Communications of the Association for Information Systems

Volume 25 Article 29

9-1-2009

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Akbulut-Bailey, Asli Yagmur (2009) "A Measurement Instrument for Understanding Student Perspectives on Stereotypes of IS Professionals," *Communications of the Association for Information Systems*: Vol. 25, Article 29.
Available at: http://aisel.aisnet.org/cais/vol25/iss1/29

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A Measurement Instrument for Understanding Student Perspectives on Stereotypes of IS Professionals

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Abstract:

Academic and popular literature suggest that one plausible explanation for declining enrollments in the Information Systems (IS) discipline is the negative stereotypical image students have about IS professionals and the profession. However, there is a lack of empirical research that investigates the image of IS professionals. This study addresses this research gap. First, an instrument was developed to measure stereotypes of IS professionals. A series of empirical analysis was conducted to establish the measure's psychometric properties. The findings revealed a five-factor, 15-item instrument that measured IS stereotypes in terms of *geeks, gender*, *intelligence, managerial* and *technical* dimensions. Then, the presence of stereotypes along each of these dimensions was examined. The literature has generally assumed that IS professionals are viewed as geeks, mostly male, intelligent, technically oriented, and lacking managerial skills. The study uncovered that strong stereotypes do exist along these dimensions. However, interestingly, most of the stereotypes were found to be in the opposite direction than the literature suggested. Students disagreed that IS professionals were geeks, that the IS profession was typically dominated by men, and that IS professionals were too technically oriented. They agreed that IS professionals possessed good managerial skills and were intelligent. The paper concludes with implications for theory and practice.

Keywords: careers, domain identification, education, enrollment crisis, information systems (IS), information technology (IT), image, stereotypes

Volume 25, Article 29, pp. 321-338, September 2009

Communications of the Association for Information Systems

I. INTRODUCTION

The dramatic decline in the number of students pursuing information systems (IS) degrees and careers is a source of great concern not only for academic institutions offering IS degrees, but also for companies in need of hiring qualified information technology (IT) professionals [George et al. 2005; Looney and Akbulut 2007; Vegso 2005]. According to the U.S. Bureau of Labor Statistics, the demand for computer and IT related occupations will continue to increase, with a projected growth rate exceeding 50 percent by 2012. [Lomerson and Pollacia 2006; Lynch 2007; Panko 2008]. However, due to declining enrollments, it is estimated that there will be only half that many qualified graduates in the United States to fulfill this increasing demand [Lynch 2007]. Alarmed by the potential detrimental effects of declining enrollments, several universities along with academic and professional organizations have started to implement a range of short and long term intervention approaches to address the enrollment crisis and boost up students' interest in the IS field [Dick et al. 2007; Firth et al. 2008; Galletta 2007; Looney and Akbulut 2007; Street et al. 2008; Van Slyke et al. 2007a]. Some of these strategies have already been fruitful, resulting in an increase in enrollments at implementing institutions [Firth et al. 2008], whereas, the outcome of others are yet to be determined [Granger et al. 2007a]. Regardless, in order to develop and implement successful intervention strategies to help IS enrollments rebound, it is crucial to gain a comprehensive understanding of the root causes of this decline.

While there may be numerous factors contributing to the diminished interest in the discipline, one potential explanation for students' lack of interest in the IS field could be the negative stereotypes about IS professionals and the profession [Colvin 2007; Enns et al. 2006; Firth et al. 2008; Granger et al. 2007a; Lomerson and Pollacia 2006; Van Slyke et al. 2007; Zhang 2007]. To date, many of the reasons presented to explain declining enrollments have been based on anecdotal evidence [Lomerson and Pollacia 2006; Van Slyke et al. 2007]. Furthermore, academic research on IS stereotypes is particularly scarce, and sound instruments to measure IS stereotypes and to understand students' point of view do not exist.

Given the importance of the topic and the relative absence of academic work, there is clearly a pressing need for research targeted specifically at understanding the stereotypes of IS professionals as perceived by college students. To this end, this study serves two major purposes. First it *develops a valid and reliable measure of IS stereotypes* via a rigorous instrument development process. Then, utilizing the newly developed instrument, the study *examines whether college students generally believe that those stereotypes are representative of IS professionals*.

The remainder of this article is organized as follows. In the following section a discussion of the potential causes of the IS enrollment crisis and the strategies for improving enrollments is provided. In the third section, theoretical underpinnings and the concept of stereotypes are described, followed by a review of the IS stereotypes literature. Next, the instrument development procedure is outlined and the results from the analyses are presented. A discussion of the findings, implications for theory and practice, and limitations conclude the article.

II. POTENTIAL REASONS FOR THE DECLINE IN IS ENROLLMENTS AND STRATEGIES FOR INCREASING ENROLLMENTS

A myriad of reasons have been cited in the literature to explain the sharp decline in IS enrollments. Although mostly anecdotal [Lomerson and Pollacia 2006; Van Slyke et al. 2007], some of these reasons focus on the economy and market conditions, whereas others focus on the IS curriculum and students' negative perceptions of IS professionals and the profession.

According to George et al. [2005], in the 1990s market conditions including the Y2K problem, the increasing number of enterprise resource planning (ERP) implementations, as well as the dot-com boom, caused the demand for IS professionals to skyrocket beyond normal growth rates. In this period, IS enrollments increased significantly as a large number of students who were not even interested in the field switched to the major due to the alluring market conditions and salaries. However, 10 years later, in the 2000s, as a result of the dot-com demise, end of ERP rollouts, and completion of Y2K overhauls, the job market started to shrink and the news about rescinded job offers and layoffs caused IS enrollments to decline [George et al. 2005].

Similarly, other researchers also focused on the changes in the economy and IT employment landscape for explaining the decline in enrollments [Baskerville et al. 2005; Becker et al. 2006]. In the early 2000s, employment in IT occupations fell by five percent; significantly higher than the total employment decline, which was less than two

percent [Hoganson 2004]. In addition to the reasons mentioned above in George et al. [2005], other factors, including the terrorist attacks of 9/11 and its effects on the U.S. economy, the brief 2001 recession, a downturn in IT spending, and offshore outsourcing of IT work have contributed to the loss of IT jobs [Lenox et al. 2005]. These shifts in the economy and employment patterns, coupled with misleading reports in popular press, have resulted in misperceptions about the lack of IT related jobs. Dick et al. [2007] stated that most students, as well as parents and career counselors, believed that almost all IT jobs were being outsourced and the salaries for remaining jobs were depressed due to competition with cheap labor overseas. The current economic slowdown might have also fueled these existing fears about IT jobs being eliminated. Therefore, it is possible that potential students shy away from the IS major due to the concerns about poor employment prospects.

