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Undergraduate Student Attitudes Toward MIS: Instrument Development and Changing Perceptions of the Field Across Gender and Time

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Abstract:

The MIS field suffers from two pressing workforce issues, underrepresentation of women and inadequate supply of entry level talent. To examine these issues, this study develops an instrument to measure attitudes toward MIS (Attitude toward success, usefulness, confidence in learning, and effectance motivation) and perceptions of both MIS and MIS professionals. Data from 1102 college students collected over a five-year period were then used to test gender differences within and across time periods. In spite of recent efforts, little progress has been made to improve attitudes and perceptions. However, in contrast to expectations, views appear not so different across gender.

Keywords: IT workforce, gender in IT

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I. INTRODUCTION

The use of information technology (IT) is pervasive, and organizations continue to depend on IT for more and more of what they do. The ability to apply these technologies to innovate and reinvent business processes both internally and with trading partners is now paramount to success. Accompanying the increasing role of IT in what organizations do is a vital need to develop a continual and diverse supply of IT talent into the workforce. From a U.S. perspective, the demand and supply curves for MIS graduates have been heading in opposite directions [Bullen, Abraham, Gallagher, Simon, and Zweig, 2009]. "U.S. demand for IS graduates is increasing, but graduation numbers from university IS programs are flat or in decline. … many CIOs report continuing frustrations in attracting enough newly-minted IS talent" [Benamati, Ozdemir, and Smith, 2010, p. 1]. While demand is projected to grow, the number of MIS bachelor degrees awarded in the U.S. has fallen by 63 percent nationally [U.S. Department of Education, 2012] and by 60 percent in the top fifty U.S. business schools [Benamati et al., 2010]. Figure 1 highlights the decline in U.S. MIS bachelor's degrees awarded from 2003–2011.

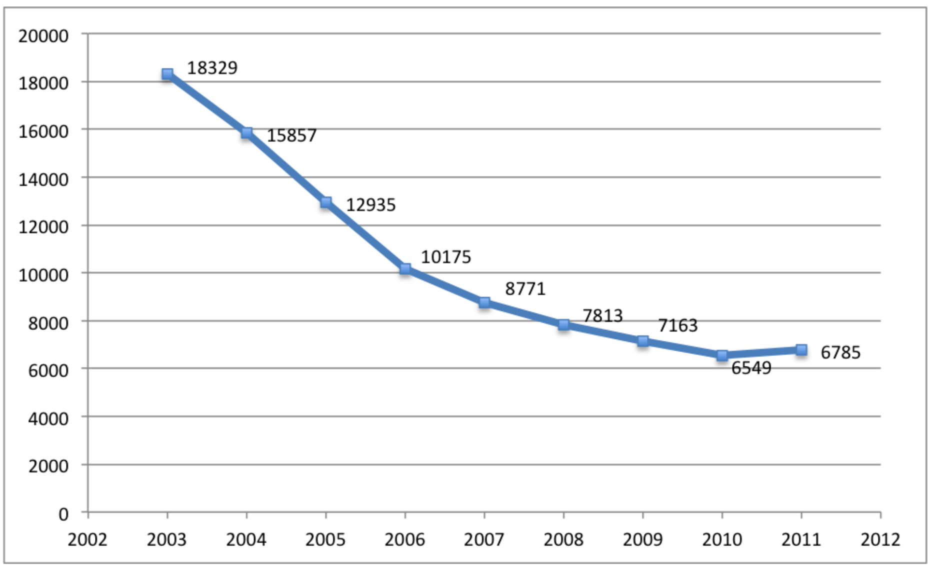

Figure 1. U.S. MIS Bachelor Degrees Awarded
[Source: U.S. Department of Education National Center for Education Statistics]

In addition to overall supply, diversity in the IT workforce has long been recognized as an issue that needs to be addressed, especially the gender imbalance in the field. This is not only a problem in the U.S. where women make up only a quarter of the IT workforce, but also a global problem [Ilavarsan, 2006; Crump, Logan, and McIlroy 2007; Adya, 2008; McKinney, Wilson, Brooks, O'Leary-Kelly, and Hardgrave, 2008; Panko, 2008]. Accentuating the problem, the number of females entering the field in the U.S. is declining disproportionately to males as illustrated in Figure 2. Women earn 57 percent of all undergraduate degrees nationally [Ashcraft, Eger, and Friend, 2012], but earn only about 24.5 percent of MIS degrees [U.S. Department of Education, 2012].

