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The Temporal Stability of Gender Differences in MIS Students

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ABSTRACT

Few women major in Management Information Systems (MIS), which creates a serious bottleneck of women qualified to enter into the MIS workforce. To address this bottleneck, this study examines gender issues in MIS education. We assessed whether gender differences in MIS students' educational goals, stereotypes of MIS, and attitudes towards MIS classes and instructors remain stable over time. In addition, we analyzed the differential effects of individual MIS instructors on female and male students. Finally, we examined whether attitudes toward MIS instructors and classes predict grades in future MIS courses. We found that gender differences in MIS students are not temporally stable. Some attitudes towards MIS courses and instructors revealed greater problems or less satisfaction with instruction for female MIS students. Another interesting finding was that female MIS students underestimated their ability to a greater extent than did male students.

Keywords

Gender and MIS, gender differences, MIS instructors, retention, educational environment

INTRODUCTION

This paper examines issues surrounding the question of why there are so few women in Management Information Systems (MIS). We take the position that although structural barriers exist that keep women from advancement in MIS careers (cf. Ahuja, 2002), the dearth of women in the MIS workforce is foremost a pipeline issue. Currently only 36.8% of Bachelor's degrees in MIS are conferred on women (U.S. Department of Education, 2002). This severely restricts the number of women qualified to enter into the MIS workforce. The pipeline of women majoring in MIS needs to widen in order to increase the number of women working in MIS-related fields. An increased presence of women in MIS is imperative if the field wants to benefit from women's special skills and perspectives. Our nation cannot afford to underutilize such a valuable and significant part of our workforce.

Why do so few women choose to major in MIS? We have addressed three reasons for the small number of women majoring in MIS in another paper (Beyer, DeKeuster, and Rynes, 2004). They include low confidence, lack of programming and hands-on computer experience, and negative stereotypes regarding the field. Besides our own work on women majoring in MIS, we are aware of few studies that explicitly examined gender differences in MIS. The small extant literature on this topic investigates women employed in MIS careers rather than gender issues in MIS education. For example, Igbaria and Baroudi (1995) found that female MIS graduates are less likely to seek employment in MIS careers and that their attrition rate is higher than that of their male counterparts. Ahuja (2002) pointed out the many obstacles (e.g., lack of role models and mentors, work-family conflict) women face in IT and MIS careers. These are laudable and important efforts, but we believe that an examination of gender issues in MIS education is imperative because it represents a serious bottleneck in the supply of women qualified to enter the MIS workforce.

The focus of this paper is threefold. (1) We are interested in the stability of gender differences among MIS students across time. For this reason, we are using a subset of the dataset used by Beyer, DeKeuster, and Rynes (2004). In this paper we are reporting on those students who filled out our initial surveys in 2001, 2002, or spring of 2003 and who responded to a follow-up survey in a subsequent semester. The purpose of this analysis is to discern whether differences between male and female MIS students are temporally stable. Rather than assuming that gender differences assessed at one point in time are set in stone, we propose that some gender differences in MIS students might be fairly fluid: Gender differences that are present when students take their first MIS class might be augmented, reduced, or even disappear as students take more advanced MIS

courses. On the other hand, some differences between men and women might not even emerge until students are more advanced in their major. We are not aware of research that has empirically addressed this question. (2) In our previous research on MIS (Beyer, DeKeuster, and Rynes, 2004) and Computer Science (CS) students (Beyer, Rynes, and Haller, 2004), we focused on psychological differences between male and female students. In this paper we are broadening our analysis by examining the effect individual MIS instructors have on students' attitudes. We are particularly interested in whether individual MIS instructors affect male and female students differently. Again, we are not aware of other research addressing this issue. (3) Finally, we are interested in whether attitudes towards MIS instructors and classes can predict grades in future MIS courses. Importantly, will the same predictors emerge for female compared to male students?

METHOD

In an initial assessment, 97 (46 females, 51 males) Business majors enrolled in MIS courses in 2001, 2002, or Spring 2003 returned our initial surveys. In a subsequent semester 54 (32 females, 22 males) of these students also responded to a follow-up survey. Thus, 69.6% of women who participated in our initial assessment completed the follow-up compared to 43.1% of men. It has been our experience that females' response rates are higher than males. In this paper we are only reporting on the 54 students who provided information at the initial assessment and the follow-up. Thus, the comparison of initial responses to follow-up responses is based on the same students.

