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Gender Differences in Factors that Promote an Interest in IT among High School and Early and Late College Students

ABSTRACT

This paper compares gender differences in the role of parental support and interaction with others about career options in IT at three points in time (during high school, early college, and late college). Results indicate that women are not having interactions about career options that contribute to an interest in IT and that by the third and fourth year of college, those enrolled in a major leading to a career in IT do not perceive significant positive support from parents or from others outside of the family. Men have fewer interactions about career options, but perceive continued positive support from parents and other family members about their interest in IT.

Keywords

family, career, gender

INTRODUCTION

Despite dramatic changes in the access and use of computers that has occurred in the last twenty years, achieving gender parity in the number and percentage of students enrolled in majors leading to a career in Information Technology (IT) has remained an allusive goal. Efforts to recruit and retain qualified women in the field face the challenges peculiar to new fields that change rapidly with technology. Typical sources of career information, such as parents and counselors, are unlikely to be in a position to share accurate and timely information about the demands of jobs in the field. Further adding to the challenge is the pervasiveness of occupational and gender stereotypes that characterize the field as inherently unattractive to women. The fact that many women enter IT through job experiences and at a later point in time than do most men, further adds to the need for informal and formal educational activities that promote informed career decision making in years that span from the middle school to the mid-point of college.

The optimism that was produced in the mid 1980s when the graduation rates of women computer science departments rose to 37% was followed by twenty years of declining enrollments of both men and women pursuing computer science degrees. Data from the National Science Foundation (NSF) indicates that the proportion of bachelor's degrees awarded to women in computer science dropped from a high of 32.5% in 1981 to 20.4% in 2006. The number and percentage of women enrolled in computer science has remained significantly below that of most STEM fields, where the graduation rates of women in the life sciences and mathematics have reached near parity with men. Like engineering, IT has proven to be a field where it has been difficult to make any significant in-roads to offset the under-representation of women.

Parental Influences in Career Decision for Females and Males

Parents play an instrumental role in occupational choice and interest in IT. During the process of occupational orientation, adolescents must identify their interests and abilities as well as balance them with opportunities while they gradually develop a preference for occupations. During this formative period adolescents speak most frequently with their parents about career issues (Otto, 2000). They often name their parents as major partners in their career preparation process (Kracke, 1997). The more child-centered and supportive parent-adolescent relationships relate to more active exploration for both females and males. This relationship provides empirical support for the general notion of the importance of the family for adolescents' career exploration and holds independent of parental education and gender of the adolescent (Super, Savickas & Super, 1996). However, in the case of IT careers, most parents hold uninformed perceptions and are often unable to provide accurate information on the full range of IT career options for their children. They may also hold outdated gender stereotypes about non-traditional career opportunities (Young, Friesen & Borycki, 1994).

The college years are a crucial time for career-related decision-making. College students are faced with the need to choose an academic major as well as to develop career goals for the future (Guerra & Braungart-Rieker, 1999). While parents remain a primary source of career information during the college years and beyond, factors such as gender race, ethnicity, and disability all combine to frame their career choices. Kerka (1998) found that girls generally explore career choices from a narrower set of career options than boys, in part due to gender-role socialization. A breadth of resources such as career exploration programs, non-traditional mentors, and discussions about occupational stereotypes both in- and outside of the classroom will likely supplement the role of parents and friends as students progress in their college major choices.

This paper shares results from the *Career Decision Making Survey (CDMS)* developed by the Women and Information Technology (WIT) team at Virginia Tech by comparing gender differences in the role of parental support and interaction with others about career options on interest in IT as a career option. The analysis differs from our previous research (e.g. Creamer, Lee, & Meszaros, 2007; Meszaros, Lee, & Laughlin, 2007) in that it disaggregates the impact of key factors on interest in IT among a cross-sectional group of students at three points in time (high school, early and late college).

Results build on our previous research by testing the applicability of three hypotheses to questionnaire respondents at three distinct periods of the educational experience.

HYP1: Parental support has a significant positive impact on both men's and women's interest in IT.

HYP2: The influence of parents and friends as a source of career information diminishes over time.

HYP3: The influence of others outside of the family (employers, counselors or advisors, and teachers) on IT career interests increases as students move from high school, to early and then late college.

