

AN EXPLORATORY INVESTIGATION OF GENDER DIFFERENCE IN STUDENT SELECTION OF A CIS MINOR

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ABSTRACT

The focus of this study is to investigate whether there exist gender differences in students' a priori knowledge about the CIS minor, and their perception, expectation and selection of a CIS minor. No significant gender difference was found in relation to students' prior knowledge about CIS minor. It was found that male students perceive a CIS minor as more interesting than female students. When asking about their expectation of a CIS minor, male students consider information systems management as an interesting CIS minor, while female students tend to be interested in web development. Moreover, male students are more likely to choose a CIS minor than female students. Possible reasons are thus provided to explain this gender difference.

Keywords: Information Systems (IS), minor, gender difference, survey methodology

INTRODUCTION

Computing has long been considered a male domain. Women are under-represented in academic computer sciences/information systems and in professional computing more generally (12, 16). According to Camp (2), the proportion of women earning bachelor's degree in compute science at colleges and universities in the United States was only 16.4% in 1997-1998. Women made up approximately 35% of the high-tech work force, and less than 11% of the top-tier executives in Fortune 500 computer companies were women (16).

The Gender gap in the information systems field may be explained by women's negative attitude toward computers, work-family conflict, lack of female role models and overwhelming dominance of boy-themed products in computer and video games. Girls at an early age are steered away from math and science and are less likely to use computers than boys (13). It has been reported that males have less computer anxiety and higher computer self-efficacy than female (3, 14, 15, 12). The work ethic of IS, including long hours, late nights and highly focused behavior, conflicts with family demands of women. The lack of role models is another barrier contributing to the gender gap in IS (16). According to Frenkel (5), only 6.5% of faculty in IT positions were held by women.

The Gender gap in the information systems field has received considerable attention in literature. Many empirical studies have reported gender inequality in this area. For example, Young (16) reported that female students in secondary school are less confident in computer skills than boys. Reinen and Plomp (11) found that female students knew less about information technology and enjoyed using it less than males. Shashaani and Khalili (12) found that female students had low confidence in their own ability to work with computers even though they showed strong beliefs in equal gender ability and competence in use of computers. Liaw (7) found that male students

had more positive perceptions toward computers and web technologies. Allyn (1) found that men and women use the computer for different purpose at work. On the other hand, some recent studies have found that gender gaps are lessening or disappearing as increasing numbers of men and women have been exposed to, and are using computers and computer applications in their work and personal life. For example, Ray et al. (10) found that there is no significant gender difference toward computer anxiety. Similarly, Rainer et al. (9) found that gender gap in students' usage and attitude toward computes are lessening. Sumner and Niederman (13) found no significant gender difference on job satisfaction, job turnover, and career experiences of IT professionals. Morahan-Martin and Schumacher (8) found that attitudes towards new technology, but not gender predicted Internet and computer competencies and experiences. These mixed results may be explained by the differences in the survey population and the exclusion of some contextual variables such as family background, personal characteristics, and culture in the analysis.

In spite of extensive studies of gender difference in the information systems (major), little research has been done on gender difference in relation to a CIS minor. One exception is the study conducted by Li et al. (6), investigating the factors (gender, major, a priori knowledge) influencing student perception of a CIS minor and whether they select a CIS minor. This study extends gender questions raised in the study of Li et al. (6) and explores the gender difference in students' a prior knowledge about the CIS minor, their perception, expectation, and selection of a CIS minor. The following questions are empirically investigated:

1. What are the gender differences in students' a prior knowledge of a CIS minor?
2. What are the gender differences in students' perception of a minor; furthermore, what are the gender differences in student perception of a CIS minor?
3. What are gender differences in students' expectation of a CIS minor?
4. What are gender differences in students' selection of a CIS minor?

RESEARCH METHOD

A survey was administrated in a total of 14 introductory CIS sections in Fall 2002 at a college of business in New England. The survey was conducted during the classes at the same week for all the sections. A total of 317 students completed the survey. Since this study focuses on the students' perception of the CIS minor, the students already majoring in CIS were removed from the analysis. The final usable sample size was 203, including students in four business majors (accounting, management, finance, and marketing). Of the sample, 59.9 % were male, 40.1% were female, 16.3% were majoring in accounting, 27.2% were majoring in management, 22.8% were majoring in finance and 33.7% were majoring in marketing. In addition, management and finance major are male-dominated with 80.0% and 65.2% respectively; while accounting and marketing major are almost evenly populated by male and female students.

