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Personality, Gender and Careers in Information Technology

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ABSTRACT

The downturn in information technology enrollment numbers in colleges and universities has spurred a stream of research focusing on identifying factors that inhibit students' interest in information technology. Most of these studies measure individuals' perceptions and beliefs. We argue that the profession is composed of multiple occupations and those occupations have different characteristics concerning the work performed, the opportunities available, and the people who are employed in those occupations. We investigate the relationship between personality and the intent of students to pursue careers in the information technology field. Last, we examine if there is a gender personality profile for students who decide to pursue careers in information technology. Our findings can be used by researchers and practitioners to better describe to students the specific opportunities and career paths available within the profession.

Keywords

Information technology careers, personality, gender.

INTRODUCTION

The U. S. Department of Labor projects the number of information technology (IT) related positions such as computer scientists, database administrators, and network managers to increase over the next 10 years by anywhere from 15 to 53% depending on specialty (Harris, Cushman, Kruck, and Anderson, 2009; United States Department of Labor, 2011a). A recent survey of Chief Information Officers (CIOs) revealed that 20% of CIOs interviewed plan to hire IT personnel in the first quarter of 2012, while 10% expect to reduce staff. The resulting net 10% anticipated increase in overall hiring is four points above the previous quarter's projection and seven points higher than the forecast for the first quarter of last year (http://www.roberthalf.us/per, 2012).

Of the top 20 fastest growing occupations, five are in the IT field (Laudon and Laudon 2011; Moore, 2011). In some of these career areas (e.g., networking, security, applications development) there exists an abundance of positions and a shortage of skilled candidates. Approximately 73% of technology executives said it is challenging to locate skilled IT professionals (http://www.roberthalf.us/per, 2012). In addition, their salaries exceed the average for all occupations and are expected to do so through 2018. As of May 2008, median earnings for IT managers were $112,210, computer application software engineers were $85,430, computer systems administrators $66,310, and computer systems analysts $75,500 (United States Department of Labor, 2011b). While job prospects and earnings in these fields are expected to remain high into the near future, women most likely will remain underrepresented in these fields (Harris et al., 2009).

IT students are among the most sought after students. In addition, individuals who graduate with degrees in IT are among the highest paid of all students. In 2011, the median starting pay for IT bachelor's degree holders was $48,300 with mid-career median pay of $78,100 (PayScale, 2011).

If the demand and earnings for IT professionals are so high, why is there a shortage of IT professionals? One reason may be related to the diminished supply of IT educated students. A study conducted by the University of California, Los Angeles, found that barely 1 % of incoming freshman planned to major in computer related fields, compared with nearly 5 % 25 years earlier (Rashid, 2008).

The lack of access to computers does not appear to be a major factor in the shortage of IT professionals or for students' lack of interest in pursuing IT careers. Based on data from the U.S. Census Bureau, access to computers and the internet from

home is at an all-time high. The percentage of homes with internet access was at 68.7 % in 2009 (United States Census Bureau, 2012). Thus, the downturn in students entering the technology majors cannot be explained by lack of familiarity with computers. Harris et al. (2009) found that 100% of respondents to their Incoming Freshman Technology Career Survey indicated they had a computer in their home during high school.

Why are student enrollments in IT programs declining? Extant research tends to focus on identifying factors that inhibit students' interest in pursuing IT career opportunities. A common thread found in these studies is the assessment of students' beliefs and perceptions concerning the IT profession (Ballard, Scales, and Edwards, 2006; Joshi and Schmidt, 2006; Martz and Cata, 2008; Scott, Fuller, MacIndoe, and Joshi, 2009; Choudhury, Lopes, A. B. and Arthur, 2010). These studies reveal that students believe IT job prospects are very good; however, they perceive IT jobs to be boring and isolating (Espiner, 2008; Koh and Joseph, 2011).