Declining enrollments have also been tied to the outdated and boring curriculum, which fails to focus on the correct mix of business and technical skills and to reflect the evolving demands of today's students and employers [Dick et al. 2007; Van Slyke et al. 2007]. It has been stated that the stale IS curriculum no longer attracts the attention of the so called "Generation Y" students, who are already computer savvy and want to learn about more interesting and hot topics.

Another reason cited for declining enrollments in IS involves the negative image of IS professionals. Several researchers have indicated that students perceive IS professionals as computer nerds sitting in front of the computer all day long doing technical work. These students are concerned about the nature of the IT work being too technical, difficult, boring, and antisocial [Enns et al. 2006; Firth et al. 2008; Galletta 2007; Lomerson and Pollacia 2006; Van Slyke et al. 2007]. Other studies also cite the gendered view of the profession and mention that female students have the perception that men, not women, pursue majors and careers in the IT field [Cory et al. 2006; Galletta 2007; Zhang 2007]. These incorrect perceptions of IS professionals have been tied to the lack of information about the profession and about the typical career opportunities available to IS professionals [Firth et al. 2008; Lomerson and Pollacia 2006; Van Slyke 2007; Scott et al. 2009].

A number of short and long term approaches have been offered to tackle declining enrollments. Some of these approaches focus on marketing and promotional efforts, while others emphasize curriculum changes. A detailed discussion of these approaches, as well as specific vignettes, can be found in the recent *Communications of the Association of Information Systems* articles [e.g. Firth et al. 2008; Granger et al. 2007b; Scott et al. 2009; Street et al. 2008].

One major recommendation has been to focus on marketing and promotional efforts to build awareness about IS degrees and careers, and to change the image of the profession by busting the prevailing myths. The suggestions that fall under this category include, but are not limited to, the following [Becker et al. 2006; Dick et al. 2007; Galletta 2007; Granger et al. 2007b; Scott et al. 2009; Street et al. 2008]:

- Connecting with and educating students, teachers, and counselors at secondary schools and community colleges so that they gain a better understanding of the IS field

- Working directly with career services at universities, holding social events for prospective students and current majors allowing them to interact with faculty and recruiters, hosting a guest speakers series, creating an undergraduate IS club, adapting a catchy slogan, as well as hosting an orientation session for IS majors

- Networking with practitioners, potential employers, and alumni (including recent IS graduates) to include them in marketing and curriculum efforts

- Distributing marketing materials to students, including informative brochures, t-shirts, and electronic gadgets, improving departmental Web sites, using college/department TV monitors and social networking tools such as Facebook and SecondLife to disseminate information, placing ads on campus buses, creating poster boards with major and career information, publishing success stories, and advertising hot IT job opportunities in student newsletters

- Collaborating with local press to publish stories that focus on future employment prospects and the skills shortage in the IS/IT field

- Marketing the profession to underrepresented groups including women, African-Americans, and Hispanics

- Utilizing the core introductory IS course as a mechanism to market the IS major

- Using current IS majors as ambassadors to market the major to other students
- Convincing parents and the public about future employment prospects
- Partnering with professional and academic associations such as Microsoft, Society for Information Management, Association of Computing Machinery, and Association of Information Systems, among others, to dispel the myths about IT careers and provide internship, scholarship, and mentorship opportunities for students

Curriculum oriented approaches focus on revamping university curriculum to make IS programs and courses more attractive and valuable to today's students as well as to change the image of the profession. Some of the curriculum oriented suggestions to increase enrollments include the following [Akbulut and Looney 2007; Becker et al. 2006; Dick et al. 2007; Galletta 2007; Granger et al. 2007b; Scott et al. 2009; Street et al. 2008]:

- Creating certification programs by prepackaging existing courses, launching a minor in IS, as well as establishing cross-disciplinary programs to smooth enrollment fluctuations and eventually attract non-IS majors to the discipline
- Flattening the prerequisite structure, and keeping the number of required courses to a reasonable number
- Increasing the presence of IS courses in the business college core requirements to emphasize the importance of IS to students
- Hiring additional and more diverse faculty to enable more diversity and smaller class sizes
- Updating the content and format of existing courses and textbooks to make them more up to date, hands on, fun, and interesting
- Introducing new courses that emphasize a mix of business and technical skills and knowledge that employers are looking for including, project management, enterprise information systems, business process management, industry knowledge, and communication skills, among others
- Creating new courses with interesting topics such as hacking, computer forensics, or digital media and/or providing multiple specialty tracks
- Using innovative pedagogical techniques in terms of course content, structure, delivery, and marketing
- Focusing on the introductory IS course to instill a "can-do" mentality in students, to show them the various types of valued outcomes that can be achieved by majoring in IS (job security, good salaries, sense of personal accomplishment, recognition, etc.) and to eventually increase their interest in the field

III. BACKGROUND

Stereotypes and Domain Identification Theory

Stereotypes are cognitive structures containing the perceiver's generalized assumptions about the members of a social group [Hamilton and Troiler 1986; Wittenbrink et al. 1997]. Stereotypes aid the perceiver to augment his subjective understanding of the social environment and, thus, to place information about a given individual into a context of subjective meaning [Wittenbrink et al. 1997]. Stereotypes may be positive (e.g., IS professionals are smart people) or negative (e.g., IS professionals are nerds) [Dasgupta and Asgari 2004]. They may be accurate or inaccurate regarding the average characteristics of a group [Leyens et al. 1994].

Domain identification theory, developed in the educational psychology discipline, can be used as a useful lens to understand the effects of stereotypes on students' educational and occupational interests and choice behaviors, as well as their performances [Cory et al. 2006; Smith and White 2001; Smith et al. 2005; Steele 1997]. Domain identification refers to an individual's positive phenomenological experiences with and self-relevance for a given domain [Smith et al. 2005]. Identification with a particular domain (e.g., information systems) is important because it often plays a major role in activating the individual's domain related attitudes and behaviors. This activation, in turn, may influence the individual's decisions, as well as his/her motivation and success in that domain [Fazio 1995; Osborne 1997; Smith and White 2001; Smith et al. 2005]. In educational settings, the more students identify themselves with a particular domain, the more likely they would be to consider pursuing a major and career in that

field, and the more likely they would be motivated to succeed [Cory et al. 2006; Smith et al. 2005; Steele 1997]. For a student to identify him/herself with an educational and occupational domain, he/she must perceive good prospects about the domain, feel that he/she has interests, skills, resources, and opportunities to prosper in that field. Moreover, the student must feel that he/she belongs to that domain, in the sense of being accepted and valued [Steele 1997].

