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Gender Stereotyping of Computing: Has Increased Exposure to Computing and the Internet Caused Perceptions to Change

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GENDER STEREOTYPING OF COMPUTING: HAS INCREASED EXPOSURE TO COMPUTING AND THE INTERNET CAUSED PERCEPTIONS TO CHANGE?

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Abstract

This paper reports on a study designed to examine perceptions of typical university students regarding gender stereotyping of computing across time. A replication study was utilized so that a previous baseline would be available for determining if perceptions had changed over the last five years. Specific factors that might drive the gender stereotyping of computing perceptions were investigated. These factors were gender, age, computer anxiety, computer self-efficacy, and computer and Internet-related computing experience. Data were collected from 272 undergraduate students. This studied identified that gender stereotyping of computing still exists. Despite the drastic increase in computing and Internet experience for both men and women over the last five years, an accompanying shift to a gender-neutral view of computing has not fully materialized. In fact, the overall perception was that computing is now perceived to be "more masculine" than in a 1995 study. Overall, the results of this study provided an useful snapshot of various gender stereotyping issues and should be useful in further studies that address the computer gender gap, participation and success of women in computing-related degrees and training, and high-tech workforce issues to name a few.

Introduction

"Gender stereotyping" issues have been the subject of much research. In the fields of computing and information technology (IT), "gender stereotyping" issues are important because it has been found that they can directly and indirectly impact participation and success of women in computing fields, high-tech workforce composition, and computing-related degree enrollments to name a few. More and more men and women, however, are being exposed to and using computers, the Internet, and other types of IT in their jobs and in their personal lives. Reports by Chirieac et al. (2001) Burns and Dick (1998, as cited in Chirieac et al., 2001) and Schrage (2000) have identified that gender-based perceptions toward the Internet are changing over time, with IT being seen as more essential to business and industry and integral to daily life. In light of this increased exposure, it is logical to pose the question of *whether the stereotypical gender perceptions (and the drivers for those perceptions) regarding computing have changed over time*? To answer this question the following research questions were identified.

Research question 1. Are males' perceptions of gender-typing of computing different from females'?

Research question 2. Will the factors of age, computer anxiety, computer self-efficacy, and computer/Internet experience be related to gender-typing perceptions?

Research question 3. Have subjects' overall computer anxiety, computer self-efficacy, and computer and Internet-related computing experience changed since 1995?

Research question 4. Have perceptions of gender-typing of computing changed since 1995?

Review of the Literature

A gender-typed activity is one where males and females are perceived as possessing different abilities or levels of ability, personality attributes, and/or interpersonal interaction styles. Activities that require abilities, attributes, and interaction styles expected of males are gender-typed as male, and those requiring feminine attributes are gender typed as female (Astone, 1995). Previous empirical research that spans from the 1970s to the early 1990s report differing findings regarding stereotyping of computing activities (Wilder et al., 1985; Smith, 1986/87; Clark, 1989; Astone, 1995). Wilder et al., (1995) in studies with children and youth determined that the computer was perceived to be more suitable for males than females. In a second study using, 334 college freshmen, Wilder et al. (1995) reported that the difference in perceptions between males and females was not significant. In another study, Smith (1986, 1987) measured the gender-typing perceptions of teachers and students in grades K-12. Even though respondents showed a positive favoring of the equality of the sexes, more males than females seemed to believe that males were better suited to computer competencies. A final study by Clarke (1989) examined 595 Australian adults and gender-typed forty occupations. Five computer-related jobs were included in the list of occupations and all but one, data entry operator was gender typed male. In another previous study, which this study replicates, Astone (1995) used a gender stereotyping of computing scale to measure perceptions. She reported that overall computing was viewed as slightly feminine.

Although there is sufficient empirical research concerning the gender stereotyping of computing from the 1970s to the early 1990s, the studies are difficult to compare because researchers use a variety of different constructs/scales to measure perceptions. This difficulty combined with the fact that there has been less empirical study in the late 90s makes it difficult to assess how perceptions have changed over time, especially from 1995 to 2000--the period when the impact of computing and the Internet has been its greatest yet.