At the University of Wisconsin-Parkside, MIS is a concentration for students earning a Business degree. We surveyed students enrolled in two kinds of MIS courses: Those for Business majors with a concentration in MIS and those for Business majors with a concentration outside of MIS. For simplicity we refer to students in these two MIS course types as "majors" and "non-majors".

Students received \$2 to fill out questionnaires assessing (among other variables not discussed here) their educational and career goals; stereotypes of MIS; and attitudes towards MIS courses and instructors. We used a combination of existing instruments and items created specifically for our research. Following is a description of those items on which we report in the Results section.

We assessed educational and career goals with items that we constructed (e.g., "My career will give meaning to my life", "An MIS degree enables one to help people"). We constructed our own "Stereotypes of MIS" scale by having students rate the personality characteristics of students majoring in MIS. A factor analysis yielded several factors, including a "popularity" factor consisting of three items (e.g., "The average student majoring in MIS enjoys socializing" - coefficient alpha = .62). We used individual items from the Role Conflict Scale (Lips, 1992) to assess students' opinions of the compatibility of work and family for women in MIS. We asked questions measuring students' general attitudes towards MIS courses, instructors, and the program (e.g., "MIS faculty make an effort to help a new student feel comfortable", "Female MIS students are not taken seriously by male faculty"). Finally, students reported on their experiences with and attitudes towards specific instructors and courses. We conducted a factor analysis of these responses. Five items assessed the quality of the instructor (e.g., "My instructor is very good" - coefficient alpha = .88), four items assessed the difficulty of the class (e.g., "This is a very difficult class" - coefficient alpha = .70), and two items assessed the perception that one is not doing well in the class (e.g., "I am doing well in this class" reversed coded - coefficient alpha = .59).

RESULTS AND DISCUSSION

To understand gender differences in MIS students across time, we performed 2 (student gender: female versus male) x 2 (major status: major versus non-major) x 2 (assessment time: initial assessment versus follow-up) repeated measures analyses. Student gender and major status were between-subjects variables, whereas assessment time was within-subjects.

Table 1 gives selected means for these analyses. Because the issue of interest for this paper is gender, we will not report on significant main effects of major status. Significant interactions between gender and major status will of course be noted. Differences in N are either due to missing values or the addition or deletion of questions in surveys sent out in different semesters.

Demographic Variables

This sample of Business students consisted of 79.6% Caucasian, 3.7% Hispanic, 1.9% Asian, and 1.9% African American students. Thirteen percent chose not to identify their race. Thirty-one students were MIS majors and 23 students were Business majors taking an MIS course (referred to as non-majors). Male and female students and MIS majors and non-majors were remarkably similar in demographic variables, year in college, number of children, and socioeconomic status.

	Initial assessment				Follow-up			
	Non-MIS Majors		MIS Majors		Non-MIS Majors		MIS Majors	
Selected variables	Women	Men	Women	Men	Women	Men	Women	Men
Educational and Career Variables								
My career will give meaning to my life***	4.18	4.00	2.50	5.07	5.00	4.20	5.14	4.93
MIS degree enables one to help others**	3.53	3.50	3.94	3.19	3.55	4.00	4.06	3.63
MIS degree enables one to earn a lot of money**	4.10	4.17	4.08	4.20	4.10	3.83	4.42	4.07
Doing well in MIS enhances career opportunities***	5.35	4.17	6.33	5.81	5.59	5.67	5.80	5.94
Stereotypes of MIS								
Students majoring in MIS are popular***	4.07	3.89	4.55	3.79	4.28	4.33	4.57	4.43
It is difficult for women to combine a family and career in MIS***	2.63	2.33	1.93	2.69	3.23	2.50	2.67	3.72
Computer-related majors interfere with social life***	2.81	2.67	2.21	2.93	2.78	2.33	2.64	3.80
Estimated % of women in MIS	30.0	35.0	31.9	28.4	27.7	28.3	25.7	29.9
Attitudes towards MIS Courses and Instructors								
Atmosphere in MIS department is impersonal***	3.18	3.00	2.47	3.56	3.32	2.75	2.87	3.56
MIS faculty try to make new students feel comfortable in major***	4.59	3.50	4.40	4.88	4.65	5.33	4.87	4.31
Female students are not taken seriously***	2.50	2.13	2.06	1.78	2.09	1.50	2.40	1.88
Ability of females is underrated by others***	2.35	2.00	1.80	1.56	2.44	1.50	2.07	1.62
MIS faculty are sensitive to the needs of students***	4.94	4.17	5.33	4.25	4.50	5.25	4.53	4.38
MIS faculty expect too much***	3.47	2.17	3.13	3.56	3.35	2.08	3.73	3.63
Grades								
MIS grades*	NA	NA	NA	NA	3.33	3.45	3.05	2.94

Table 1. Means for selected variables.