METHODS

Instrument

High school and college students completed different versions of the *CDMS*, each developed by members of the WIT Team. The high school version of the *CDMS* differed from other versions in information was collected about access to computers and engagement in different types of extracurricular activities. The final (2004-2005) version of the *CDMS* distributed to college students is a pen-and paper 119-item instrument that takes approximately 20 minutes to complete. In addition to demographic information, the instrument contains questions organized in 10 sections designed to identify key steps in the career decision making process: Reasons for Taking a Computer Course, Attitudes About the Traits of IT Workers, Computer Use, Familiarity and Interest in Computer-Related Careers, Important Factors in Career Choice, Parents' Opinions and Views, Sources of Career Information, Credibility of Information Sources, Openness to Input, and Views About Decision Making. All questions were coded so that the higher the value, the more positive the response.

Collection Procedures and Respondents

Human subjects approval was secured for three waves of data collection. The population from the first and second wave of survey administration, first distributed in 2002 and subsequently in 2003, is most comparable. At this point, the distribution of the questionnaire was not limited to a population of students expressing an interest in IT. Respondents come from 10 high schools and 4 colleges in urban and rural locations in Virginia. Respondents from the first two phases of data collection consisted of high school (n=556) and first and second year college students (n=207). The response rate for phase one was 62% and 33% for the second phase. Of the high school students, 293 (47.3%) were female and 263 (47.3%) are male. Of the first and second year students, 80 or 38.6% are female and 127 or 61.4% are male. The nature of the questionnaire and its focus on IT-related issues probably diminished the number of respondents.

The method of distribution and targeted respondents were quite different in the third (2004-2005) and final wave of data collection. As it was done largely as a way to test the applicability of a statistical model the team had developed to identify factors that confirm the applicability of the *CDMS* to students with an interest in IT (Creamer,

Lee, & Meszaros, 2007; Meszaros, Lee, & Laughlin, 2007), the questionnaire was only distributed to upper-level college students enrolled in IT. We worked with personnel in the IT department at two research universities in the mid-west and north-Atlantic region to recruit upper-level college students to complete the questionnaire. Of the 350 students identified, 221 completed usable responses to the questionnaire, for a response rate in this phase of 63%. As the distribution of the major is strongly skewed toward men, it proved difficult to recruit large numbers of women to complete the survey.

A summary of the characteristics of the respondents to the questionnaire appears in Table 1.

Demographics

		Gender		
		Female	Male	Total
High School	Count	293	263	556
	% Within Group	52.7%	47.3%	100.0%
	% Within Gender	68.5%	50.3%	58.5%
1st & 2nd Year	Count	80	127	207
	% Within Group	38.6%	61.4%	100.0%
	% Within Gender	18.7%	24.3%	21.8%
3rd & 4th Year	Count	55	133	188
	% Within Group	29.3%	70.7%	100.0%
	% Within Gender	12.9%	25.4%	19.8%
Total	Count	428	523	951
	% Within Group	45.0%	55.0%	100.0%
	% Within Gender	100.0%	100.0%	100.0%

Table 1: Demographic Characteristics of the Survey Respondents

Data Analysis

Earlier phases of the research involved the development of a statistical model to identify factors that play a significant role in predicting high school and college students' interest in IT as career choice. To do this, confirmatory factor analysis was used to determine which sets of questionnaire items identified from the literature produced the most reliable measures. The final model contains a single dependent variable, IT Career Interest and Choice, and seven independent variables (Creamer, Lee, & Meszaros, 2007; Meszaros, Lee, & Laughlin, 2007). All of the factors or scales used in the final analysis proved to have either moderate (Cronbach Alpha of .60-.79) or high (.80 or better) reliability when the data from the high school and early college students collected during the first phase were considered together.

The analysis reported in this paper uses the dependent and two of the independent variables identified by the authors in the 2007 model as being significant predictors of students' interest in IT as a career choice. These are described in greater detail in the next section of the paper.

IT Career Interest and Choice

The dependent variable, IT Career Interest and Choice, contains 7 questionnaire items and has a reliability of .71. It contains the following set of questions: (1) I have a good idea of what people in computer-related fields do in their jobs; (2) I feel a sense of satisfaction when I am able to use the computer to solve problems; (3) If I chose to, I probably have the skills to be successful in a job in a computer-related field; (4) I have family, friends, and/or acquaintances who work in the field of information technology or a computer-related job; (5) I would be comfortable working in a male-dominated job; (6) Working in a computer-related field is one of the career options I have considered; and (7) My parents would probably consider a career in a computer-related field a good option for me. Response options are (1) disagree, (2) somewhat disagree, (3) somewhat agree, and (4) agree.

Parental Support

This factor contains 9 items from the questionnaire with a reliability of .692. Items in this factor are: (1) It is important to my mother/female guardian that I have a career; (2) It is important to my father/male guardian that I have a career; (3) My mother/female guardian has a clear idea about careers that would suit me; (4) My father/male guardian has a clear idea about careers that would suit me; (5) My parents/guardians encourage me to make my own decisions about my future career; (6) I would like my parents to approve of my choice of career; (7) My parents have encouraged me to talk to others about career options; (8) My parents have encouraged me to explore a variety of career options; and (9) When we disagree, my parents listen to my point of view.