In this respect, stereotypes about a particular domain may influence students' identification with the domain in question [Smith et al. 2005; Steele 1997]. Students tacitly assess their prospects in a particular domain, and broadly speaking, their identification increases when the prospects of the domain are favorable, and decreases when the prospects are unfavorable [Steele 1997]. In this respect, on the one hand, since people prefer to identify themselves with groups that enjoy distinct and positive identities [Taylor and Moghaddam 1994], students who perceive a positive image of IS professionals would be more inclined to pursue a major and career in IS. On the other hand, negative stereotypes about the IS profession may make it more difficult for students to identify themselves with the domain, and can cause them to shy away from the discipline. When negative stereotypes exist, students would hesitate to be associated with the IS domain as they would feel the threat of being evaluated in terms of those stereotypes [Smith and White 2001]. Therefore, understanding the stereotypes of IS professionals as perceived by college students might prove helpful in explaining their interests and choices, as well as their performances in the IS field.

Prior Research on IS Stereotypes

Broadly speaking, prior research has focused on the occupational stereotypes of computer scientists and the computer science (CS) profession. Due to the underrepresentation of women in the discipline most of these studies have either investigated the perceptions of only females or compared the female and male students' views of computer professionals [Carter 2006; Craig et al. 2002; Margolis and Fisher 2003; Teague 2002; Tjaden and Tjaden 2000]. Even though similar stereotypes are assumed to exist in the IS field [Joshi and Schmidt 2006], given the distinction between the two disciplines, there might be differences between the stereotypes of CS and IS professionals [Wilson and Braun 1985]. Unfortunately, to date only a very limited number of studies have been conducted to understand the image of IS professionals [e.g., Jennings et al. 2002; Joshi and Schmidt 2006; Mawhinney et al. 1988; 1989].

Two decades ago, Mawhinney et al. [1988; 1989] conducted two studies to understand students' perceptions of the computer information system (CIS) graduates' work style. The authors found that students held a narrow and somewhat inaccurate view of the profession. Later, Jennings et al. [2002] revisited these studies to investigate whether the students' perceptions had changed over time. As opposed to their expectations, the authors observed no significant change in students' perceptions. Even though these studies contribute to our knowledge of IS stereotypes, given the changes in technology, curriculum, and computer literacy of college students over time the need for more up to date studies is inevitable. In addition, these studies are limited in certain aspects. One limitation is that these studies focused on understanding the perceptions of CIS students, not necessarily the perceptions of IS students. Consequently, they surveyed students enrolled in introductory level computing courses which focused on hardware and software concepts, rather than on IS concepts. The contents and structure of an introductory IS course would differ from those of a computing course. In addition, for most students an introductory level course is their first formal exposure to IS topics [George et al. 2005] and it plays an important role in shaping their perceptions about IS professionals and the profession. Therefore, surveying students enrolled in an introductory IS course would prove more helpful in understanding their image of IS professionals. Another limitation associated with these studies is that the psychometric properties of the stereotypes instrument were not established. First of all, the instrument included only a limited set of items, failing to capture different dimensions of stereotypes. Furthermore, since the instrument failed to yield sufficiently interpretable and reliable subscales, stereotype measures were treated as separate items [Jennings 2002; Mawhinney et al. 1989]. Given these limitations, it is vital to develop a valid and reliable instrument to investigate whether the different types of IS stereotypes mentioned in the literature are empirically distinct factors.

More recently, Joshi and Schmidt [2006] conducted a study to understand students' perceptions of IS professionals. The authors collected data from undergraduate business students at the beginning and the end of an introductory IS course. The authors' findings revealed that, in general, the stereotypical image of an IS professional was similar to that of a computer scientist. However, by the end of the semester, it was observed that the students developed a somewhat better understanding of the IS profession. Even though students focused more on technical skills when describing IS professionals and the profession, they also recognized the social, systems and managerial skills, to an extent. The authors also observed that students attributed more masculine traits and abilities to IS professionals.

Joshi and Schmidt's study contributes greatly to our understanding of students' perceptions of IS professionals. However, the major limitation of the study is that these perceptions were captured using qualitative methods (i.e.,

open ended questions). Given the relative lack of accumulated knowledge about the subject, utilizing qualitative methods was an appropriate choice. Regardless, the interpretive understanding gained through this study needs to be confirmed and validated through quantitative approaches. Therefore, the use of the survey method is more appropriate for justifying whether these different types of IS stereotypes identified in literature are empirically distinct factors, and whether strong, significant stereotypes exist along these factors. This current study addresses these issues.

IV. RESEARCH METHODOLOGY

The IS stereotypes scale was developed utilizing a systematic, multistage procedure as suggested by IS researchers [e.g., Boudreau et al. 2001; Straub 1989; Straub et al. 2004]. The first stage involved generating an initial set of items that captured different dimensions of IS stereotypes identified in the literature. This initial item pool contained all of the dimensions reported in Joshi and Schmidt [2006], as well as in the other relevant studies discussed earlier. In stage two, an exploratory analysis was conducted, and based on the results of the exploratory analysis, only five of the dimensions identified in the literature were found to be distinct. The results suggested a five-factor, 15-item instrument that measured IS stereotypes in terms of *geeks, gender*, *intelligence, managerial,* and *technical* dimensions. In this stage, additional data were collected and subjected to another round of exploratory analysis to confirm the factor structure of the retained items. In stage three, utilizing new data a confirmatory analysis was conducted, to ensure the reliability and validity of the measure developed. The following subsections describe the data collection and instrument development processes in detail.

Data Collection

Survey methodology was used to collect the data. The survey targeted students enrolled in multiple sections of the introductory IS course offered in the business schools of two large American universities. At both universities, the introductory course was designed to provide students with a basic understanding of IS and how they supported modern organizations. Throughout the course, students were introduced to different types of IS careers and learned about the roles and responsibilities of IS professionals. Both universities followed the same textbook, covering similar material. At each university, the professors employed a variety of teaching techniques including lectures, in-class discussions, hands-on exercises, videos, guest speakers, etc. Notwithstanding these similarities, there were also certain differences across universities and sections. For example, professors at each university developed their own lecture materials, assignments, quizzes, as well as exams. Moreover, in one of the universities, emphasis was given to the fundamental business processes and enterprise resource planning systems. The other university, however, focused on broader IS concepts.