ANALYSIS AND DISCUSSION

Gender Difference in Students' a Priori Knowledge of a CIS Minor

Students' a priori knowledge about CIS can be obtained from professors, advisors, parents, friends, websites, published materials, and/or their own experience in using computers. A priori

knowledge was measured by students' familiarity with a CIS minor program in this study. A t-test was used to see whether student prior knowledge of a CIS minor differ by gender. No significant difference was found ($\alpha=.51$). It can be seen that both males and females may have the same level of familiarity with a CIS minor.

Gender Difference in Student Perception of a Minor and a CIS Minor

This study first investigated gender difference in the factors that might influence students' decision in choosing a minor since they may be important in understanding gender difference in student perception of a CIS minor. In the questionnaire, students were asked to rate the importance of seven factors (on a scale of 1 -5) in choosing a minor (see Table 1). A t- test was used to see whether there was significant gender difference in relation to each factor. No significant difference was found for any factor. For both male and female students, the top three factors influencing their decision in choosing a minor are personal interest, helpfulness to their major and future job-seeking, in that order.

Table 1. Factors Influencing Students' Decision in Minor Selection and Gender

Influencing Factors	Gender	Mean	P-value
Personal Interest	Male	4.50	.63
	Female	4.44	
Helpfulness to my major	Male	4.28	.41
	Female	4.17	
Helpfulness in my future job-seeking	Male	4.16	.21
	Female	4.33	
Creativity and challenge	Male	3.80	.81
	Female	3.83	
Difficulty level	Male	3.29	.85
	Female	3.31	
Amount of time and effort required	Male	3.52	.98
	Female	3.51	
Job opportunities	Male	3.98	.81
	Female	3.95	

Table 2. Students' Perception of a CIS Minor and Gender

Influencing Factors	Gender	Mean	P-value
CIS minor is interesting	Male	3.15	0.01
	Female	2.75	
CIS minor is helpful to my major	Male	3.41	0.19
	Female	3.23	
CIS minor is helpful to my future job-seeking	Male	3.58	0.43
	Female	3.47	
CIS minor offers creativity and challenge	Male	3.56	0.68
	Female	3.51	
CIS minor is more difficulty than other minors	Male	3.58	0.63
	Female	3.64	
CIS minor involves lots of time and effort	Male	3.59	0.86
	Female	3.57	
CIS minor provides lots of job opportunities	Male	3.67	0.67
	Female	3.73	

Students were also asked to indicate their perception of the CIS minor according to the above seven factors. A t-test was again used to see if there was gender difference in each factor. A significant gender difference was found in relation to student interest of a CIS minor (see Table 2). Male students consider a CIS minor as more interesting than female students, with a mean of 3.15 and 2.75 for male and female students, respectively. Out of the seven items, the top 3 items (according to the mean) for male students are: job opportunities, time and efforts involved, and helpfulness to my future job-seeking. For female students, the top 3 items are: job opportunities, difficulty level, and time and efforts involved. It can be seen that both male and female students consider a CIS minor as offering more job opportunities and involving considerable time and

efforts. Moreover, female students perceive the CIS minor as more difficulty than male students, while male students also view a CIS minor as helpful to their future job-seeking.

Another interesting finding is that there exists a gap between student expectation of a minor and student perception of a CIS minor. Students rate personal interest and helpfulness to their major as most important factors in choosing a minor, but their perception of a CIS minor in terms of these two items received the lowest scores. To verify our initial observation, a paired sample t-test was conducted based on the importance of each factor in choosing a minor and the students' perception of CIS minor on this factor (See Table 3). Among seven factors compared, six factors have significant differences. It appears that a gap exists between students' perception of a minor and a CIS minor. Students do not perceive the CIS minor as meeting their expectation for a minor.

Table 3. Paired sample t-tests in student perception of a minor and CIS minor

Item	The importance in choosing a minor	Student perception of a CIS minor	Mean difference	p-value
Personal interest	4.47	3.13	1.34	.000
Helpfulness to my major	4.18	3.38	0.80	.000
Helpfulness in my future job-seeking	4.20	3.58	0.62	.000
Creativity and challenge	3.74	3.53	0.21	.004
Difficulty level	3.29	3.53	-0.24	.001
Time and effort required	3.49	3.56	-0.07	.342
Job opportunities	3.94	3.68	0.26	.000

Gender Difference in Student Expectation of a CIS Minor

In the questionnaire, students were asked to select the focus that would interest them as a CIS minor and courses that they feel are most useful for a CIS minor. Out of the three focuses (information systems management, web development and programming), almost half of male students (47%) choose information system management; while 59% of female students choose web development. Both males and females dislike a programming focus with 14% of male students and 11% of female students select this focus (See Figure 1).