Information Sources-Family and Friends

This is a new factor produced for this analysis that contains 9 items about the frequency of interacting with parents, friends, and family members about career options and plans. Response options were: 1=never, 2=once or twice, 3=several times, and 4=many times.

Information Sources-Non-Family or Friends

This new factor contains 3 items about the frequency of interacting with non-family or friends about career options and plans. Groups included are: teacher or professor, counselor or advisor, or employer. Response options were: 1=never, 2=once or twice, 3=several times, and 4=many times.

RESULTS

Table 2 provides descriptive information about the dependent and independent variables in the study. The mean is the non-normalized sum of responses to the questionnaire items in the scale divided by the number of items in the scale. Data show that on average respondents either somewhat agree with the 7 items in the dependent variable, IT Career Interest and Choice, and interacted several times with the items in the two groups of information sources. Respondents reported interacting with family and friends about career options more frequently than sources outside of the family.

	N	Mean	Std. Deviation	Minimum	Maximum
Non-Family Info Source (3 items)	947	9.18	2.04	2.00	12.00
Family Info Source (6 Items)	931	19.54	4.00	7.00	28.00

IT Interest & Career Choice (7 Items)	949	21.7	1.00	1	4
Parental Support (9 items)	800	30.78	1.00	1	4
Valid N (listwise)	767				

Table 2: Descriptive Statistics for Key Variables

Parental Support for IT Interest and Choice

Figure 1 depicts the results of a simple linear regression with IT Career Choice as the dependent variable and Parental Support as the independent or predictor factor. The figure provides a graph of the Beta Weights or R-squared (standardized regression coefficient) for the amount of IT Career Choice and Interest that is predicted by Parental Support. R-square reflects the amount of variance in the probability of being interested in IT as a career choice explained by the one factor. Because they are standardized, Beta Weights offer a direct way to compare the contribution of a latent variable constructed of multiple questionnaire items to explaining the dependent variable.

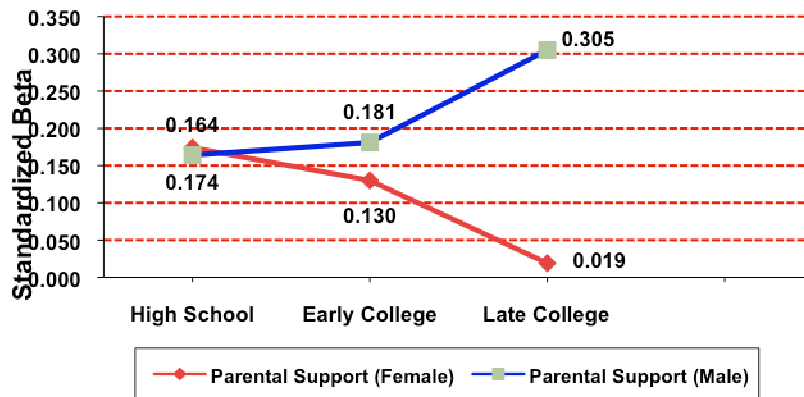


Figure 1: Results of Structural Equation Predicting IT Interest and Choice with Parental Support, by Point of Time and Gender

There are some significant differences by gender in the impact of Parental Support on IT Career Interest and Choice by point of time (Figure 1). While always positive, the impact of Parental Support diminishes for women across the three points of time, but increases for males. The impact of Parental Support on IT Career Interest and Choice is strongest for men, but weakest for women, in late college.

Gender differences in the effect of Parental Support on IT Career Interest and Choice are most dramatic among college juniors and seniors who have made a commitment to an IT-related major. At this point in time, the impact of Parental Support is not significant for women, but highly significant for men. Women in this group were 94% less likely than their male counterparts in the same major to perceive Parental Support for their career interest.

Family and Friends as a Source of Career Information

We know from our previous research that women interact more frequently than men with others about career options, but that these interactions were not related to IT Career Choice and Interest in the ways expected. For men, there was no significant connection between these interactions and IT Career Choice and Interest, while for women the connection was significant and negative. These results contributed to our unhappy conclusion that career

decisions were being made with little information other than from family and friends. The negative connection lead us to conclude that women were not being encouraged by parents and friends to pursue IT as a career option.

Table 3 contains the standardized regression coefficients (Beta weights) from a simple structural equation conducted to determine the influence of two types of information sources (family and friends and non-family and friends) on IT Career Choice and Interest and how this varies by gender.