The survey was conducted over the Internet during the last week of classes. Administering the survey at the end of the semester was preferred as the course was students' first formal exposure to IS, and it was important for them to have gained an initial understanding of IS topics and the careers in the discipline before completing the survey. Students participated in the survey anonymously and were asked to carefully read the questions and respond as honestly as possible. Participation in the survey was voluntary. As an incentive for participating, students received extra course credit.

In total, three different samples were obtained from the two universities to be used in the study. These particular samples were considered appropriate to answer the research questions based on the following reasons. First, given the fact that stereotypes may actually impact a student's choice of a major and career, it was necessary to understand the perceptions of students who were yet to finalize their decisions about which major to pursue [Akbulut and Looney 2007; Joshi and Schmidt 2006]. The introductory IS course was required of all business students at both universities and the majority of students enrolled in the course were yet to decide which major to select. Students who had already declared a major were removed from the final sample. To ensure that the retained and discarded respondents did not systematically differ, these two groups of respondents were compared based on demographic data including gender, age, class standing, and business school classification. Chi-squared and t-tests revealed no significant differences between the two groups. Second, collecting data over multiple semesters at multiple universities from students learning from different professors was desirable to enhance the ability to generalize the findings.

Item Generation

A two step process was applied to establish content validity to ensure that the IS stereotypes instrument contained representative items drawn from a universal pool capturing the theoretical essense of the construct [Straub 1989; Straub et al. 2004; Tojib and Sugianto 2006]. Based on the pertinent literature [e.g., Jennings et al. 2002; Joshi and Schmid 2005; Mawhinney et al. 1988; 1989] a preliminary list of items was generated and subsequently, a draft survey instrument was created. A seven-point Likert-type scale was used, with a range from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Three domain experts were then consulted to evaluate the validity of the instrument. The

experts were asked to comment on the instrument in general, as well as the individual items, and offer suggestions for improvement. Based on their feedback, items and the draft instrument were modified, resulting in an initial pool of 26 items, which served as the basis for the exploratory analysis stage.

Exploratory Analysis

The exploratory analysis stage served to refine the IS stereotypes measure by exploring which of the preliminary items accurately represented IS stereotypes. The survey was administrated to a pool of students enrolled in the introductory IS course at one of the universities. After eliminating cases containing missing data, 240 usable responses were obtained (sample 1). The sample averaged 22 years of age and consisted of 60.8 percent males.

Responses were factor analyzed using principal component factor analysis [Conway and Huffcutt 2003]. A combination of the Kaiser-Guttman Rule (eigen values greater than one) and scree plot was used to determine the most appropriate component solution [Chin et al. 1997; Nunnally and Berstein 1997]. Consistent with prior research, items that loaded at 0.60 or higher on one factor and no greater than 0.40 on any other factor were retained, whereas items that did not load properly or had cross loadings were dropped [Chin et al. 1997]. The results yielded a five-factor solution consisting of 15 items, which loaded logically on their respective factors. The resulting factor structure corresponded with geeks, gender, intelligence, managerial, and technical dimensions. The five-factor model explained 67.5 percent of the variance. Table 1 represents the results of the first exploratory factor analysis.

Table 1. First Exploratory Factor Analysis
Constructs, Items, Loadings, and Cross-loadings

	Loadings and Cross-Loadings[a]				
Constructs/Items	GEEKS	GENDER	INTELLIGENCE	MANAGERIAL	TECHNICAL
GEEKS1	**0.833**	0.260	-0.055	-0.097	0.158
GEEKS2	**0.850**	0.196	0.096	-0.045	0.068
GEEKS3	**0.790**	0.151	-0.033	-0.262	0.195
GENDER1	0.172	**0.778**	0.123	-0.202	-0.009
GENDER2	0.179	**0.739**	-0.185	-0.045	0.129
GENDER3	0.194	**0.842**	0.004	-0.030	0.103
INTELLIGENCE1	-0.054	-0.021	**0.770**	0.107	0.146
INTELLIGENCE2	0.184	-0.067	**0.721**	0.236	-0.118
INTELLIGENCE3	-0.057	0.021	**0.784**	0.018	0.103
MANAGERIAL1	-0.196	0.099	0.343	**0.657**	-0.069
MANAGERIAL2	-0.148	-0.119	0.148	**0.809**	-0.123
MANAGERIAL3	-0.042	-0.217	-0.016	**0.831**	-0.034
TECHNICAL1	-0.007	-0.038	0.156	-0.080	**0.772**
TECHNICAL2	0.171	0.149	0.156	-0.009	**0.639**
TECHNICAL3	0.240	0.125	-0.227	-0.132	**0.712**

[a]Entries in bold denote items that exhibited acceptable factor loadings. All loadings in bold are significant at the 0.01 level (2-tailed tests).

Additional data were collected from the second university to confirm the factor structure of the retained items. 231 usable responses were obtained (sample 2) and subjected to another round of exploratory analysis. The sample averaged 21.5 years of age and consisted of 56.7 percent males. The results produced the same five-factor solution as anticipated. The five-factor model explained 69.7 percent of the variance. Table 2 represents the results of the second exploratory factor analysis.

Confirmatory Analysis

For the confirmatory analysis, new data were collected from the first university during a different semester. After removing the cases containing missing data, 279 usable responses were obtained (sample 3). The sample averaged 21.5 years of age and consisted of 66.3 percent males. A component-based structural equations modeling technique, partial least squares (PLS), was chosen as the analysis tool. PLS Graph Version 3.0 [Chin 2003] was used.