Notes: Higher scores signify stronger endorsement of item. * 1-4 scale; ** 1-5 scale; ***1-7 scale

Educational and Career Goals

There was a significant interaction between gender and time on students' career orientation ("My career will give meaning to my life"), $F(1, 48) = 8.06, p = .007$. Men's career-orientation remained fairly stable across time, whereas women became more career-oriented. Thus, at the follow-up, the initial gender difference disappeared.

We asked students whether they thought that an MIS degree enables one to help people. There was a significant effect of time, $F(1, 50) = 5.54, p = .02$, and a borderline interaction between time and gender, $F(1, 50) = 2.93, p = .09$. Overall, students became more optimistic over time that an MIS degree would allow them to help people. The increased optimism was larger for male than female students.

There was a significant interaction between time and gender regarding the perceived earning potential in MIS, $F(1, 44) = 4.64, p = .04$. At the follow-up women thought the earning potential in MIS was higher than they had initially indicated. In contrast, men perceived the earning potential to be lower at the follow-up.

There was a significant interaction between gender and time for students' perception that doing well in MIS courses enhances career opportunities, $F(1, 51) = 7.16, p = .01$. While women initially were more convinced that doing well in MIS courses enhances career opportunities, this gender difference disappeared by the follow-up because men increased their endorsement of this item.

This pattern of results reveals that for the educational and career goal variables assessed in this study gender differences found at the first assessment vanished or were reduced by the follow-up one semester later. This points out that static assessments of gender differences do not reveal the fluidity of gender differences over time. Possibly, as male and female students take more MIS courses together, their educational and career goals become more similar, eradicating initial gender differences.

Stereotypes of MIS

The interaction between time and gender for the perception that students majoring in MIS are popular was of borderline significance, $F(1, 48) = 3.39, p = .07$. While women's perceptions of the popularity of MIS students remained steady around the neutral point, males' more negative perceptions of the popularity of MIS students became neutral with time.

There was a borderline interaction between gender and major status for students' perception that it is difficult for women to combine a family and career in MIS, $F(1, 49) = 2.95, p = .09$. At both assessment times female majors were more optimistic about women's ability to combine a family and career in MIS than female non-majors. The reverse was true for males, with male non-majors being more optimistic than male majors. In addition, the significant effect of time indicates that at the follow-up students had become less optimistic regarding women's ability to combine family and career in MIS, $F(1, 50) = 8.75, p = .005$.

There was a marginally significant interaction between gender and major status for students' belief that it is difficult to pursue a computer-related major and still have a social life, $F(1, 47) = 3.01, p = .09$. At both assessment times, the stereotype that students who major in computer-related fields have little time for a social life was stronger for female non-majors than majors. Male majors espoused that view to a greater extent than did male non-majors.

There was a borderline interaction between gender, major status, and time for estimates of the percentage of women in MIS, $F(1, 49) = 2.82, p = .10$. While estimates of the percentage of women in MIS decreased at the follow-up, this was especially true for female majors and male non-majors.

We emphasize that there were few gender differences in stereotypes of MIS. Some stereotypes showed a complex pattern of interaction between gender and major status. Some of the gender differences in stereotypes that did exist at the first assessment disappeared by the follow-up (e.g., popularity of students majoring in MIS). And for some stereotypes, female majors had less negative perceptions than male majors at the follow-up (difficulty of women combining career and family; students who major in computer-related fields have little social life). Still, there is reason for concern. Male and female students' perceptions of women's ability to combine family and career became more pessimistic over time. Even though the extent of pessimism at the follow-up was lower for women than men, this stereotype should affect women more because it applies to them personally. Furthermore, female majors had the lowest estimates of the percentage of women in MIS. This perception might make them expect greater isolation and gender discrimination in the workforce.

Attitudes towards MIS Courses and Instructors

Some noteworthy gender differences in attitudes towards MIS courses and instructors emerged. There was a borderline interaction between gender and major status regarding ratings of the atmosphere in the MIS department, $F(1, 50) = 3.52, p = .07$. Female non-majors felt the atmosphere was more impersonal than did male non-majors, whereas male majors found the atmosphere more impersonal than did female majors.