Undoubtedly, the computing and IT landscape have changed drastically during the last five years. Most significantly, more and more men and women are using IT in both their personal and professional lives. Especially interesting are the statistics concerning women. In 1995, less than 5 % of Internet users were women; in 1999, about 50% of Internet users were women (Ebenkamp, 2000). This increased exposure is theorized to bring about changes in a variety of areas, one of them possibly being gender typing of computing perceptions. In the literature the "exposure to computing" referenced above is captured in a concept called computer experience. In addition to computer experience, the literature discusses many other factors that may contribute to individuals' gender typing perceptions. Some of the more prevalent and accepted factors to be addressed in this study include gender (Collis, 1985), individual computer attitudes (Ray et al., 1999; Ogletree & Williams, 1990) computer anxiety (Dambrot et al., 1985; Heinssen et al., 1987; Wilder et al., 1985; Igabara & Parasurama, 1989), and computer self-efficacy (Collis, 1985; Miura, 1987; Smith, 1986, 1987; Murphy et al., 1989).

Methodology

In order investigate perceptions of gender stereotyping of computing over time, a replication study was conducted. A replication study based on Astone's 1995 Gender Stereotyping of Computing work was specifically chosen. The study was conducted in a university setting to facilitate comparison of demographically-similar respondents. The study utilized a convenience sample of 300 undergraduate business students from a large southern university and 150 undergraduate business students from a smaller southern state university.

Instrument Development and Data Collection

A questionnaire was developed based on Astone's previous study and the literature reviewed earlier in the paper. Some changes were made to the survey instrument in order to update it for the current time frame and reduce its length, but overall the changes were minor. The survey instrument included a demographic section, a computer experience section, a Gender-typing of computing scale (GTS) section (Astone, 1995), a Computer Anxiety Rating Scale (CARS) section (Harrison & Rainer, 1992; Heinssen et al., 1987), and a Computer Self-efficacy Scale (CSE) section (Murphy et al., 1989). The different sections were necessary to identify the various factors that might have a relationship with gender typing of computing perceptions. The Gender Typing Scale (GTS) was measured using a six-point Likert-type scale, ranging from 1 (strongly disagree with the masculine stereotype) to 6 (strongly agree with the masculine stereotype). The midpoint of this Likert scale, 3.5, was considered neutral (no sexual stereotype). The Computer Anxiety Scale (CARS) and the Computer Self-efficacy Scale (CSE) were measured using a five-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly disagree). The items representing computer and the Internet-related computer usage (i.e. computer experience) were measured on a 5-level frequency scale with 1 being "do not use at all" and 5 being "use very frequently." Two versions of the survey were used to mitigate survey wording bias. After pilot testing the instrument with 32 undergraduate business students, both versions of the survey were factor analyzed to ensure the various scales (GTS, CARS, and CSE) accurately captured the concepts they were designed for. The factor analysis showed accurate

groupings. Alpha reliability tests were also run for the various scales and high reliabilities were achieved for both versions of the survey.

Procedures

Following pilot testing, the questionnaire was submitted to the 450 undergraduate business students. Of the 300 surveys submitted to students of the large southern university, 249 were completed. Of the 150 submitted to the smaller southern state university, 108 were completed. After a review of the surveys for missing data etc., a total of 305 usable surveys remained. In order to equalize the number of male and female responses, 33 male respondent surveys were randomly excluded, resulting in a final sample size of 272 and an overall response rate of 77%.

Results

Demographics

Before the research questions were answered, an examination of the respondent demographics was conducted. The final study consisted of 50.4% male responses and 49.6% female responses. 69.5 % of the respondents were under the age of 23, and 30.5 % were over age 23. Respondents possessed, on the average, 10 years of computer experience. 89% had taken less than seven computer-related courses, while 11 % had taken more. As for reported Internet activity, 28.2% spent less than 5 hours per week, 23.8% spent more than 5 but less than 10 hours per week, 37.2% spent between 10 and 20 hours per week, and 10.7 % spent more than 20 hours per week.

Research Questions

Research Question #1. The first research question investigated if males' perceptions of gender stereotyping of computing were different than females'. This research again showed what has been repeatedly identified in the literature—that significant differences in gender typing beliefs exist between men and women. In this study a correlation coefficient of $r = -0.24$ showed a significant correlation at the 0.01 level between gender and gender stereotyping as measured by the GTS scale. Unsurprisingly, females perceived that computing is gender-typed feminine, and males perceived that computing is gender-typed masculine.

Research Question #2. The second research question investigated whether the factors of age, computer anxiety, computer self-efficacy, and computer and Internet-related experience were related to gender typing perceptions. These factors were purposely investigated as a group because each of them can similarly impact individuals' gender stereotyping of computing perceptions. Results of the correlation tests are shown at Table 1.