Table 2. Second Exploratory Factor Analysis Constructs, Items, Loadings, and Cross-loadings

	Loadings and Cross-Loadings[a]				
Constructs/Items	GEEKS	GENDER	INTELLIGENCE	MANAGERIAL	TECHNICAL
GEEKS1	**0.818**	-0.198	0.245	-0.043	0.122
GEEKS2	**0.822**	0.029	0.287	-0.018	0.115
GEEKS3	**0.817**	-0.292	0.172	0.034	0.195
GENDER1	0.262	-0.134	**0.825**	0.042	0.113
GENDER2	0.350	-0.065	**0.727**	-0.092	0.060
GENDER3	0.111	-0.188	**0.854**	0.009	0.093
INTELLIGENCE1	0.140	0.217	-0.049	**0.757**	0.132
INTELLIGENCE2	-0.075	0.285	0.078	**0.719**	-0.004
INTELLIGENCE3	-0.065	-0.055	-0.041	**0.760**	-0.032
MANAGERIAL1	-0.133	**0.773**	-0.064	0.320	-0.060
MANAGERIAL2	-0.105	**0.832**	-0.136	0.159	0.003
MANAGERIAL3	-0.132	**0.796**	-0.169	-0.011	-0.036
TECHNICAL1	0.116	-0.140	0.014	0.060	**0.799**
TECHNICAL2	0.068	0.094	0.074	0.184	**0.712**
TECHNICAL3	0.198	-0.048	0.195	-0.295	**0.657**

[a]Entries in bold denote items that exhibited acceptable factor loadings. All loadings in bold are significant at the 0.01 level (2-tailed tests).

The reliability of items compromising each dimension was examined to ensure the items collectively measured their intended dimension consistently [Gefen et al. 2000]. Cronbach's alpha coefficients and composite reliabilities were calculated to assess internal consistency reliability [Nunnally 1978]. Alpha coefficients ranged from 0.703 to 0.818. Composite reliabilities were even higher, ranging from 0.788 to 0.892. As such, both reliabilities exceeded the generally agreed upon lower limit of 0.70 [Fornell and Larker 1981; Nunnally 1978] and the reliability of the scale was confirmed. Table 3 depicts the internal consistency reliability estimates.

Table 3. Descriptive Statistics, Reliability, Correlations, and Discriminant Validity

	No.	Avg Item Scores[b]					Construct[a]				
Construct	Items	*M*	*SD*	∝	CR	AVE	1	2	3	4	5
1. GEEKS	3	3.75	1.23	0.818	0.892	0.734	**0.857**				
2. GENDER	3	3.75	1.02	0.816	0.891	0.732	0.382	**0.856**			
3. INTELLIGENCE	3	5.41	0.88	0.720	0.844	0.643	0.014	0.030	**0.802**		
4. MANAGERIAL	3	4.46	0.86	0.777	0.870	0.691	-0.359	-0.227	0.343	**0.831**	
5. TECHNICAL	3	3.83	0.90	0.703	0.788	0.544	0.278	0.182	0.000	-0.276	**0.738**

[a]Diagonal elements (in bold) represent the square root of AVE. Off-diagonal elements represent the correlations among constructs.
[b]Item scores ranged from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*).

M = mean average item score (unweighted). *SD* = average item score standard deviation. ∝ = Cronbach's alpha. CR = composite reliability. AVE = average variance extracted.

Convergent validity was assessed at the individual item and construct levels [Fornell and Larker 1981; Gefen et al. 2000]. As shown in Table 4, all individual item loadings exceeded the 0.707 recommended level, indicating that the items converged adequately on their intended dimensions [Fornell and Larker 1981; Gefen et al. 2000]. No undesirable cross-loadings emerged. Additionally, average variance extracted (AVE) values for each dimension

exceeded the recommended threshold value of 0.50, confirming that the items collectively demonstrated convergent validity (see Table 3).

Table 4. Confirmatory Analysis
Constructs, Items, Loadings, and Cross-loadings

	Loadings and Cross-Loadings[a]				
Constructs/Items	GEEKS	GENDER	INTELLIGENCE	MANAGERIAL	TECHNICAL
GEEKS1	**0.868**	0.375	-0.047	-0.379	0.219
GEEKS2	**0.827**	0.361	0.098	-0.245	0.233
GEEKS3	**0.874**	0.247	-0.011	-0.296	0.261
GENDER1	0.353	**0.869**	0.010	-0.169	0.114
GENDER2	0.313	**0.813**	-0.057	-0.274	0.218
GENDER3	0.314	**0.883**	0.117	-0.146	0.140
INTELLIGENCE1	-0.028	0.007	**0.828**	0.306	0.010
INTELLIGENCE2	0.015	-0.001	**0.782**	0.280	-0.011
INTELLIGENCE3	0.048	0.067	**0.795**	0.238	-0.001
MANAGERIAL1	-0.219	-0.154	0.318	**0.765**	-0.150
MANAGERIAL2	-0.349	-0.185	0.330	**0.875**	-0.257
MANAGERIAL3	-0.320	-0.226	0.210	**0.851**	-0.274
TECHNICAL1	0.175	0.105	0.025	-0.225	**0.799**
TECHNICAL2	0.184	0.089	0.107	-0.076	**0.710**
TECHNICAL3	0.265	0.216	-0.133	-0.312	**0.720**

[a]Entries in bold denote the factor on which the item was intended to load. All loadings in bold are significant at the 0.01 level (2-tailed tests).

Discriminant validity was assessed by comparing the square root of AVE associated with each dimension (i.e., the diagonal elements in Table 3) to the correlations among the dimensions (i.e., the off-diagonal elements in Table 3) [Barclay et al. 1995; Fornell and Larcker 1981]. According to the estimates provided in Table 3, the square root of AVE for each dimension exceeded the correlations among different dimensions. Therefore, discriminant validity was established.

Combined with the strong evidence for reliability and validity, the psychometric properties of the IS stereotypes measure were deemed satisfactory.

V. ASSESSING STEREOTYPES

The exploratory and confirmatory analyses identified and confirmed five distinct dimensions of IS stereotypes. The geeks dimension consisted of items referring to the geeky and nerdy attributes associated with IS professionals. The gender dimension included items that focused on whether the IS profession was dominated by men. In the intelligence dimension, items captured intellect, including the ability to problem solve and keep up with technology. The managerial dimension included items that were related to managerial, communication, and people skills. Lastly, the technical dimension captured the technical nature of the work performed by IS professionals as well as the need for a strong background in math and science. The Appendix contains a list of the items used to measure each dimension.

Given the compelling evidence for the reliability and validity of the measures, the next step consisted of detecting the presence of stereotypes along each of the five dimensions to understand whether students generally believed that those stereotypes were representative of IS professionals. The scores across the five dimensions were examined to identify whether students held strong stereotypic images towards IS professionals. The data from the confirmatory analysis stage (sample 3) was used to achieve this goal. First, for each respondent, average item scores were calculated along each of the five dimensions. A series of one-sample t-tests were employed to detect the presence of stereotypes. A score significantly different from the scale midpoint (4) would indicate the presence of a strong stereotype. The t-statistic could also be used to detect the directionality of the stereotype. The t-test results are provided in Table 5.