Factors	Standardized Beta Weights (Regression Coefficients)			
		High School (N=548)	Early College (N=206)	Late College (N=190)
Information Sources- Family & Friends				
	Males	.229**	.016	.260*
	Females	-.036	.338*	.220
Information Sources- Non-Family				
	Males	.016	.099	.101
	Females	.009	-.294	-.025

** .005 impact on IT Career Interest and Choice

Table 3: Results of Structural Equation: Predicting IT Career Choice With Information Sources. By Gender and Point in Time

On average, male and female respondents in each of the three groups reported interacting about career options with family and friends “several times.” The impact of these interactions on IT Career Choice and Interest varied for male and female respondents (Table 3). For men, the interactions had a direct, positive, and significant impact on IT Career Interest and Choice during high school and again in the final years of college. These coincide with a traditional pattern of career choice where interactions during high school might be expected to involve choice of major and those in later college could well involve choice of a job and plans for the future.

The regression coefficients shown in Table 3 support the idea that women often express an interest in IT at a later point in their educational trajectory than do men. The interaction between women and family and friends about career options was only significant and positive for first- and second year college students. It was negative, but not significant for high school or third- and fourth-year college students. Results support the idea that women do not perceive positive support from parents about an interest in IT as a career option at critical junctures in the decision making process during high school and at the point in late college when they are considering job options.

Non-Family Members As a Source of Career Information

Interacting with others, particularly individuals employed in the field, is particularly influential in the career decision making process involving new and emerging fields like IT that may be unfamiliar to the family and friends of most students. The separation of information sources into family and non-family members allowed us to examine the contribution of individuals outside of the family (e.g. employers, counselors or advisors, teachers or faculty) to the intent to pursue IT as a career. The comparison across time shown in Table 3 reveal that students at each of three points in time only report interacting with non-family or friends about career options on average of “once or twice” and that this interaction had no significant impact on interest in IT for either male or female respondents.

DISCUSSION

Career choice is not exclusively an individual matter, as it emerges from interactions with others about options that appear to be a good fit with the needs and interests of the individual and with those who are important to him or her. Results point to meaningful differences in the support women and men perceive for their career interest. Women are not having interactions about career options that contribute to an interest in IT and by the third and fourth year are

enrolled in a major leading to a career in IT without significant positive support from parents or from others outside of the family. Men have fewer interactions about career options, but perceive continued positive support from parents and other family members about their interest in IT.

Results do not fully support any of the three hypotheses. Results about Parental Support and the first hypothesis indicate that perceptions of Parental Support vary by point in time and by gender. For males, Parental Support had a positive impact on interest in IT that increased over time, but the opposite holds true for women. The role of Parental Support on women's interest in IT diminished over time and is not significant at either two points during college. Particularly when compared to the much stronger and significant Beta weight for men (Beta=.305**), the weak and non significant relationship (Beta=.019) between Parental Support and interest in IT among women in their third and fourth year of college leads to the central conclusion of the paper, which is that women are enrolled in IT majors despite perceiving the lack of support from their parents and others.

The second and third hypotheses assumed that impact of parents on career interest diminishes over time, as students interact with a growing number of individuals outside of the family about their career interests. Variations by gender and point and time indicate the results only partially support the second and third hypotheses. Results from this research underscore the minor role counselors, advisors, and teachers play in promoting an interest in IT. With the exception of the first two years of college, interactions with parents support men's, but not women's interest in IT. Interactions with others about career options continues through the college years and is significantly higher during college than high school for both men and women. Interactions with family members about career options has a significant positive impact on men's interest in IT during both high school and late college, but only plays a significant role on women's interest in IT during the early college years.

CONCLUSIONS

Results from this research have implications for both recruiting and retaining women in IT-related majors and support a conceptual framework that views career choice as a process that continues throughout college and is a decision that is shaped by interactions with others. Parents continue to play a significant role in providing support for career choice throughout the college years.

Recruiting more young women to IT related majors and careers requires initiatives that extend beyond middle school and high school and that provide meaningful opportunities for interactions with professionals employed in IT. Such initiatives are needed to create environments where parents, school counselors, and advisors can counter the idea that IT is not a field that is attractive to women.

Different types of data are needed to answer the many questions that remain about what promotes women's interest in IT as a career option. Qualitative, observational data would provide one way to identify the types of interactions that discourage both young men and women from considering the IT field as an attractive career option. An assessment of parents' and counselors' endorsement of occupational and gender stereotypes may provide a platform to extend the dialogue about nontraditional career options beyond simply women to encompass the broader community.

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