and the process of data analysis (Boulton-Lewis & Wills, 2004; Creswell, 2003; Tashakkori & Teddlie, 2003). The focus for descriptive phenomenology (Husserl, 1970) is the intuitive ways of knowing emphasizing the presentation of meaning from the perspective of the participants' own voices through descriptive narratives. Interpretive phenomenologists (Heidegger, 1982; Merleau-Ponty, 1967) on the other hand believe that meaning is a social construction based on individuals' interaction with others in their settings. Therefore, interpretation is viewed as a critical component in constructing meaning and understanding from thick description of participants' experiences.

The rationale for mixing methodologies was based on its potential for providing deeper understanding of the inquiry, especially in complex social contexts such as women's decision-making process in careers that have been perceived as male domains (Siann & Callaghan, 2001; Thom, 2001). To understand women's decision-making behavior in male-dominated careers, there was need to construct participants' motivation and experiences within a specific context. Triangulation of methodologies ensured the reliability and validity of the information constructed. Epistemologically, interpretive phenomenology challenges the perception of value free research (Denzin & Lincoln, 2000). Denzin and Lincoln indicate that research is a process whereby the investigator and the investigated are interactively involved in the creation of knowledge. Therefore, in this study the relationship between the author as a researcher and the participants was viewed to involve subject-subject interaction.

Research Questions

In particular, this study aimed at finding answers to the following research questions: What factors motivated and influenced female students' course selection in the undergraduate ICT program? What are women's areas of interest and preferences in ICT courses? What are the perceived economic implications of women's choices and course preferences into specific areas of ICT in the current labour market?

Study Setting

The study was conducted in an ICT program in a Californian university. Although the program was designed for students to specialize in a design or technical track, all students were required to obtain core courses in both tracks before majoring into specific fields at higher levels of the program. Students who specialized in the design track focused on web design, web publication, multi-media artistry, instructional design, and computer animations; while those in the technical track aspired to become telecommunications engineers, computer programmers, and network or computer systems administrators. Adopting an integrated approach in the program was an attempt to bridge the traditional way of training common in ICT disciplines by providing students with experiences within a wider variety of courses in order to broaden their options in the current technology global society.

Participants

Participants were selected based on purposive sampling (Gay & Airasian, 2003). This process involved selecting participants believed to have characteristics representative of the population under study. This involved eighteen female undergraduate students in the two tracks (design and technology) of ICT who were in the final year of their degree and specializing in their respective tracks of the program. The rationale was that women at this level of the program had better perceptions of the nature of the ICT program and work environments, having gained experience in the field through internships and community work, which is a requirement for the program. All participants at this level had experience with courses in both tracks as required by the program before specializing at higher courses.

Data Collection

Baseline questionnaires, interviews, and archival data records were used to collect specific information. Eighteen participants filled out questionnaires of which fifteen were subsequently interviewed, with three participants leaving the study. The intention was to interview equal representation of participants from both tracks of the program, but this was not possible given the attrition levels and low female enrolment in the technical track. Therefore, six women from the technical track and nine from the design track of the program were interviewed. The three participants who opted out were in the design track.

Interviews were conducted using structured and semi-structured questions lasting approximately one hour per session. Interviews were tape-recorded after gaining permission from participants and assuring them of confidentiality. As well, to protect the identity of participants pseudonyms are used in the reporting of the study. During the interviews, participants provided in-depth accounts of their experiences, motivations, and perceptions, explaining how these factors influenced their decisions to take up specific ICT courses that would lead them to ICT careers of their interests. Interview transcriptions were given to participants for debriefing and confirmation of the accuracy of the information. The resulting interview data were complemented by questionnaire and archival data on enrolment by gender from course registration, pro-seminar course, and Senior Capstone classes. These alternative sources of data served to triangulate the information gathered from the interviews.

Data analysis

Data were analyzed simultaneously using a thematic approach in an on-going process to answer the research questions (Merriam, 1998; Miles & Huberman, 1994). The thick description of interview data was reconstructed and interpreted to identify evidence of female students' course preferences, influences in the selection of course choices, and unique experiences of participants in the program. Units of analysis were identified using recurring patterns to serve as a basis for defining categories, which were clustered under emerging themes. The domains were based on the cause-effect semantic relationships that were coded in sets of 3" x 5" index cards and linked to the coded data sources for triangulation of information. Color-coding was used for sources, while letter coding was used for the categories. A domain analysis worksheet was prepared in the form of concept mapping (Miles & Huberman, 1994) to visualize emerging themes, identify consistencies, inconsistencies, and relationships from the data sources. Integration of the methodologies occurred at the level of data analysis and reporting of study findings. Questionnaires, interviews, and archival data sources were analyzed. Excerpts and interpretation of the text and figures were reported in order to present in-depth understanding of the findings (Creswell, 2003; Tashakhori & Teddlie, 2003).