Table 5. One-Sample T-Test Results

	Sample 3 (n = 279)						
	Avg Item Score					*95 % Confidence Interval*	
Construct	*M*	*SD*	*df*	*t*		*Lower*	*Upper*
GEEKS	3.75	1.23	278	-3.45	**	-0.40	-0.11
GENDER	3.75	1.02	278	-4.14	***	-0.37	-0.13
INTELLIGENCE	5.41	0.88	278	26.87	***	1.31	1.52
MANAGERIAL	4.46	0.86	278	8.96	***	0.36	0.56
TECHNICAL	3.83	0.90	278	-3.20	**	-0.28	-0.07

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

For the geeks dimension, the t-test revealed a significant value (t = -3.45, $p < .01$), meaning that the average item score (M = 3.75, SD = 1.23) was significantly lower than the scale midpoint. This indicates that respondents tended to disagree that IS professionals are geeks. For the gender dimension, the t-test revealed a significant value (t = -4.14, $p < .001$), meaning that the average item score (M = 3.75, SD = 1.02) was significantly lower than the scale midpoint. This indicates that respondents tended to disagree that the IS profession is typically dominated by men. For the intelligence dimension, the t-test again revealed a significant value (t = 26.87, $p < .001$), meaning that the average item score (M = 5.41, SD = 0.88) was significantly higher than the scale midpoint. This indicates that respondents tended to agree that IS professionals are intelligent. For the managerial dimension, the t-test revealed a significant value as well (t = 8.96, $p < .001$), meaning that the average item score (M = 4.46, SD = 0.86) was significantly higher than the scale midpoint. This indicates that respondents tended to agree that IS professionals possess good managerial skills. Finally, for the technical dimension, the t-test again revealed a significant value (t = -3.20, $p < .01$), meaning that the average item score (M = 3.83, SD = 0.90) was significantly lower than the scale midpoint. This indicates that respondents tended to disagree that IS professional are too technically oriented.

VI. DISCUSSION

The objectives of this study were twofold: (1) to develop a valid and reliable instrument to measure IS stereotypes; and (2) to examine whether college students generally believe that those stereotypes are representative of IS professionals. These objectives have been achieved successfully. The measure developed in this study exhibited excellent psychometric properties. The multiple items representing the image of IS professionals identified in the literature were yet to be confirmed and validated through quantitative approaches. This study empirically tested these items, and found a five-factor, 15-item multidimensional instrument for measuring IS stereotypes. As such, the findings suggest that the different factors proposed in the literature can be reduced to five major empirically distinct factors.

The literature has broadly assumed that IS professionals are viewed as geeks, mostly male, intelligent, technically oriented, and lacking managerial skills. The results of this study uncovered that strong stereotypes do exist along these dimensions. However, interestingly, most of the stereotypes were found to be in the *opposite direction* than the literature suggested.

Students disagreed that IS professionals were geeks, that the IS profession was typically dominated by men, and that IS professional were too technically oriented. They agreed that IS professionals possessed good managerial skills and were intelligent. Given this surprising pattern of results, the findings were double checked using the two exploratory analysis stage samples. The same procedures were employed to assess the presence of stereotypes along each of the dimensions. As depicted in Tables 6 and 7, the same pattern of results was revealed in samples 1 and 2. The significance and directionality of each t-test replicated the pattern of results found in the confirmatory analysis sample (sample 3). This replication provided greater confidence in the robustness of the findings across time and setting. In particular, the exploratory analysis samples were extracted during different semesters at different universities, increasing confidence in the results. As an added precaution, in order to investigate whether age played a role in shaping students' perceptions of IS professionals, each sample was divided into two age groups based on that sample's average age and a series of independent samples t-tests were conducted. No significant differences were found between the two age groups.

Table 6. One-Sample T-Test Results – Sample 1

	Sample 1 (n = 240)						
	Avg Item Score					*95 % Confidence Interval*	
Construct	*M*	*SD*	*df*	*t*		*Lower*	*Upper*
GEEKS	3.70	1.37	239	-3.36	**	-0.47	-0.12
GENDER	3.75	1.08	239	-3.54	***	-0.38	-0.11
INTELLIGENCE	5.64	0.80	239	31.90	***	1.54	1.74
MANAGERIAL	4.55	0.89	239	9.60	***	0.44	0.66
TECHNICAL	3.83	0.99	239	-2.60	*	-0.29	-0.04

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

Table 7. One-Sample T-Test Results – Sample 2

	Sample 2 (n = 231)						
	Avg Item Score					*95 % Confidence Interval*	
Construct	*M*	*SD*	*df*	*t*		*Lower*	*Upper*
GEEKS	3.80	1.34	230	-2.31	*	-0.38	-0.03
GENDER	3.83	1.15	230	-2.20	*	-0.31	-0.02
INTELLIGENCE	5.56	0.85	230	28.07	***	1.45	1.67
MANAGERIAL	4.30	1.07	230	4.28	***	0.16	0.44
TECHNICAL	3.80	1.01	230	-2.99	**	-0.33	-0.07

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

These findings can be attributed to the fact that today's college students are longtime users of technology. In the past several years, due to the widespread availability of the Internet, reduced cost of computers, and the introduction of new and improved applications, there have been significant changes in terms of computer literacy and ownership [George et al. 2005]. A study conducted in 2002 found that 20 percent of college students began using computers between the ages of five and eight. They were also introduced to the Internet at such a relatively early age that they are not even aware of a pre-Internet world. In other words, today's college students have grown up with technology and view it as an integral part of their everyday life [George et al. 2005; Jones 2002]. As such, it is possible that, even though IS is much more than technology, students who are well versed in technology have a more accurate understanding of technology related careers, including the IS profession.

It is also possible that at the beginning of the course students might have had negative stereotypes of IS professionals similar to what the literature would suggest. However, these perceptions might have shifted during the course as students gained more information about the IS field in general, and the nature of IS careers in particular. Research has shown that if the content, instructors, and the technologies used in introductory level IS courses are selected correctly, they might have a positive influence on how students view the IS field [Akbulut and Looney 2007; George et al. 2005; Looney and Akbulut 2007]. For example Looney and Akbulut [2007] found that students who are taught by effective teachers are more likely to be attracted to the IS discipline. Similarly, other studies have confirmed that having pedagogical support available to help students outside the classroom and teaching sophisticated ITs that reflect the technologies that are utilized by contemporary organizations positively influence student psychology and behavior [Akbulut et al. 2008; Akbulut and Looney 2009]. Since the data were collected during the last week of the course, this study stopped short of capturing whether students' perceptions of IS stereotypes changed throughout the course. Additional research is necessary to investigate this issue.