In literature that focuses on technology and technology careers, both terms information technology (IT) and information systems (IS) are often used, sometimes interchangeably. IS, in general, includes the interaction between the technology, the organizational environment and the people in this environment. It is a set of interrelated components that collect, or retrieve, process, store, and distribute information to support decision making, coordinating, and control in an organization (Laudon and Laudon, 2011; Software Engineering Institute, 2007). A particular information system can be viewed as a special type of work system, in which humans and/or machines perform work using resources to produce specific products and/or services for customers (Alter, 2006). IT is a subset of IS that involves the technology within the system environment. It consists of the computer hardware and software that firms need to achieve their business objectives (Laudon and Laudon, 2011; Galliers, 1999). Most of the research on technology careers focuses on IT. For this study, we will use the term IT.

In this study, our goals are two-fold. First, we seek to find out if there is a student personality "profile" for those who decide to pursue IT degrees. In this profile, gender is of particular interest due to the low percentage of females who are currently working as IT professionals, and the low number of females who currently major in IT. An understanding of personality types and students' choices of academic majors is important. McPherson and Mensch note that three of four students express uncertainty about their majors and between one and two-thirds change majors (2007). If we can discover a personality profile for technology majors, we may be able to assist students in their choice of majors.

For our second goal, we seek to develop a clearer understanding of IT students' perceptions regarding career paths within the field. Most prior research has treated the IT profession as if it is a monolithic, single-dimensional construct. However, both the Bureau of Labor Statistics and the AIS model curricula recognize the existence of multiple distinct career paths within the IT field (Topi, H., Valacich, J. S., Wright, R. T., Kaiser, K., Nunamaker, J. F., Sipior, J. C., de Vreede, G. J., 2010; United States Department of Labor, 2011b). Thus, we seek to find out if IT students perceive differences in the characteristics of these career paths. Specifically, we measure students' perceptions concerning the types of work performed, the career opportunities available, and the characteristics of people who pursue each career path to determine if and when IT students develop a distinct perception of each career path.

BACKGROUND

Student Perceptions of IT Careers

Prior research indicates that declining student enrollments may be due to students' negative perceptions concerning IT career opportunities. However, the manner in which most of these studies conceptualize the IT profession presents a problem. As previously mentioned, prior research treats the IT profession as if it is a single-dimensional construct. However, over the past forty years, the IT field has evolved and self-organized into a range of occupations/career paths, with each focusing on specific components of information systems. Due to this, we believe it is important to explore students' perceptions of these career paths. In this section, we begin by discussing the literature pertaining to occupations within the IT profession and then present the literature pertaining to students' perceptions of the IT profession.

Occupations within the IT profession

After the turn of the 21st century, interest in modifying undergraduate IT academic curricula to address specific career paths began to appear in the literature. Trauth and Hafner (2000) called for greater collaboration between practitioners and academics in order to better educate and articulate the career paths available to students. Additionally, in 2007, a task force composed of representatives from the Association for Computing Machinery (ACM) and the Association for Information Systems (AIS), called for a major revision to the model curriculum in order to incorporate career tracks into the structure of undergraduate academic programs (Topi, H., Valacich, J. S., Kaiser, K., Nunamaker, J. F., Sipior, J. C., de Vreede. G. J., and

Wright, R. T., 2007). In 2010, a new model curriculum was published and officially adopted by both of the above mentioned organizations (Topi et al., 2010). It recognizes 17 distinct career paths within the IT profession and specifically states that different combinations of courses are necessary to prepare students for jobs in these different career paths.

The United States Bureau of Labor Statistics (USBLS) officially recognizes IT professionals under the Computer and Mathematical (15-0000) occupations category within their Standard Occupational Classification (SOC) systems. Within these categories, there are six specific subcategories of computer related occupations (United States Department of Labor, 2011b).