Research Findings

Findings showed that the majority of women in the ICT program preferred the design track as opposed to the technical track. Individual preference into the specific tracks was influenced by personal interest, self-efficacy, professional motivation, role models, and prior skills in ICT at entry in the program Figure 1 below reflects course registration by gender in the design track of the ICT program.

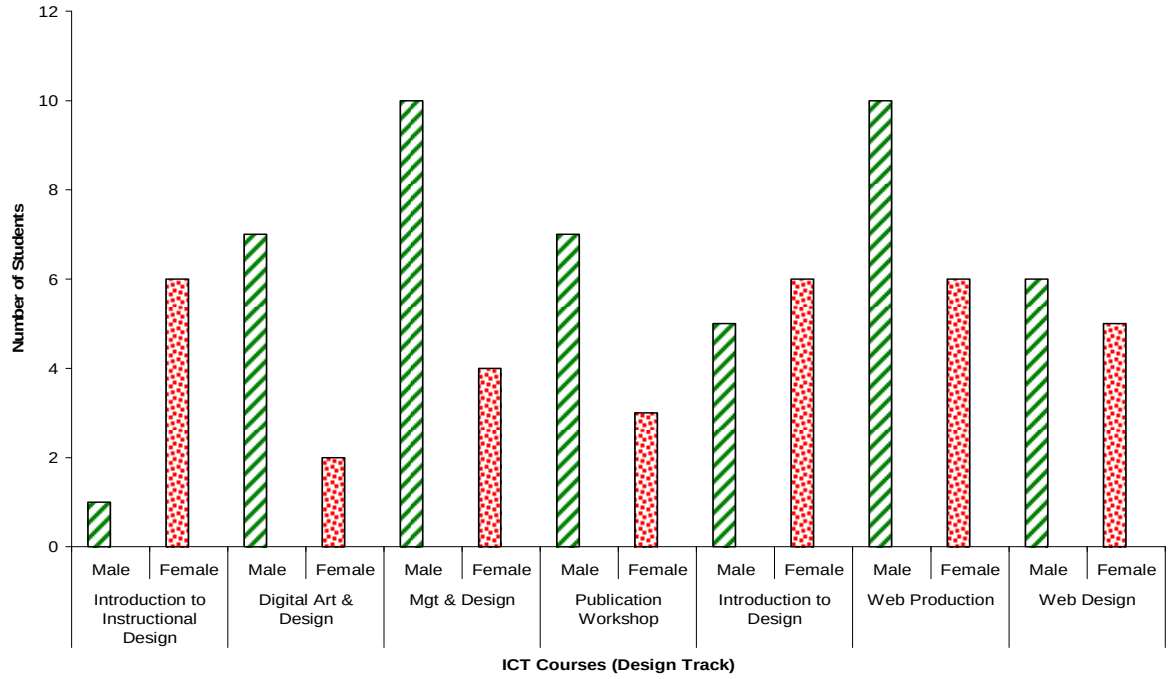

Figure 1: Course registration in design track by gender, spring 2004.

Data showed that more women were registered in the Introduction to Design course as well as in the Introduction to Instructional Design course than their male counterparts. In introductory courses to design and web design, enrolment was fairly distributed among the genders. Yet in the Publication Workshop and Digital Art and Design courses, women had much lower enrolment than men.

Figure 2 below indicates course registration in the technical track. The data reflect very low enrolment of women in advanced level technology courses during the semester, with no women registered in the Unix and X-windows course.

