

COMMUNICATION CLIMATE AND SATISFACTION IN THE COMPUTER SCIENCE CLASSROOM

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Abstract — This study investigated the correlation between student's feelings of similarity based on gender, perceptions of communication between persons, and desire to remain in computer science. Perception of gender homophily correlates significantly with satisfaction in computer science study at the university level.

Index Terms — Homophily, peer immediacy, teacher immediacy.

INTRODUCTION

Women make up 47 percent of the U.S. labor force but comprise only 27 percent of computer/math scientists. Since the early 1990s, the percentages of women in most science and engineering occupations have gradually increased except in computer science/math where the percentage of women declined approximately four percent between 1993 and 1999. The percentage of women earning their bachelor degrees in computer science peaked at 15,126 in 1986 and came down to 7,063 by 1995. Since then the number has stabilized. Of incoming freshman in 2002, only 0.7% of women planned to major in computer science compared to 4.2% of men [5]. The overwhelming majority of students in the computer science field in post-secondary education tend to be males.

Scholars have identified a number of possible factors that affect the enrollment and retention of female students in computer science programs. These factors include exposure to computers, sex role stereotyping, and gender socialization, motivational differences, differences in learning strategies and behaviours, and negative attitudes towards women in computer science programs [1]-[4].

The fact that computer science programs are overwhelmingly populated by males has also given rise to such terms as "geek" and "nerd" [1]. Women do not feel part of the computer science culture. Even when girls are enthusiastic and successful in early experiences with computers, they do not use them in the same way as their male peers and voice different values and preferences. It is believed that female role models and more female centered support systems would be helpful in retaining women in computer science programs.

Some research has been done on providing all-female classrooms in school, and in all-girl environments such as the Girl Scouts to counter the effect of male culture in computer science. These environments are based on girls

feeling free to ask questions and make 'mistakes' without feeling judged. Others have been investigating the social construction of gender and information technology with the goal of overcoming negative attitudes of girls towards computers that are based on perceptions of computers as a male cultural milieu. The value of such research may be in the identification of societal and classroom communication norms that support females to retain confidence in their ability to be successful in computer science.

The research question that guided the current study is: What creates a supportive communication climate for women in the computer science classroom? In exploring classroom communication norms as a support system for female students, the present study investigated the correlation between student's perceived gender similarities with others in the computer science discipline (homophily), their feelings of the openness of communication between persons (immediacy), the resulting supportive communication climate in the classroom, and their satisfaction in the study of computer science.

METHOD

Given the totality of homophily, teacher immediacy, and peer immediacy contribution to an overall supportive communication climate in the classroom, this paper investigated classroom climate as it correlates to student satisfaction in the computer science classroom. It tested the following three hypotheses:

H1: Teacher immediacy and program satisfaction will be correlated positively.

H2: Peer immediacy and program satisfaction will be correlated positively.

H3: Gender homophily and program satisfaction will be correlated positively.

Participants

The participants in the present study were students in computer science at four institutions of higher education. Two institutions were Hispanic-serving universities, one was a historically Black university and the other was a Native American tribal college. The total sample size was 66 which included 35 female and 31 male participants. The sample was ethnically diverse with 21 White (11 female, 11 male), 15 African American (7 female, 8 male), 10 Hispanic (5 female, 5 male), 10 Native American (8 female, 2 male), and

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nine Asian American (4 female, 5 male) participants.

Interviews

The data for this study was gathered in 2002 through in-depth interviews, as part of a larger project on women and minorities in information technology. Questions analyzed for data covered areas such as experiences in the classroom; interactions with students and teachers, encouraging and discouraging experiences, likes and dislikes of the computer science program; experiences specifically related to gender; and future plans.

Analysis

A content coding scheme was developed based on four variables: teacher immediacy, peer immediacy, perception of homophily, and satisfaction with computer science. The data were analyzed in three stages. First, frequencies for all variables, including demographic variables, were investigated. Second, bivariate relationships were computed using a chi-square analysis (Table 1). Gender (male/female), ethnicity (white/non-white), homophily (yes/not-yes), and satisfaction (yes/no) were measured against all other variables, including all demographic variables. Third, logistic regression was used to explore the relationships between the variables that were included in the hypotheses of the present study. A logistic regression model was tested that included satisfaction as the dependent variable, with teacher immediacy, peer immediacy, and homophily as the independent variables.