Increasing diversity in the field is important for multiple reasons [Taylor and Ladner, 2011]. First, the MIS workforce numbers are bleak. Supply of MIS graduates is simply not meeting demand. Women make up 57 percent of the workforce, but only 25 percent of the IT workforce [U.S. Dept. of Labor Statistics, 2012; Ashcraft et al., 2012]. The number of women in the U.S. IT workforce dropped 13 percent in the period 2000–2012, while the number of men increased by 11 percent [U.S. Dept. of Labor Statistics, 2012]. Simply increasing female participation in the field to better take advantage of this underrepresented resource could help ease looming workforce supply issues [Beyer, 2008; Coder, Rosenbloom, Ash, and Dupont, 2009; Riemenschneider, Armstrong, and Moore, 2009].

Second, technology disciplines, including MIS, have been labeled as male dominated [Lemons and Parzinger, 2007; Wajcman, 2010]. MIS researchers have found that women receive lower performance evaluations, hold lower level positions, and have fewer prospects for career advancement than men [Baroudi and Igbaria, 1994; Igbaria and

Baroudi, 1995]. These findings are important because perceptions of IT job qualities influence advancement opportunities and increase voluntary turnover for women [Armstrong, Riemenschneider, Allen, and Moore, 2007]. Thus, women leave the IT workforce to work in other fields at twice the rate of men [Hewlett, Buck Luce, Servon, Sherbin, Shiller, Sosnovich, et al., 2008]. Much MIS gender research has focused on women in the workforce and the retention of them [Baroudi and Igbaria, 1994; Igbaria and Baroudi, 1995; Adam, Howcroft, and Richardson, 2004; Ilavarasan 2006; Armstrong et al. 2007; Trauth, Quesenberry, and Huang, 2009].

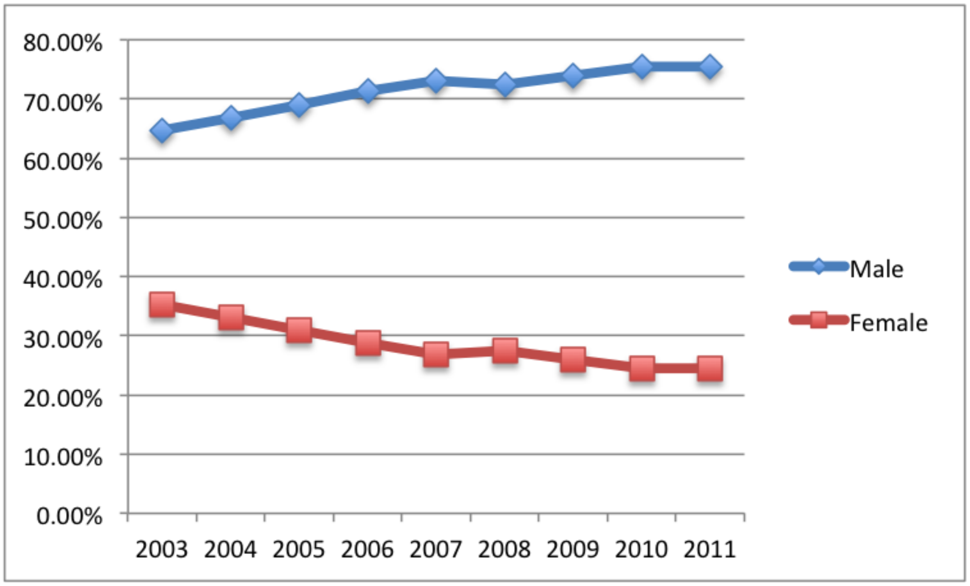

Figure 2. Percentage of U.S. MIS Bachelor Degrees Awarded by Gender [Source: U.S. Department of Education National Center for Education Statistics]

Third, diversity of thought produces faster and better solutions to complex problems [Page, 2007]. Innovations are viewed as sociotechnical networks, and gender relations inform the design, development, and use of technical products [Wajcman, 2010]. One measure of innovation—the percentage of IT patents issued in the U.S. held by women—has increased from 2 percent in 1980 to about 8 percent in 2010 [Ashcraft and Breitzman, 2012]. When diverse perspectives are used in the design of products, more robust end-user products may be created [Taylor and Ladner, 2011]. Thus, the lack of female perspectives may have detrimental effects on the design, content, and use of technical artifacts [Wajcman, 2010].