Students' perceptions of the IT profession

Several researchers have investigated beliefs and perceptions relating to the IT profession (Ballard et al., 2006, Choudhury et al., 2010, Enns et al., 2006, Joshi and Schmidt, 2006, Kuechler, McLeod, and Simkin, 2009, Martz and Cata, 2008, Scott et al., 2009). Joshi and Schmidt (2006) asked undergraduate students in an introductory IS course to describe the traits possessed by and the tasks performed by IT professionals at both the beginning and the conclusion of the course. Prior to the course, students described IT professionals as being intelligent, technically oriented, and good problem solvers; additionally, they described the tasks performed by these individuals as highly technical, focused on programming, and requiring most of the work day be spent in front of a computer. At the end of the course, students still described IS professionals as technically oriented but they also used the phrases such as "socially oriented", "geeky", and "possessing good managerial skills" more frequently. Additionally, they described IT work as mostly managerial-oriented, involving the use of social skills, and requiring a variety of daily tasks and activities.

Martz and Cata (2008) compared students' and professionals' perceptions concerning the skills necessary to succeed in an IT career. Professionals indicated that critical thinking, problem solving, and analytical skills were significantly important for both current and future success. Students believed that those skills were important for future success but believed them to be less important for current success. Additionally, professionals believed that written communication and forecasting skills were highly important for current success whereas students rated them as less important for both current and future success. Finally, students perceived specific technical skills (database, network security, enterprise resource planning) to be more important to future success than did professionals.

Kuechler et al., (2009) surveyed undergraduate business students enrolled in an introductory IS course to measure their beliefs concerning the IT profession and the impact those beliefs had on their decision to pursue a career in the profession. Results indicated that a genuine interest in technology was the only variable that significantly influenced students' attitudes toward majoring in IT; students' beliefs concerning the profession did not significantly influence their attitudes toward the field nor did they influence their intentions to pursue an IT major. Interestingly, both career advisors and family members were found to significantly influence students' intentions to major in IT; however, fellow students, friends, and professors were not found to influence that decision.

Scott, et al., (2009) conducted focus group sessions with undergraduate business students to identify the factors that influence students' selection of a major and to determine what students perceptions were of the IT profession. Job scope and career opportunities were the reasons most frequently stated as influencing students' selection of a major. Interestingly, IS majors perceived jobs in the IS field as having very broad scopes whereas non-IS majors perceived job scopes in the field as very narrow. Additionally, IS majors perceived the field as having great job opportunities while non-majors perceived the field as only having average career opportunities.

Choudhury, et al., (2010) implemented a summer IT career camp for high school students to determine if participation in the camp improved students' beliefs concerning IT job prospects, beliefs pertaining to the nature of IT work, and their intentions to pursue IT majors. Comparison of participants' pre- and post- camp survey responses (Choudhury et al., 2010) revealed that the camp experience dramatically improved students' beliefs about the IS profession. At the conclusion of the camp, all measures pertaining to students' beliefs about job opportunities exhibited highly significant improvements from their pre-camp values. Additionally, most of the measures used to assess students' beliefs pertaining to the nature of IT work showed significant improvements due to the camp experience. Unfortunately, for most of the camp participants, these improvements in beliefs did not significantly improve their intentions to pursue an IS major. While students who had indicated an intention to pursue an IS major at the beginning of the camp showed an even stronger intention at the conclusion of the camp, students who were not committed to IS at the beginning of the camp showed no change in their intentions to pursue an IS major at the conclusion of the camp.

Personality, IT and the Five Factor Model

Individual personality is an important factor in many decisions that people make. Cain states, "It affects the careers we choose and whether or not we succeed at them (2012, p. 2)". Heinzström (2003) believes that it is important to consider individual personality in order to thoroughly understand why students major in technology fields. Thus, the decision to major in IT and the students' intent to pursue careers in the IT field could be related to their personality.