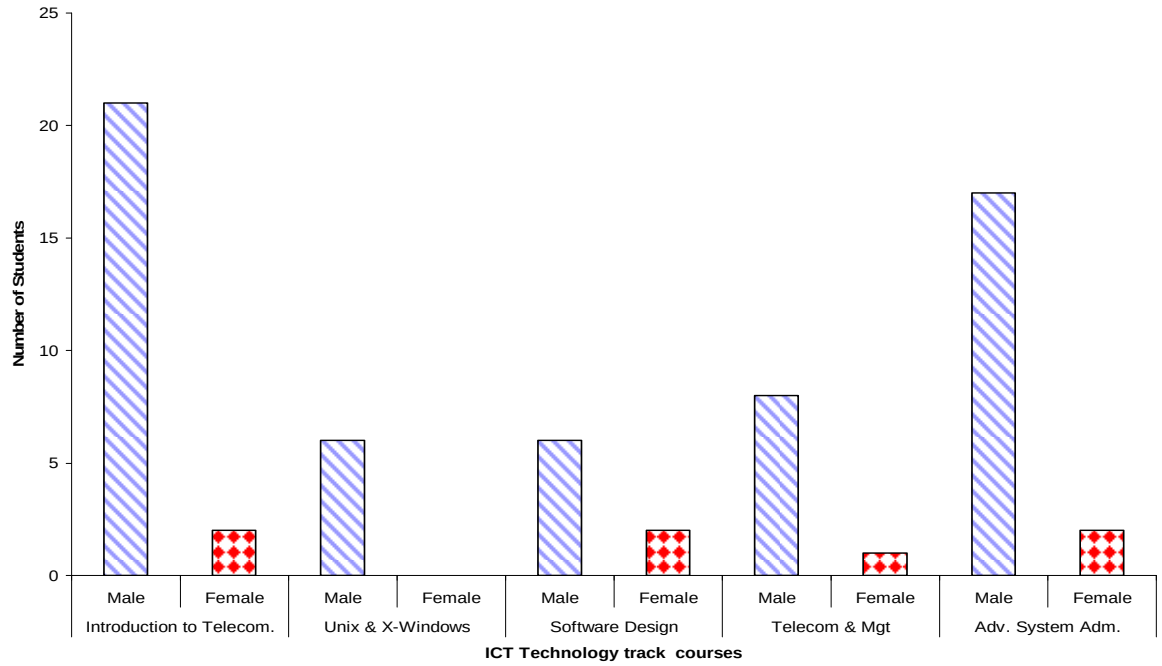

Figure 2: Course registration in technology track by gender, spring 2004.

Although the majority of women preferred the design track, participants in both the design and technical tracks appreciated the importance of acquiring skills in both tracks as indicated by Sue, a design major, who stated, "it is important to learn about technology even for those who specialize in design to help work together." Similar sentiments were expressed by Anita specializing in technology, "I am happy to know a little bit of design although I am in the technology track. I find web design interesting and I enjoy creating websites. Designers also need to know how to install software."

Eight out of nine participants in the design track narrated how their technical skills in ICT were supportive to either their internship placements or in the actual work environment during their internships. Three of the participants got internships in a technical field although they were majoring in design. As stated by Betty, a design major, "the internship I got was more on the technical side of the job when I was supposed to be doing more on the graphic design which was what I am doing in the school." The other five participants in the design track indicated that although they were taken into the internship as designers most of the time they were assigned tasks in database administration or programming. Angel, who is a design major, corroborated the advantage of having both skills in ICT work environments from her experiences during internship. She said:

> We came to Population Services International with one of my male colleagues. They needed two people, one person for website coordinator and one person for technical troubleshooting issues for the network that they had in the office. And that was what my male colleague was there for, but instead they used me and him to kind of troubleshoot.

Thus four participants in the design track indicated the advantage of acquiring knowledge in both aspects of ICT as they applied for internship placements and in the workplace.

Reasons for Course Preferences

Female students' decisions to enroll in the different aspects of the ICT program were influenced by factors such as personal interests supported by self-efficacy, the nature of preferred ICT field for employment, role models, stereotyping of gender abilities, and prior skills in ICT .

Personal Interests and Self-efficacy

Individual narratives by all participants in both the technical and design tracks indicated how personal interests strongly influenced their course choices in the program. For example, Emily, a design major explained, "I wanted a career where I could be creative but still be able to have a steady job. That is why I switched to graphic design and web design." Vivian's course choices emerged from her passion as well when she stated, "I have passion for mathematics and that is why I'm in programming." At the same time, women in both the technical and design tracks believed in their capabilities to perform well in their respective course preferences. Alacia, a technology major, believing strongly in her cognitive abilities in supporting her performance shared, "I don't think I am good in design although I know I could think of good design ideas but I am not artistic. So I chose computer programming." So did Lisa, a design major, who expressed similar sentiments by commenting, "I am not a tech person, I am a design person. I like design, I don't like tech and my brain doesn't work that way." Participants expressed strong beliefs in their capabilities in their fields of specialization, but indicated inability for the track they were not specialized in.