There was a highly significant interaction between time, gender, and major status for students' belief that MIS faculty try to make new students comfortable, $F(1, 50) = 7.84, p = .007$. Most students became more positive in their belief that faculty try to make new students comfortable over time, with male non-majors becoming much more positive.

The interaction between time and major status for the perception that female students are not taken seriously by MIS faculty was significant, $F(1, 51) = 6.18, p = .02$. Whereas non-majors were more negative in their perceptions of the treatment of female students initially and then became less negative over time, the perceptions of majors became more negative over time.

We found a borderline significant gender difference in students' perception that the ability of female MIS students is underrated by others, $F(1, 51) = 2.84, p = .10$, with women espousing that belief more strongly than men.

There was a significant interaction between time and gender for students' belief that MIS faculty are sensitive to the needs of their students, $F(1, 51) = 4.63, p = .04$. Whereas female students' attitudes became less positive with time, male students' became more positive.

Female students thought that MIS faculty expect too much from students to a greater extent than did male students, $F(1, 50) = 3.70, p = .06$. Thus, some attitudes towards MIS courses and instructors revealed potentially greater problems or less satisfaction with instruction for women than men.

We supplemented these analyses with in-depth analyses of students' experiences with individual instructors. All instructors were male, hence the effect of instructor gender could not be analyzed. However, we were able to analyze the results by student gender, instructor, and gender by instructor. It is important to note that the following results are not due to differences in students' grades. There were no significant differences in MIS grades by gender, $F(1, 146) < 1$, or instructor, $F(2, 146) < 1$.

It may come as no surprise that students' opinions of how good an instructor was showed a highly significant instructor effect, $F(2, 129) = 14.01, p = .0001$. Of the four instructors for whom we had sufficient data, one was the clear favorite, one was generally seen positively, one was somewhat unpopular, and one was quite unpopular. Gender interacted with instructor, $F(2, 129) = 3.77, p = .03$. These analyses revealed that males and females preferred different instructors. Although women and men agreed on who the best instructor was, they disagreed on the ratings of the other three instructors. The instructor who was the least popular with female students was the second most popular instructor for male students. These effects are not due to the difficulty of the courses or students' assessment of their performance in the class.

There was no gender difference in how difficult students thought the classes were, $F(1, 148) < 1$. Instructors were rated as equally difficult, $F(2, 148) < 1$. In addition, there was no effect of instructor on students' assessment of their performance in their class, $F(1, 68) < 1$.

Why did female and male students prefer different instructors? It is possible that some instructors are more sensitive to the issues that women face in a male-dominated major. Alternatively, teaching style or encouragement and support of students might differ across instructors. These variables may matter more to women. Research in the natural sciences, math (Kumagai, 1994; McIlwee and Robinson, 1992; Seymour and Hewitt, 1994; Strenta, Elliott, Adair, Matier, and Scott, 1994), and CS (Cuny, Aspray, Cohoon, and Jesse, 2003; Margolis and Fisher, 2001) has found that social support, faculty encouragement, classroom climate, and advising are more important to women's than men's decision to enroll in or leave a major. We are not aware of research on the importance of these variables for undergraduate MIS students.

Predictors of Students' MIS Grades

We also wanted to find out if students' perceptions of their MIS classes and instructors could predict their future MIS grade point average (GPA). To address this question we conducted multiple regression analyses where gender, MIS major status, students' perceptions of their MIS classes and instructors, and the interactions of these variables were used to predict students' MIS GPAs. It is important to note that we are not predicting the grades in classes in which students were currently enrolled. We assessed their GPAs in MIS courses one to three semesters later.

As Figure 1 indicates, the perceived difficulty of the classes taken during the period of the initial assessment negatively related to their MIS grades in subsequent semesters, $F(1, 151) = 37.75, p = .0001$. Similarly, students who thought they were not doing well in their classes received lower MIS GPAs in the future than did those who thought they were doing well, $F(1, 73) = 6.22, p = .02$.