Table 1. Factors and Relationship to Gender Stereotyping

Factor	Gender Stereotyping	
	r	p-value
Age	-.226	<.01*
Computer Anxiety	-.115	.058
Computer Self-efficacy	.090	.137
Computer Experience		
Multimedia software use	.187	.002*
Internet Experience		
Hours per week	.129	.025*
Downloading/uploading	.163	.007*

*significant at p<.05

The first interesting finding indicated the significant relationship between age and gender stereotyping. In this study, it was found that as age increased the masculine stereotyping of computing decreased. As for computer anxiety, a factor which measured feelings of high anxiety towards computer use, it was found not to be significantly related (using a .05 level) to gender stereotyping perceptions. Similar findings existed for computer self-efficacy. In evaluating computer experience a number of distinct activities were evaluated. These activities included years of computer use, number of computer courses taken, wordprocessing software use, spreadsheet/database/statistics software use, personal assistant software use, and multimedia software use. Of all eight of these activities, it was only found that multimedia software use was significantly related to gender

stereotyping perceptions. A similar approach was taken in evaluating Internet experience. The activities measured included e-mail use, online shopping, obtaining news/weather, downloading/uploading digital files, copying pictures or text, and use of online entertainment. Of all the activities evaluated, it was found that only the number of hours per week spent on the Internet and uploading/downloading activities had any significant relationship to gender stereotyping perceptions.

By assessing all these factors, it was possible to obtain a general snapshot of the respondent population and the factors that might be influencing their gender stereotyping perceptions. It was also necessary in order to compare the differences in the respondents of this study and the one previously conducted in 1995.

Research Question #3. The purpose of the third research question was to compare respondent attributes between the current and previous study. In particular, we wanted to examine whether subjects' age, computer anxiety, computer self-efficacy, and computer and Internet-related computing experience had changed since the 1995 study. Table 2 below shows a summary of the means between studies.

Table 2. Comparison of Means Between Studies

Current Study	Previous Study (1995)		
	Mean	Mean	P-value
Age	24.64	24.87	.99
CARS	1.62	2.18	1.06E-15*
CSE	4.32	3.55	4.45E-28*
Computer Experience			
Years of comp use	9.13	5.64	2.96E-20*
Comp. Courses	3.51	2.03	1.38E-07*
WP use	3.22	3.09	0.24
Spreadsheet use	2.24	1.90	0.00*
DB use	1.87	1.86	0.86
Statistics Soft. use	1.77	1.43	5.17E-05*
Personal Asst. soft	1.61	1.54	0.34
Multimedia use	2.37	1.52	1.41E-17*
E-mail use	4.23	1.79	1.24E-97
Internet experience			
Online shopping	2.58	Not measured	
Online research	3.11	"	
Obtain news	2.85	"	
Down/Upload files	2.54	"	
Copy pictures/text	2.62	"	
Online Entertainment	2.50	"	

*significant at p < 0.01

The mean age of both groups was not found to be significantly different. The mean value of the computer anxiety scale (CARS) from the current study, however, was shown to be significantly different from that of the previous study at the 0.01 level. Overall, findings indicated that the subjects from the current study had less anxiety toward computer use than did those of the previous study. The mean value of the computer self-efficacy scale (CSE) was also shown to be significantly different from that of the previous study at the 0.01 level. Specifically, the means of the current study indicate that respondents, in general, have less computer anxiety and higher computer self-efficacy than was reported in the earlier study. Given this finding, a further investigation of the correlations (which are not reported here in the interest of space) between computer and Internet-related experience and computer anxiety and self-efficacy were examined. It was determined that there was a significant positive relationship between computer/Internet experience and computer self-efficacy. In general terms, it was found that the more experience an individual had, the more self-efficacy he/she would report. An opposite (negative) relationship between computer/Internet experience and computer anxiety was then expected, but not supported by the data.

The mean values of all items of computer experience, except those mentioned below, were found to be significantly different from those of the previous study at the 0.01 level. The mean values of word processing software use and database software use were not significantly different from those of the previous study at the 0.01 level. Predictably, all items that indicated computer experience were found to have higher means in the current study than were found in the previous study. This meant that on average subjects from the current study had used computers several years longer and had spent more time on computer activities, in general, than those in the previous study.