Professional Motivation as Empowerment

Other influences came from perceptions of the benefits of career choices in the labour market in both design and technical tracks. The six women interviewed in the technical track perceived their choices as capable of providing better employment opportunities and favored formal employment over self-employment. They argued that employment in the technical track of ICT provided job security, medical insurance, and there was less competition in the job market given that few people ventured into the field. As stated by Melissa:

> There are not as many people technically and there are a lot of people who can design. So I thought it would be advantageous for me to do something that most people don't do. So I chose programming, it has better chances of getting a job.

Yet, the majority of participants (5/9) in the design track were motivated towards self-employment as they hoped to become consultants. Self-employment was perceived by four design participants, who were mothers, as being capable of providing a flexible work schedule that could help them combine employment with family responsibilities. Lisa, a single mom in design found this viable by saying,

> I am a single mom and I don't have time for full time employment and that is why I chose design. I can establish my own consultancy and work from home. I have too much to juggle between family and work.

Participants in both tracks (design & technical) believed strongly in the possible advantages for job prospects in their respective career choices.

Influence from Role Models

Role models in the family and the gendered nature of the different aspects of ICT tracks in the program seemed to have also had significant influence on course choices. Course registrations indicated how the technical and design tracks of ICT program were highly gendered with males dominating the technical track, while women were inclined towards the design track (see Figures 1 and 2). The presence of more female faculty and students in the design track of the ICT program seemed to have provided social support and suitable role models for women. According to Marabu, pursuing a design major, "there are a lot of women in the track, so I don't feel uncomfortable at all. My professors are actually women and there are more women in the design as compared to the tech track." Madeline, a technology student, lamented on the lack of female professors in the technical track:

> If you look at our faculty in the program, you see that all the women are designers and the real technical courses are taught by male professors. It would be encouraging if we would have some women faculty who are in programming, networking, telecommunication, and database management.

Family members involved in ICT careers also acted as role models to some of the participants (5/15) as in the case of Margy who shared, "my mother is a network engineer and my stepdad is also a network engineer. They definitely

influenced my career choice." She shared how her parents' career in computer engineering might have influenced her course choice into the technical track of the ICT program.

Stereotyping of Gender Abilities in ICT

Although women in the technical track showed higher levels of self-efficacy, four of the participants' responses indicated internalized stereotypes of male abilities in ICT as stated by Sue,

> A lot of technology is so geared towards the way men think. Not all women are bad at math but it seems like more men are better at math than women. I don't know why so. Whenever we get projects that involve math or some kind of logical skills that men seem to be better at it can be intimidating. It is hard to be the only woman in the group and not always get what is going on and you are trying to follow.

Audrie's response also supports internalized societal beliefs that men have more knowledge and skills in technology than women. She claimed,

> Many of the males are either networking gurus or programmers or both and they have been fooling around with computers since they were adolescents. They're very knowledgeable and use all kinds of computer talk. I feel ignorant when I am around them.

Despite the challenges created by stereotyping of male abilities, findings of this study also showed that women in the technical track were not intimidated by the nature of technology but more by male dominance of the track as indicated by Tracy's response. She said,

> I feel that I don't belong to that class. I think if I said something it will be wrong since most of the time men are the ones who are always giving opinions or asking questions. Men don't even bother to turn their heads towards a female when she is talking.

Natali expressed similar experiences in technology classes and shared,

> I don't actually feel intimidated but more embarrassed and lacking that sense of belonging. I feel so embarrassed if I am the only girl in the class. Like I don't feel comfortable even though I haven't experienced any discrimination from a guy. But I have that mentality in me that I can't say what I want because I feel that the men will contradict what I am saying.

Women in the technical track felt that their colleagues in the design track were more advantaged socially given the presence of more female students in the design courses. As stated by Vicky, who was the only woman in one of the technical courses, "there are more women in design than technology and therefore, they are more comfortable in the design classes." Only two responses from participants in the technical track indicated that they were neither intimidated by the male dominance of the technical track nor did they feel that the men had a better grasp of technical skills than themselves. The reason was that they had a strong background in technical skills and mathematics, which helped them to cope with higher level technical courses in the program. As stated by Akulia:

> I had a good grounding in mathematics, which is very useful in coping in technology courses. Knowledge in other programs like programming and media technology was very helpful. I was able to focus on more advanced skills than trying to learn the basics.