How can we assess one's personality? The greatest single advance in personality research has been the emergence and broad acceptance of the Five Factor model of personality, commonly referred to as the five-factor model, or the "Big Five" (Digman, 1990; Hogan, Hogan, & Roberts, 1996). The Big Five are bipolar dimensions of personality that have been found to form the taxonomic (and factorial) core of personality models and also capture lay-persons' descriptions of personality as found in everyday language (McCrae and John, 1992). These dimensions/factors are extraversion, agreeableness, conscientiousness, openness and neuroticism. McCrae and John (1992) investigated the history and evolution of the model and concluded that all five factors were shown to have convergent and discriminant validity across instruments and observers.

The personality traits are fairly stable across individuals' lifespans (Balthazard, Potter, and Warren, 2004; Heinström, 2003; McCrae and John, 1992). They have been characterized as the most important ways in which individuals differ in their emotional, interpersonal, experiential, attitudinal, and motivational styles. Accordingly, the five-factor model evolved from an analysis of the terms which are used to describe personality (Heinström, 2003). Many of today's personality tests measure one or more of the five factors (McCrae & John, 1992).

The extraversion-introversion dimension contrasts an outgoing character with a withdrawn nature. Extraverts tend to be more physically and verbally active whereas introverts are independent, reserved, steady and like being alone. Introverts may be described as quiet, reserved, shy and less sociable (Costa and McCrae, 1992). The word introvert, however, is not a synonym for hermit, misanthrope, or a person lacking in social skills. Most introverts are perfectly friendly and are comfortable in social situations; they just do not dominate conversations and are not as gregarious as extroverts.

Neuroticism is a measure of affect and emotional control. Persons with high levels of neuroticism are reactive and more easily bothered by stimuli in their environment. They more frequently become unstable, worried, temperamental and sad.

Openness to experience relates to intellect, openness to new ideas, cultural interests, educational aptitude and creativity as well as an interest in varied sensory and cognitive experiences. Those with a high openness to experience have broad interests, and are often characterized as "liberal." Those with low openness to experience are conventional, conservative and prefer familiarity (Costa and McCrae, 1992).

The agreeableness scale is linked to nurturance, caring and emotional support versus competitiveness, hostility, indifference, self-centeredness, spitefulness and jealousy (Howard & Howard, 1995). Agreeable people can be described as altruistic, gentle, kind, sympathetic and warm (Costa & McCrae, 1992).

Conscientiousness is a measure of goal-directed behavior. It has been linked to educational achievement and particularly to the will to achieve (Costa & McCrae, 1992).

Gender and IT

IT jobs continue to increase, while the number of females pursuing careers in technology is declining. In addition, the percentages of females who work in technology fields are considerably lower than that of males. Consequently, although job prospects and earnings in these fields are projected to remain high into the near future, women continue to be underrepresented in these fields (Harris, Cushman, Kruck, and Anderson, 2009, Rosenbloom, Ash, Dupont, and Coder, 2008).

Research including both high school students and college students revealed several reasons why relatively few females pursue careers in IT. Students held negative and sometimes incorrect perceptions regarding the IT profession, believing that those working in IT related fields are "nerdy," and believing that a career in the IT field would mean sitting in front of computers all day with little social interaction (Beyer, S., M. DeKeuster, K. Walter, M. Colar, and C. Holcomb, 2005; Harris, 2009; Randall, C., Price, B., and Reichgelt, H., 2003; Teague, J., 2002; Trauth's, E. M., Quesenberry, J. l., and Huang, H., 2006). In addition, some women see the culture as predominantly male, and a career that would be difficult to balance family and work (Bürge, J. D. and T. L.Suarez, 2005; Cohoon, J. M., 2003, Harris et al., 2009). Others expressed feelings of being uncomfortable, or even "intimidated" as students in predominantly male classes.

A study involving high school students revealed that males were more likely to have had experience with computers than females. At least 40 % of the males had taken at least one formal IT type class but only 27 % of the females had taken similar classes. Generally women found more reasons to reject a computer information systems or computer science major and were more likely to cite that they would prefer a more people oriented major or occupation. Additionally, women may place a different value on the attractiveness of technical occupations than men (Rosenbloom et al., 2008).