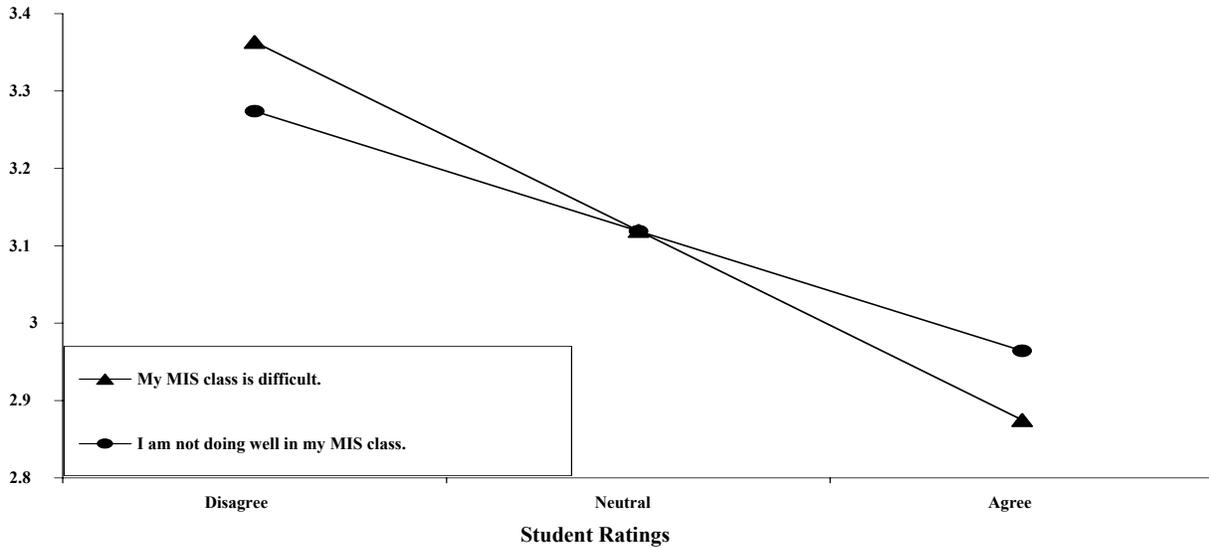


Figure 1. Students' perceptions of their MIS courses as predictors of their grades in future MIS classes.

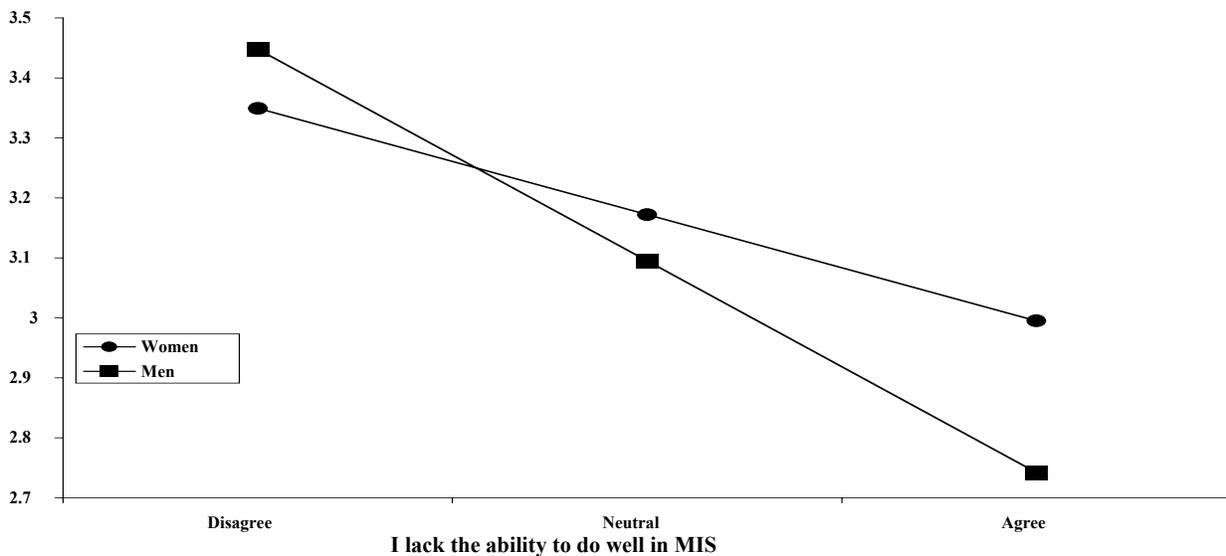


Figure 2. Students' perceptions that they lack ability in MIS as a predictor of their grades in future MIS classes.