Rebecca, who also seemed to have confidence in her technology skills, refuted her colleagues' claims that men were better in ICT technical skills than women. She argued that based on her experience, if one was to perform well in the technical track, a sound grounding in the courses was important to all, irrespective of an individual's gender. Given her experience, Rebecca indicated that:

> What really worked as a boost for me is that I really enjoyed math and a good mathematical grounding would be a jump-start to technology career. And you know these stereotypes that men are better in math than women are not true.

This indicated the need for school counselors to guide students through required subjects for those preparing to pursue ICT careers after the high school levels.

Prior ICT Skills at Entry in the Program

Although four of the participants indicated that some of the teachers in their respective high schools influenced their career choices, the rest thought of careers in ICT after completing high school and enrolling in community colleges, where they acquired some ICT skills. These skills have partly influenced their course choices in the undergraduate program. The majority of participants had exposure to advanced skills in the design aspects of ICT at entry into the program. As indicated in Table 1, thirteen participants had more than basic skills in both the design and technical tracks from community colleges.

Table 1: *Participants' Skills Clusters at Entry into the ICT Program*

Cluster Category	**ICT Skills Acquired**	**Number of Participants**
1	Introductory-word-processing, e-mail, website design and graphics.	1
2	Advanced-word processing, e-mail, website design and graphics, programming, media- technology, spreadsheet.	1
3	Introductory-word processing and e-mail.	2
4	Advanced-word processing, spreadsheet, e-mail, website design and graphics, programming.	2
5	Advanced-word processing, spreadsheet, e-mail, & programming,	2
6	Advanced-word processing, spreadsheet, & e-mail	7
7	Advanced-word processing, spreadsheet, e-mail, media technology, website design & graphics.	3

Cluster category in this case defines levels of ICT skills that participants had when entering into the program. For instance, Erica, who indicated how prior skills were helpful, stated, "I had a good grounding in programming, media technology, website design, and graphics before coming into the program, which was very helpful. I was now able to focus on more advanced skills in technology." Vicky, a design student, also concurred, "I already had enough skills in technology from the community college and what I now needed was to improve my skills in design." As indicated by the participants, prior ICT skills provided an advantage for all participants in the program, significantly helping them in their decision making regarding their respective fields of specialization.

Discussion

Findings of this study showed that most women had preference for the design track with very few specializing in the technical track of the ICT program. This is consistent with findings of other studies (Cockburn, 1988; Fountain, 1999; Gatta & Trigg, 2001; Lanius, 2003; NCES, 2004), and explains the presence of more women in graphic design, desktop publishing, and web design than in the more technical aspects of ICT such as programming, network engineering, and database management in ICT labour market as reflected by statistics presented by NCES (2004).

Findings also indicated how personal interest and self-efficacy had significant influence on female students' decisions related to their respective course choices in the ICT program. Therefore, Bandura's (1997) self-efficacy theory provided a plausible explanation for how women's levels of self-perception in their abilities exerted individual confidence and motivation into the design or technical tracks of the ICT program. Bandura argues that self-efficacy beliefs provide the foundation for human motivation, and influence the choices they make towards desired personal accomplishment. Individuals tend to select tasks and activities in which they feel competent and confident. Women in both tracks believed strongly in their capabilities in their respective choices in the ICT program, and indicated their limitations in the tracks that were not of their choice.

Impact of role models as an extrinsic motivator was also significant in determining participants' course and career choices. The impact of role models in enhancing positive attitudes of women in ICT careers has been cited in several

studies (AAUW, 2000; Bandura, 1997; McLester, 1998; Siann & Callaghan, 2001; Thom, 2001). According to Bandura's self-efficacy theory, individuals are often influenced by observed modeled behavior to inspire their decisions and subsequent actions. Participants in the design track of the program indicated how the presence of more women, especially female faculty, supported their learning. They felt more comfortable in their courses than their female colleagues in the technical track which was male dominated at the faculty and student levels. Female dominance of the design track might have given a misconception that the track was a feminine sphere, an assumption supported by the male domination of the technical track of the program. Some of the participants also mentioned how family members who were already in technology careers inspired them in their specific ICT course choices. The influence of role models supports Bandura's (1997) argument that people can also develop self-efficacy beliefs through observing models with similar attributes and qualities they admire, as they reflect success in the capabilities they desire.