Revisiting the domain identification theory, students who perceive a positive image of IS professionals would be more likely to be attracted to the IS discipline. As such, the more students become aware that IS professionals tend to be intelligent individuals and they are not just nerds sitting in front of computers all day long, doing purely technical tasks, and lacking people and managerial skills, they would be more likely to consider IS as a career

option. This is also true for the gendered view of the IS discipline. As students, particularly female students, understand that the IS profession is not just for men, it is possible that they would be more likely to develop aspirations to choose IS as their major and profession. However, since this study does not provide direct evidence to support these assertions, additional research is necessary to gain a better understanding of these issues.

Caution is warranted when interpreting the results. Students' having a better and more accurate picture of IS professionals and the profession might not necessarily transfer directly into an increase in the number of students pursuing IS degrees and careers. Further research is clearly needed to investigate the role stereotypes play in facilitating or inhibiting student interest in and pursuit of IS majors and careers. Moreover, it is also necessary to illuminate the underlying mechanisms through which stereotypes might inhibit or facilitate students' decision to choose the IS profession. This would provide a more comprehensive understanding of the interplay between different variables in shaping students' interests and decisions. Akbulut and Looney [2007] developed the IS Major Choice Goals Model to explain the mechanisms that shape student choice of an IS major. Even though their model provides an explanation of the factors that motivate students to choose a major in the IS field, it does not incorporate all the factors that could potentially influence students' major or career decisions. The stereotypes instrument developed in this study can be leveraged to extend this model to gain a more comprehensive understanding of the factors influencing students' decisions. Moreover, further research could also shed light into the effects of the different dimensions of the IS stereotypes identified in this study.

Along the same lines, it is also important to note that students' identification with a particular domain, and hence their academic and career choices, can be shaped by just the awareness of stereotypes, regardless of whether they believe the stereotype or not [Devine 1989; Steele 1997]. Research has shown that, through their expectations, other people can directly affect an individual's behavior [Smith and White 2002]. As such, negative stereotypes that others hold about a profession can prevent students - even the most highly talented ones [Smith and White 2002; Smith et al. 2005; Steele 1997] - from pursuing an IS degree and career, even though they might not necessarily believe in those stereotypes. People prefer to identify themselves with groups that bolster their self-esteem and they want their identity to be positive compared to that of other groups [Taylor and Moghaddam 1994]. The threat of being evaluated in terms of the negative stereotypes that pervade our society might deter students from identifying themselves with the IS domain, even though they personally might not believe in the stereotypes [Steele 1997]. As a result, students might decide to channel their efforts into other disciplines that are relatively more positively perceived by others [Smith and White 2001].

Implications for Research and Practice

This research constitutes a major step toward understanding stereotypes of IS professionals. This is the first quantitative study designed to examine IS stereotypes from both a theoretical and empirical perspective. This research gap was addressed by developing and testing a theoretically and psychometrically sound instrument to measure IS stereotypes that later facilitated a comprehensive understanding of students' perceived image of IS professionals.

IS researchers have emphasized the importance of developing valid and reliable measures of information technology constructs as these measures become the major tools for generating valid and meaningful relationships among different variables [Straub 1989; Torkzadeh and Dhillon 2002]. Without the existence and use of such validated measures, research findings cannot be fully trusted [Straub 1989]. Although, the stereotypical image of IS professionals have been mentioned numerous times in popular and academic literature, very limited empirical research has been conducted to investigate IS stereotypes. Therefore, the development of a psychometrically sound IS stereotypes measure serves as a building block for future IS image studies [Joshi and Schmidt 2006]. Future research can utilize the instrument developed in this study to tackle many intriguing research topics.

An important research question that can be addressed by utilizing the IS stereotypes measures is the role the introductory level IS course plays in shaping students' image of IS professionals. As mentioned earlier, this study did not capture perceptions at the beginning of the semester and hence falls short in evaluating whether students' perceptions of IS professionals shifted during the course. It is possible that the content and structure of the course, the effectiveness and image of the instructor as perceived by the students, the technologies used and taught in the introductory IS course, or other similar mechanisms might have dispelled the initial negative stereotypes. Therefore, additional studies are needed to understand the impact of the introductory course on students' perceptions of IS professionals and the profession.

Gender related stereotypes have often been cited as one of the major reasons for the under representation of women in IT careers [Ahuja 2002; Lee 2005; Rettenmayer et al. 2007; Smith et al. 2005]. As Joshi and Schmidt [2006] pointed out, similar arguments have been made for the IS field, but these arguments are yet to be empirically

examined. Future research could utilize the IS stereotypes instrument developed in this study to understand the impact of IS stereotypes in women's career interests and choices.

The results also carry important implications for practice. Even though most of the students in this study generally disagreed with the negative image of IS professionals, these negative stereotypes still pervade our society. Therefore, outreach programs are necessary to undermine the negative stereotypical image of IS professionals.

Research has found that students' traditional negative stereotypes can be undermined if they inhabit local environments in which they are exposed to counter stereotypic roles [Dasgupta and Asgari 2004]. In this respect, at the college level, the introductory level IS course represents an excellent opportunity to clarify any misunderstandings students might have about IS professionals. As mentioned earlier, for most students the introductory course is their first formal introduction to the IS field and, moreover, the majority of these students are yet to decide what major to pursue. Therefore, with careful planning and execution, introductory IS courses can be leveraged to dispel any myths, misconceptions, and stereotypes [Firth et al. 2008] and to attract more students to the discipline [Akbulut and Looney 2007; Dick et al. 2007; George et al. 2005; Looney and Akbulut 2007]. In this respect, the introductory course should emphasize the role IS plays in business, for society, and for individuals; rather than merely focusing on technical concepts [Firth et al. 2008; George et al. 2005]. The content of the course and the IT used in the classroom should be up to date and interesting. The course should expose students to different career options that are available to IS professionals and instill an understanding of the positive aspects of becoming an IS professional. Inviting guest speakers or arranging company visits would also prove helpful in providing students firsthand exposure to issues facing IS professionals on a day-to-day basis. The instructor teaching the introductory IS course is extremely important as well [Firth et al. 2008; George et al. 2005; Looney and Akbulut 2007]. The instructor should be a business and IS savvy professional who would serve as role model to students [George et al. 2005].