In relation to the course offerings that students feel are most useful for a CIS minor, the top five courses selected by male students are: E-commerce (49%), Web Site Design & Development (46%), Database Processing (43%), Managing Information Resources (39%), and Telecommunications (29%). The top five courses selected by female students are: Web Site Design & Development (60%), Database Processing (42%), System Analysis & Design (35%), Managing Information Resources (31%), and Telecommunications (30%).

It can be seen that students tend to consider that a CIS minor should focus on how to analyze, design, implement, and manage information system, including building e-commerce site, to support their area of major study, rather than focus on programming. It is clear that a CIS minor should have a different focus compared to a CIS major.

Gender Difference in Student Selection of a CIS Minor

In the questionnaire, for students who have not yet chosen a minor, they were asked to indicate whether they were considering choosing CIS as their minor. To test for the impact of gender on student selection of a CIS minor, a chi-square test of homogeneity was performed. Our intent was to test the hypothesis that the breakdown of student by category (considering choosing CIS minor, not considering choosing CIS minor and undecided) to the question of the selection of a CIS minor for male students would not differ significantly from the corresponding breakdown for female students. The results disproved the hypothesis, with a significant level less than .01 (see Table 4). The percentage of male students considering choosing CIS minor (26%) was significantly higher than that of female students (9%).

Table 4. Student Selection of a CIS Minor by Gender (Chi-square test)

Student Selection	Male		Female		Chi-square Test
	Actual Freq.	Expected Freq.	Actual Freq.	Expected Freq.	
Choose CIS	19	14.35	4	8.65	$\chi^2=19.73$ df=5 P<0.01
Not Choose CIS	31	42.43	37	25.57	
Undecided	23	16.22	3	9.78	
Total	73	73	44	44	

The gender difference in student selection of a CIS minor may be explained by a different perception of male and female students in relation to their interest in a CIS minor. Male students consider a CIS minor as more interesting than female students and personal interest is the most important factors in choosing a minor. Therefore, it is not surprising that male students are more likely to select a CIS minor than female students.

In the questionnaire, students were asked to list the reasons why they would not consider choosing CIS as their minor. For male students, the top three reasons for not choosing a CIS minor are:

- No interest/dislike computers (CIS, programming)/want to work with people
- Interest in other minors
- Difficult/hard/burnout/challenging.

For female students, the top three reasons for not choosing a CIS minor are:

- No interest/dislike computers (CIS, programming)/want to work with people
- Difficult/hard/burn out/challenging
- Not good at computers.

Again, these indicate that lack of interest in computer and perceived difficulty level of a CIS minor are the major reasons for not choosing a CIS minor. Meanwhile, it can be inferred that both male and female students perceive a CIS minor as working with computers but not with people. Obviously, this is a misperception since even an IS professional usually spend less than half day working with their computers (4).

CONCLUSION AND RECOMMENDATION

This study investigated whether there are gender differences in students' a prior knowledge about CIS minor, and their perception, expectation and selection of a CIS minor. No significant gender difference was found in relation to students' prior knowledge about CIS minor. It was found that male students perceive a CIS minor as more interesting than female students. When asking about their expectation of a CIS minor, male students consider information systems management as an interesting CIS minor, while female students tend to be interested in web development. Both male and female students consider web site design and development, database process, managing information resources, and telecommunications as most useful courses for a CIS minor. Moreover, male students are more likely to choose a CIS minor than female students. It should be noticed that the study relates to the students who might potentially select a CIS minor, thus excluding those taking a CIS major. Different results may be obtained if the targets are students majoring in CIS.

Based on the result of the analysis, some recommendations can be drawn to lessen the gender gap in students' selection of a CIS minor:

First, efforts need to be made in increasing the confidence and interest of female students in the CIS minor. Female students usually lack confidence in their decision to enter a CIS minor program and this lack of confidence is a factor to be recognized. CIS faculty need to create an unbiased environment for men and women. To build the confidence of female students in the CIS field, short summer courses can be offered to help talented female students bridge deficiencies in their background and develop confidence in their abilities in computer science and mathematics. To encourage female students to select a CIS minor, female students can be invited to visit the CIS department in their freshman year. A day of demonstrations and tutorials about the CIS minor can be organized for female students. Furthermore, faculty and upper-level student role models can provide evidence that women can succeed in computing/IS disciplines.