Figure 2 shows that the perception that one lacks the ability to do well in one's class negatively related to MIS GPAs, $F(1, 84) = 29.79, p = .0001$. This perception also interacted with gender, $F(1, 84) = 3.66, p = .06$. Women and men with identical views of their ability had significantly different GPAs in their MIS courses. This was especially true for students who had low opinions of their ability. Men who believed they lacked MIS ability had much lower MIS GPAs one to three semesters later than did women with identically negative opinions of their ability. In fact, women who thought they lacked ability in MIS earned only somewhat lower MIS grades than women who thought they had a lot of ability. This suggests that these women underestimated their ability, which we have found in much of our previous research (Beyer, 1990, 1998, 1999, 2002; Beyer and Bowden, 1997; Beyer, Rynes, Perrault, Hay, and Haller, 2003).

CONCLUSION

The purpose of the present study was threefold: to investigate whether gender differences in MIS students remain stable over time, to examine how individual instructors affect students' attitudes toward MIS, and to assess whether attitudes toward MIS instructors and classes predict grades in future MIS courses.

We found that gender differences in MIS students are less temporally stable than might be expected. Most gender differences in educational and career goals decreased between the first and second assessment. These changes were generally in the direction of more positive perceptions of MIS. Similarly, some of the gender differences in stereotypes that did exist at the first assessment disappeared by the follow-up. This indicates that students' perceptions may be amenable to change through engagement in MIS courses. Thus, one-time assessments might lead to erroneous conclusions. In the future, researchers should be careful not to jump to conclusions without examining the changing opinions of both genders over time. It is possible that gender differences are reduced over time because those who are more involved and more advanced in their MIS studies begin to feel assimilated i.e., they see themselves simply as MIS students, instead of seeing themselves as male or female MIS students. Of course, as with all longitudinal research, an alternative explanation is that other intervening factors (e.g., maturity) are responsible for changes across time.

For some stereotypes female majors were less negative than male majors at the follow-up. However, stereotypes may still have a more adverse impact on women in MIS. For example, the stereotype that it is difficult for a woman to combine a family with a career in MIS is likely to either dissuade women from entering into MIS or may decrease their retention in the major because it applies to them personally. Another example of a stereotype that men held more strongly at the follow-up than women did is that students who major in computer-related fields have little social life. This stereotype conflicts more with the gender roles and self-concepts of women than with those of men (Cross and Madson, 1997; Markus and Kitayama, 1991), increasing the probability of female students leaving the MIS major. This suggests that even if female and male students held identical stereotypes about MIS, female students might be more negatively affected by those stereotypes. Furthermore, female majors thought that there were few women in MIS, which might breed a sense of isolation and an increased expectation of gender discrimination in the workforce.

Women had somewhat more negative experiences with MIS instructors than did men. Female students were more likely than male students to believe that their abilities are underrated by their instructors, that instructors are insensitive to students' needs, and that faculty expect too much from students. Some of the perceptions of the MIS department and MIS instructors became more negative with time. Again, these variables appear to be amenable to change, suggesting that MIS departments' efforts to improve their responsiveness to students' needs might bear fruit.

We found a significant interaction between gender and instructor suggesting that men and women respond differently to instructors' teaching styles. Perceptions of classes at the initial assessment were found to predict grades in different classes with different instructors at the follow-up.

Limitations of the present research and suggestions for future research

In the present study participants were re-contacted in the semester following their initial assessment. Follow-ups over even longer periods of time would provide more in-depth information about the stability of gender differences over time. We are presently conducting additional follow-ups of our initial participants to address the stability of gender differences over a two-year period. Especially interesting would be a follow-up study of students entering the workforce. What happens to gender differences as individuals transition into the MIS workforce?

Our finding that male and female students evaluate instructors somewhat differently suggests that instructor variables merit more in-depth empirical attention, from both the students' and instructors' perspectives. We need to determine what variables are important and whether they can be changed to the benefit of everyone. For example, are the instructors who are preferred by women especially sociable, supportive, or interested in advancing women's opportunities?

At the present institution there are no female MIS instructors preventing us from examining the gender of the instructor as a variable. Clearly, this is an important issue awaiting further study, especially given the fact that female role models and mentors have been shown to have a significant positive effect on female students in related disciplines such as CS (Lagesen, 2002; MacKeogh, 2002).

A further limitation of the present research is that most participants were Caucasian preventing us from conducting analyses by race. More research on minorities in MIS is needed. Currently there are efforts underway to study CS students at historically Black colleges (Lopez and Schulte, 2002). Similar efforts targeting minority students in MIS would be fruitful.

We believe that this research has yielded intriguing results. Understanding what contributes to success in MIS can aid in our efforts to recruit and retain female MIS majors and thereby increase the number of qualified women entering into MIS careers.

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