Even though our study focused on college students, beyond them, outreach programs should also target high school students, career counselors, parents, and the public in general. At the high school level, selecting a college major and deciding on a future career path can be quite challenging and frustrating. In this respect, an up to date curriculum as well as informed teachers and counselors can prove helpful in conveying the students the true image of IS professionals. Mentoring programs, presentations by IS professionals, career nights, and college visits can help in explaining the correct mix of business and technical skills that IS professionals need to possess, and in providing students a better idea of the realities of the profession. Media also plays an important role in imparting a positive image of IS professionals, communicating the rewarding prospects of the profession, as well as the important role IS professionals play in the advancement of our society.

Limitations

The findings of the study must be interpreted in the light of its limitations. Since survey methodology was used, the threat of common response bias can be present in the data, which could inflate the correlations among the factors. In this study, since discriminant validity was established, the correlations did not appear to pose a significant problem.

Even though the study employed a rigorous instrument development process, psychometric properties of instruments are difficult to empirically establish based on a single study [Torkzadeh and Dhillon 2002]. Therefore, additional studies are needed for the validation of the IS stereotypes scale.

The samples used could also limit the ability to generalize the study findings. Sampling demographics (e.g., United States data only, gender, age, similarities in the recent IS course taken, etc.) might have influenced the survey results. Since the study only surveyed students enrolled in introductory IS courses at two large American universities, the samples were relatively homogenous. Therefore, although the data were collected over multiple semesters at multiple universities, these students might not represent the broader student population to which the results are to be generalized. Considering the diversity of students and instructors, curricula, and pedagogical approaches, differences might arise in different academic settings [Looney and Akbulut 2007]. As such, the issue of generalizability is best addressed through replication in different contexts using contemporary samples. Other researchers are encouraged to conduct confirmatory studies of the IS stereotypes measure and study findings. Moreover, at the time the date were collected, the unfavorable market conditions and the economic landscape (such as concerns about IT jobs being outsourced and the economic recession) might have influenced students' perceptions of IS professionals. If the survey was conducted with the same group of students when the market and economic conditions were more favorable, different results might have emerged. Therefore, further studies are needed to investigate how these environmental factors affect the image of IS professionals and the profession.

As discussed earlier, the introductory level IS course is believed to have a significant role in shaping students' image of IS professionals and the profession. This study only captured students' perceptions at the end of the semester and, hence, did not tackle whether any shifts in students' perceptions have occurred throughout the course. As such, further research should survey students at the beginning and at the end of the course and examine if any differences in perceptions surface.

Additional research is also needed to understand how different pedagogical mechanisms might influence stereotypes throughout the course of the semester. On one hand, some of the intervention approaches that have been discussed earlier in this paper have the potential to increase IS enrollments by overcoming any negative stereotypes students might initially hold. On the other hand, not all intervention approaches would work in every situation (e.g., young women are not always drawn to IT or CS through promotional programs at their high schools or colleges). As such, the instrument developed in this paper could be utilized to understand the effectiveness of different approaches in influencing students' image of IS professionals and the profession.

This study intentionally targeted undergraduate business students who were yet to finalize their decisions about which major to pursue. Since the identities of survey participants were anonymous, it was not possible to determine what majors the study participants might have eventually decided to pursue. In order to identify the impact of stereotypes in facilitating or inhibiting students' decisions to major in IS and to expand our understanding of the factors shaping students' academic and career choices, longitudinal studies that keep track of students' academic pursuits are warranted. Along the same lines, future studies are needed to capture the stereotypes of students at all levels, including lower and upper level IS Majors and non-IS majors. In this manner researchers can investigate and compare the perceptions of a diverse set of students. An analysis of the perceptions of students by discipline might uncover if differences in IS stereotypes exist between students majoring in IS and in other disciplines. If significant differences exist between IS and non-IS majors, the findings might help researchers diagnose why some students might be avoiding IS major and careers [Scott et al. 2009].These studies might also shed light into what majors and careers have more favorable images among students than IS majors and careers and why. Furthermore, this study focused only on college students. Beyond college students, it is also necessary to determine whether prevailing negative stereotypes of IS professionals exist among high school students. By the time high school students reach college, they might have already decided on what major and/or career to pursue. Therefore, at the college level, it might be too late to overcome any potential negative perceptions these students might hold and to persuade them to major in IS. The IS stereotypes measure developed and validated in this study can be leveraged to investigate these important research questions.

VI. CONCLUSION

The IS community has been searching for answers to explain the reasons behind the sharp decline in enrollments and developing intervention approaches to help IS enrollments rebound. The study herein represents a first step towards this objective by utilizing domain identification theory and the pertinent literature in the computer science, information systems and psychology disciplines in the development of an instrument to measure stereotypes of IS professionals. The findings suggest that the stereotypes construct is multidimensional, including the geeks, intelligence, gender, managerial, and technical dimensions. As opposed to the prevailing perceptions, students in this study disagreed that IS professionals were geeks, that the IS profession was typically dominated by men, and that IS professional were too technically oriented. They agreed that IS professionals possessed good managerial skills and were intelligent. The measure can be used to address a wide array of interesting research questions, facilitating a richer understanding of IS stereotypes and its impact on students' academic and occupational interests and choices.

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Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the paper on the Web: can gain direct access to these linked references. Readers are warned, however, that:

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APPENDIX: ITEMS

GEEKS
GEEKS1: IS professionals tend to be nerds.
GEEKS2: IS professionals tend to be technology geeks.
GEEKS3: When I think about IS professionals, I think about computer geeks.

GENDER
GENDER1: The IS profession is dominated by men.
GENDER2: Women typically avoid careers in IS.
GENDER3: Men, rather than women, typically pursue careers in IS.

INTELLIGENCE
INTELLIGENCE1: IS professionals tend to be intelligent.
INTELLIGENCE2: IS professionals tend to have good problem solving skills.
INTELLIGENCE3: IS professionals tend to be willing to keep up with technology.

MANAGERIAL
MANAGERIAL1: IS professionals tend to have good managerial skills.
MANEGERIAL2: IS professionals tend to have good communication skills.
MANEGERIAL3: IS professionals tend to have good people skills.

TECHNICAL
TECHNICAL1: IS professionals do a lot of programming.
TECHNICAL2: IS professionals tend to have a strong background in math and science.
TECHNICAL3: Computer science and IS professionals basically do the same type of work.

ABOUT THE AUTHOR

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Communications of the Association for Information Systems

ISSN: 1529-3181

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