As for professional motivation, findings of this study concur with a number of studies (McLester, 1998; Siann & Callaghan, 2001; Thom, 2001) that postulated how anticipated career opportunities have significant influence over women's decisions to take various ICT courses. All participants believed strongly in the career opportunities they were likely to gain in their respective ICT track preferences. However, some studies (Gatta & Trigg, 2001; Holzberg 1997; Lanius, 2003; Lang, 2003) indicated that fewer women graduates from ICT programs were likely to take up employment in the ICT field, even in the design aspects of ICT that offers opportunities for self-employment through consultancy practices (Lanius, 2003). Yet, findings of this study indicated how participants in both tracks of the program showed interest in entering ICT work environments, especially engaging in self-employment by those in the design track. Self-employment was perceived by some of the women in the design track as providing opportunities for them to combine family responsibilities with employment.

Conclusion

It is concluded from this research that although women in the study preferred the design track, an integrated ICT curriculum was well received and seemed to broaden career opportunities for women in the ICT field. This was acknowledged by participants during placements for internships and in the work environment during their internships. This confirms the argument by Fountain (1999) and Thom (2001) that an integrated approach to ICT programs opens career opportunities for women in all aspects of ICT courses. Study findings also concur with Mitter's (1995) argument that the changing nature of the technology work environment requires employees to have multiple skills in ICT. Some of the participants' experiences in the work environment during internship confirmed that employers assign tasks indiscriminately with less reference to individuals' areas of specialization in ICT. This indicates the employers' assumptions that employees in the field have the mastery of multiple ICT skills and knowledge.

At the same time, findings of this study support Lanius's (2003) argument that exposing women to all aspects of ICT alone, without addressing other societal factors, does not guarantee their motivation to take technical courses. For instance, the gendered nature of the different aspects of the ICT program and stereotyping of women's capabilities by some of the women in the ICT program is likely to limit female enrolment in technical ICT courses impacting efforts to reduce the gender gap in the field.

Recommendations

Findings of this study provided a clear indication of the need for continued effort by stakeholders to address issues of gender gaps within the technical aspect of the ICT industry and postsecondary institutions focused on ICT skills and education. Based on the findings, it is recommended that ICT training departments work with public schools within their vicinity to re-evaluate the role of counseling units and school programs, such as computer programming courses at this level, in preparing students for ICT careers. This is important given that relevant subject choices in high school are supportive to students' entry into ICT programs (Siann & Callaghan, 2001). Findings showed that a strong mathematical background for female students at the secondary and college levels was necessary in building self-confidence in pursuing technical courses of ICT. Secondly, the university and other ICT training institutions could initiate a deliberate recruitment drive to increase female students' participation in the technical track through scholarships offered to potential female candidates who may lack funding. Finally, ICT training institutions need to

expose girls in high schools to ICT programs within their vicinity through outreach programs involving the participation of female students and faculty. This could be one way of building a social network in the technical track course to help female students develop a sense of inclusiveness given the small number of enrolled female students which seemed to have been a discouraging factor to participants in this study.

As such, several studies (AAUW, 2000; Lankard, 2003; Thom, 2001) have indicated successful intervention programs through national organizations, postsecondary training institutions, and technology corporations aimed at encouraging and developing the confidence of women and girls of diverse ethnic and racial backgrounds into technology careers at all levels. Such projects emphasize the need for mentors and networking for girls as a way forward starting from elementary schools through postsecondary training levels and careers in the field. This is necessary in building women's self-efficacy in technology programs such as ICT. Thom (2001) and Lankard (2003) reported great success by institutions such as Smith College, in Northampton Massachusetts, and El Paso Community College, which engaged in community outreach programs to increase enrolment in their technology programs. Through outreach initiatives, these institutions reported increased enrolment and retention of women in their technology programs, including ICT, as they provided role models and mentors to girls in the communities.

Findings of this study, like previous studies, indicate women's preference for the design aspect of ICT. The question is how does this preference impact women in the competitive ICT labour market in terms of employment opportunities, career advancement, and better paid careers? As well, how can educational institutions encourage women to take courses in all aspects of ICT given the labour market opportunities that having such skills provides?

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