RESEARCH OBJECTIVES AND PROPOSITIONS

Most of the extant research measures individuals' perceptions and beliefs regarding the IT profession in general. Many students are not aware of the different facets of IT work and careers, often viewing it as one dimension consisting primarily of monotonous writing and editing computer program codes. The National Science Foundation reports that 41.1% of IT graduates in a given year do not go on to pursue an IT career (Board 2010; Koh and Joseph 2011). We assert that the profession is composed of multiple occupations and that those occupations have different characteristics concerning the nature of the work, the opportunities available, and the people who are employed in those occupations.

Proposition 1: Students are not very sure about the different types of careers in the IT field.

Social cognitive career theory (SCCT) attempts to understand the processes through which individuals develop occupational interests, choices and pursuits However, research on SCCT and technology careers has not fully explained why some IT students pursue careers in IT while others do not (Lent, Lopez Jr, Lopea, and Sheu, 2008). We believe that the personality profile of individuals may provide an explanation why this is so.

Proposition 2: Individuals who intend to pursue careers in the IT field will exhibit similar personality profiles.

The Careers Research and Advisory Centre (CRAC) found that the percentage of female applications for IT degree courses fell from 18 % to 15 % between 2001 and 2007 (Espiner, 2008). Extant research revealed that feelings of males about IT have been more favorable than that of females (Schumacher and Morahan-Martin, 2001; Sanchez-Franco, Ramos, and Velicia, 2009).

Proposition 3: There is a relationship between the personality profiles of females and their decisions to pursue IT work.

METHODOLOGY

This research consists of survey analyses conducted during the spring 2012 semester. The subjects are students who attend a large university located in the south central region of the United States. These students have already declared their majors in the IT discipline. They completed the "Self Perceptions and Attitudes" and the "Information Technology Careers" survey questionnaires. These instruments were designed to collect opinions about individual personality characteristics and to collect information regarding the participants' knowledge of five distinct career fields in information technology. Both survey instruments have been tested and validated (see Balthazard, et al., 2004; Choudhury et al., 2010; Moore, G. and Benbasat, I., 1991).

STATISTICAL ANALYSIS AND RESULTS

Statistical analyses will be performed using the Statistical Package for the Social Sciences (SPSS), and the Partial Least Squares (PLS) software. Exploratory factor analysis, Pearson product-moment correlations, and analysis of variance (ANOVA) will also be calculated.

We are currently in the process of collecting data. The reporting of the survey results, statistical analyses, and conclusions will be presented during the conference.

CONCLUSION

Careers in science, technology, engineering, and mathematics are among the highest paying career fields. In the United States, students typically avoid these somewhat challenging classes. As a result, many college graduates are not qualified for these high paying jobs upon graduation. Jobs that require computer programmers are outsourced, not only due to lower labor costs, but due to the shortage of U. S. employees who have these skills. To address these concerns, several science, technology, engineering, and mathematics (S.T.E.M) initiatives have been developed, led by the National Science Foundation (NSF), at both the college and high school levels.

The insights resulting from this study will offer several contributions to the IT discipline. The findings can be used by researchers, practitioners, and occupational counselors to better describe to students the specific opportunities and career paths available within the IT profession. Additionally, the study findings, when combined with a clear understanding of students' existing perceptions concerning the IT profession, can be used to develop methods and programs to provide the students with a more realistic perception of the field. That result, in turn, should have a positive impact on IT undergraduate enrollment numbers.

A further contribution of this work is that it will provide evidence as to whether or not prior treatment of the IT profession as a monolithic, single dimensional construct is appropriate or if a more multi-dimensional view of the profession is warranted in future research efforts. If support is found for a multi-dimensional view of the profession, the findings can be used in future research to specify a framework of IT professionals. Finally, findings from this study can also be used in future efforts to further delineate IT and IS as a discipline separate from computer science (CS).

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