FINDINGS

The first hypothesis predicted that teacher immediacy and program satisfaction would be correlated positively. No significant bivariate relationship or odds ratio for prediction was found between teacher immediacy behaviours and program satisfaction (See Table 1). Hypothesis One was not Supported. The second hypothesis predicted that peer immediacy and program satisfaction would be correlated positively. No significant bivariate relationship or odds ratio for prediction was found between peer immediacy behaviours and program satisfaction. Hypothesis Two was not supported.

The third hypothesis predicted that gender homophily and program satisfaction would be correlated positively. Bivariate measures and forward logistic regression was conducted to determine which independent variables (teacher immediacy, peer immediacy, and gender homophily) would predict satisfaction in computer science education. Results indicated a significant relationship. Perception that gender homophily exists was positively correlated with satisfaction ($X^2=9.251$, $p<.05$). Regression results indicated the overall model fit of one predictor of satisfaction, perception of gender homophily

($X^2(1)=10.30$, $p<.05$; Nagelkerke $R^2=.22$; OR=.11[95%CI .023 to .547]). The odds ratio for this variable indicated a significant change in being able to predict satisfaction. Hypothesis three was supported.

TABLE 1
BIVARIATE RELATIONSHIP FOR GENDER, TEACHER IMMEDIACY, STUDENT IMMEDIACY, HOMOPHILY AND SATISFACTION IN COMPUTERS

	Satisf.	Teach.+	Teach.-	Peer+	Peer-	Homo
Gender	$X^2=.088$	$X^2=.409$	$X^2=.002$	$X^2=.851$	$X^2=3.04$	$X^2=.041$
Satisf.		$X^2=.001$	$X^2=.148$	$X^2=.015$	$X^2=.015$	$X^2=9.251$
Teach.+			$X^2=.203$	$X^2=.680$	$X^2=.129$	$X^2=.541$
Teach.-				$X^2=.001$	$X^2=2.37$	$X^2=1.07$
Student+					$X^2=1.98$	$X^2=.098$
Student-						$X^2=.120$

Satis=Satisfaction; Teach=Teacher; Homo=Homophily

DISCUSSION

The purpose of the current study was to investigate communication factors in the computer science classroom that contribute to satisfaction and retention of female computer science students. In this sample, perceptions of a homophilous culture based on gender were a sign of whether or not students would be satisfied with their computer science program.

Perceptions by computer science students that there exists, or does not exist, a difference in the classroom based on gender, predicts that communication will not occur and that a positive interpersonal relationship will not exist between male and female students in the classroom. Particularly, students who perceived that there was no difference between men and women in skill and ability, and in the way they were treated in the classroom, were more likely to be satisfied and remain in computer science through graduation and into graduate school. Alternatively, those students that perceived a division between students based on gender were dissatisfied with computer science. This finding provides a new context for study when applied to the study of how the existence of a strong male culture in the computer science classroom affects the communication climate.

IMPLICATIONS

It is the tendency of many scholars to concentrate their research efforts on concepts and constructs that have already been well defined and are relatively easy to study. Such is the case with the concept of teacher immediacy, which has a

long history of research and a ready made population for study in the college and university environment. However, student learning outcomes do not only center around instructor skills in relating on a student-to-student basis. The instructor must also be able to set an environment in the classroom that encourages supportive peer relationships. The current study demonstrates the importance of ensuring a perception of homophily in the classroom; creating an environment where all students feel they have similarities with others that increase their ability to communicate about knowledge and assignments. In the computer science classroom this entails getting rid of attitudes, on the part of both instructors and students that allow a male culture to persist.

In the setting of the classroom there are other practical implications of this research. The current study supports the self-report of women who indicate that there is still a strong gender centered culture in the post-secondary level computer science classroom. Several solutions have been suggested to overcome this dynamic. Scholars have suggested that female role models, more female faculty, and more female centered support systems in computer science would be helpful in retaining women in computer science programs. However, the present research indicates that these are limited fixes and that more work needs to be done on current classroom climates to change the gender centered dynamic. This includes paying more attention to the way that instructors communicate to both males and females; that an effort is made to structure classes in such a way that females feel comfortable communicating with all of their peers; and that a new culture is created that includes both male and female students.

CONCLUSION

Efforts at retaining women and minority students in computer science have, in the past, been concentrated on providing early hands-on computer experiences and on recruitment into programs on the premise that a critical mass of women will provide a community of scholars that will support each other. Some of these efforts have been successful but do not get at underlying factors that include the way in which teachers communicate to students, the way that students treat their peers, and whether women and minority students feel a part of the culture in the classroom based on communication about gender or ethnicity similarities and differences. Researchers and schools need to take a serious look at these factors when modifying programs that are not acting to retain women and minority students.

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