Second, the perception about a CIS minor needs to be refocused and a better understanding of a career in IS needs to be promoted. The results show that there exists a gap between student perception of a minor and a CIS minor. Non-CIS major students tend to lack interest in a CIS minor and consider it less helpful to their major. This is a surprise finding since computers and information systems have penetrated into almost every corner of the business world. The result of this study also shows that the major reason for students not choosing a CIS minor is that they dislike computers and want to work with people. This is a misconception since interpersonal skill is important for an IS professional (4). It is clear that what IS professionals really are needs to be identified and communicated to the students.

Finally, a CIS minor should have a different focus from a CIS major. The results show that student rate difficulty of a CIS minor as one of major reasons for not choosing a minor, which may, in turn, contribute to their lack of interest in a CIS minor. The study also shows that both male and female students consider the courses such as web site design and development and managing information resources as most useful courses for a CIS minor. Probably, the core courses for a CIS minor should not focus on programming, thus making them more interesting and relevant to students. Moreover, courses in a CIS minor needs to match students' expectations

of a minor. The courses should be designed to be more interesting and to integrate more tightly with students' major and future careers. Another approach can be to bring back students who have graduated with a CIS minor and let them introduce how the knowledge they have learned in a CIS minor helps them in their work.

REFERENCES

1. Allyn, M. R. (2003). Computers, Genders, and Pay, Journal of Business & Economic Studies, 2003, 9(2), 33-44.
2. Camp, T. (1997). The Incredible Shrinking Pipeline, Communications of the ACM, 40, 103.
3. Dambrot, F. H., Watkins-Malek, Silling, M. S., Marshall, R. S., Garver, J. A. (1985). Correlates of Sex Differences in Attitudes Towards and Involvement with Computers, Journal of Vocational Behaviors, 27(1), 71-86.
4. Fox, T. L., Hindi, N., Remington, W. S. (2001). Students' Perceptions and Misperceptions of a Career in IS, Journal of Computer Information Systems, 42(1), 83-89.
5. Frenkel, K. A. (1990). Women and Computing, Communications of the ACM, 33(11), 33-46.
6. Li, S., Records, H., Fougere, K (2003). Managing the Recruitment of Students to the CIS Minor in the College of Business, Issues in Information Systems, 4(4), 556-562.
7. Liaw, S. S. (2002). An Internet Survey for Perceptions of Computers and The World Wide Web: Relationship, Predication, and Difference, Computers in Human Behavior, 18(1), 17-35.
8. Morahan-Martin, J., Schunacher, P. (1999). Comparison of Computer and Internet Competency, Experiences and Skills by Gender (Abstract), Proceedings of the Annual Meeting of the Society for Computers in Psychology, 1999, Los Angeles, CA.
9. Rainer, R. K., Laosethakul, K., Astone, M. K. (2003). Are Gender Perceptions of Computing Changing Over Time, Journal of Computer Information Systems, Summer, 108-114.
10. Ray, C. M., Sormunen, C., Harris, T. M. (1999). Men's and Women's Attitudes Toward Computer Technology: A Comparison, Office System Research Journal, 17(1), 1.
11. Reinen, I. J., Plomp, T. (1993). Some Gender Issues in Educational Computer Use: Results of International Comparative Survey, Computers in Education, 20, 353-365.
12. Shashaani, L. and Khalili, A. (2001). Gender and Computers: Similarities and Differences in Iranian College Students' Attitudes toward Computers, Computers and Educations, 37(3-4), 363-375.
13. Sumner, M., Niederman, F. (2003). The Impact of Gender Differences on Job Satisfaction, Job Turnover, and Career Experiences of Information Systems Professionals, Journal of Computer Information Systems, Winter 2003-2004, 29-39.
14. Temple, L., Lips, H. M. (1989). Gender Differences and Similarities in Attitudes Toward Computers, Computers in Human Behavior, 5, 215-226.
15. Wilder, G., Mackie, D., and Cooper, J. (1985). Gender and Computers: Two Surveys of Computer-related Attitudes, Sex Roles, 13(3), 215-228.
16. Young, B. J. (2000). Gender Differences in Student Attitudes toward Computers, Journal of Research on Computing in Education, 33(2), 204-216.