The previous study did not investigate the Internet-related computing experience of subjects as the Internet had not yet gained wide popularity and usefulness. It was included, however, in this study because it has undoubtedly affected the lives computing habits of many individuals and possibly their gender stereotyping perceptions. Findings from this study showed that subjects, on the average, spent 11 hours per week on the Internet. Additionally, they reported accessing the Internet for different online activities at least once per day. E-mail was found to be the most frequently used online activity with the mean usage of between two to three times per day.

Research question #4. The fourth and final research question investigated whether gender stereotyping of computing had changed since the 1995 study. A comparison of means is shown in Table 3 below.

Table 3. Comparison of Gender Stereotyping Means Between Studies

	Previous Study		
	Mean	Mean	P-value
GTS	3.89	3.13	6.38E-14*

* significant at p< .01

The overall mean from the gender stereotyping scale (GTS) of 3.89 indicated a slightly masculine gender type. The GTS mean from the previous study had a mean of 3.13, which showed an overall feminine gender type. T-tests confirmed that the two means, although both hovering around the "3.5--no sexual stereotype" range, were significantly different. Subjects from the current study perceived an overall slightly masculine gender stereotyping of computing.

Discussion and Suggestions for Further Research

The increase in computer and IT exposure for both men and women during the late 1990s is a possible influence that might change stereotyping of computing perceptions. To ascertain current gender stereotyping perceptions of computing and the possible factors that influence those perceptions is an important step in determining how these stereotypes can be dealt with. This study used a large sample of university students; thus, the results of this study should be interpreted appropriately. In particular, readers should be cautious when generalizing the results reported in the study to all sectors of the population.

Despite what seems to be a gaining equality in the use of IT between men and women, it was surprising to note that both sexes still have very different stereotyping perceptions about computing. Men and women both still maintain gender stereotyping perceptions from the perspective of their own sex—females perceive that computing is gender-typed feminine and males perceived that computing is gender-typed male. This suggests that computing stereotypes are still very much a reality and must be acknowledged in working the realm of computing issues.

As for the factors (i.e. age, computer anxiety, computer self-efficacy, and computer and Internet-related experience) that were examined for their possible relationship with gender stereotyping of computing perceptions, interesting results were found. The finding that as age increases the masculine stereotyping of computing decreases gives us hope that, in general, an aging computer-literate population may be moving toward a non-stereotyped mindset. As for computer experience, the most surprising finding was the lack of correlation between any of the computer experience elements other than multimedia software use. Our research proposes no explanation for the positive correlation between multimedia software use and a masculine perception of computing other than the fact that multimedia software in the forms of games, video players, etc. have been traditionally linked with male users and may therefore form the basis of perception. As for Internet experience, we were surprised to find that usage levels appeared to have a strong positive correlation with masculine gender typing of computing perceptions. The same relationship existed between downloading and uploading activities and gender typing perceptions. This suggests that although men and women both are continuing to increase their Internet experience in a variety of ways, that this type of use still has a masculine gender association.

In comparing current study data with the previous (1995) study, what was found proved, in general, what we know and suppose about growing levels of computing activity. Students of today, for instance, have on the average twice as much computing experience, have taken one and half times more computer-related classes, and have doubled their use of a wide range of available software. It is no surprise, then, that the levels of individual computer anxiety have been reduced while the levels of self-efficacy have increased. The usefulness of this knowledge lies in the fact that it appears that these factors will become less and less of an issue in the investigation and accommodation of gender stereotyping of computing issues.

The overall focus of this study was to determine whether gender stereotyping of computing perceptions had changed over the last five years, specifically due to the boom in computing and the Internet. Contrary to what we had supposed, increased use and exposure seemed reinforce a more masculine gender stereotyping of computing. What this tells us is that gender stereotyping

of computing is still a valid issue for discussion. We may feel that computing, in many circles, has become gender-neutral, but it is still seen by men and women alike as a gender-related activity.

While this research has examined gender stereotyping of computing in a university setting using an undergraduate population, other research is needed to determine if findings can be replicated in other settings. Also, research on the impacts of gender stereotyping of computing in IT education and training curriculum development and IT workforce composition are equally necessary.

Conclusion

What this studied identified was that gender stereotyping of computing still exists. Despite the drastic increase in computing and Internet experience for both men and women over the last five years, an accompanying shift to a gender-neutral view of computing has not fully materialized. In fact, the overall perception was that computing is now perceived to be "more masculine" than in the 1995 study. Overall, the results of this study provided an useful snapshot of various gender stereotyping issues and should be useful in further studies that address the computer gender gap, participation and success of women in computing-related degrees and training, and high-tech workforce issues to name a few.

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