Finally, inclusion requires that the field be representative of society. The policy perspectives on equality in Sweden include a qualitative dimension that requires the knowledge, experience, and values of both women and men to be used and have an equal impact on all areas of society [Alvesson and Billing, 1997, p. 222]. Inclusion allows for integration of diverse perspectives into the organizational discourse and supports enhanced decision making when inclusion is built on principles of mutual recognition, understanding, standpoint plurality and mutual enabling, trust, and integrity [Pless and Maak, 2004]. According to Steinhorn, for a majority of Americans, "diversity is not just a slogan—it's a moral value" [Florida, 2007, p. 216]. The improvements and advantages diversity provides in creativity and decision-making is increasingly well recognized [Kuhn and Joshi, 2009].

Gender Theories in IS

Research on gender and IT has taken two major approaches [Pretorius and de Villiers, 2009]. The first approach is that men and women are inherently different and the behavior of men and women are fixed, predetermined, and natural [Trauth, 2002; Howcroft and Trauth, 2008]. These essentialist approaches basically view gender as a single characteristic (sex) while ignoring equally important impacts of factors such as race, class, national origin, or the self-identity of women [Kvasny, 2006].

The second approach is that gender differences are socially constructed—or human action is the product of the culture in which they are born and raised [Berger and Luckman, 1966; Ridley and Young, 2012]. The social construction framework of gender posits that social scripts prescribe different values, attributes, and activities for men and women, and individuals construct their gender identity based on these social scripts [Joshi and Kuhn, 2007]. The IT field has been socially shaped as masculine, which interacts with the social construction of femininity and leads to many women opting out of the IT field [Trauth, 2002; Joshi and Kuhn, 2007] and to the shortage of women candidates in IT [Ahuja, 2002]. The social prescription of gender-based roles leads to male domination and under-representation of women in the IT profession.

The individual differences theory applies the social-cultural construction of gender and IT, not at the societal level, but at the individual level [Trauth, 2002]. Individual women respond to the social shaping and IT work in their unique way based on the different personality, overall outlook, and intellectual characteristics they bring with them [Trauth, 2002; Adya and Kaiser, 2005]. The individual differences theory of gender and IT (IDTGIT) provides a basis for looking beyond differences across genders and examining differences within a gender [Trauth, 2002, Trauth and Howcroft, 2006]. IDTGIT uses the three constructs of individual identity (demographic and professional characteristics), individual influences (personality, ability, and mentors), and environmental influences (cultural, economic, policy, and infrastructure) to account for differences in responses within gender [Trauth et al., 2009; Ridley and Young, 2012]. Using the individual differences theory can help organizations develop more individualized interventions to help retain women in the IT workforce [Trauth et al., 2009].

Culture and Gender

The under-representation of women in IT studies is prevalent in many parts of the Western world. The phenomenon has been identified and studied in Australia [Clayton, Beekhuyzen, and Nielsen, 2012; Miliszewska, Barker, Henderson, and Sztendur, 2006] and Europe [Clegg and Trayhurn, 2000; Panteli, 2012]. Perception variations in IT study and work between different national cultures has been identified in several studies [Clarke and Teague, 1994; Adya, 2008; Clayton et al. 2012]. For example, unlike in Western countries, IT is seen as a women-friendly field in both Malaysia and India [Mellström, 2009; Varma, 2009]. While some have studied how culture variations across nations interact with gender in shaping student choices to study IT, others have focused on within-country variations of culture or multicultural influences on gender and IT within a specific societal context and how the individual backgrounds of women influences their choices with respect to IT [Trauth, Quesenberry, and Huang, 2008].

Guzman, Sharif, Blanchard, Ellis, and Stanton [2005] identify occupations as specific cultures in and of themselves, and when practiced within organizations are powerful subcultures. Thus, *culture* refers to the complex set of relationships, values, attitudes, and behaviors that bind specific communities or occupations [Blum, Frieze, Hazzan, and Bernardine Dias, 2007]. Workplace culture is the medium in which gender behaviors interact with opportunities that exist in the organization [McIlwee and Robinson, 1992]. Elements from societal, organizational, and occupations culture together form the social system that shapes experiences in the workplace [Soe and Yokura, 2008]. If the social system is masculine-gendered, some women may have an increasingly dysfunctional experience [Powell, 2009]. An inclusive organizational climate is a key factor in retention of women in IT [Trauth, et al. 2009]. Students interpret their experiences within the student's cultural context as they decide to choose their majors. Weinberger [2004] finds that expectations about the classroom and workplace climate are on the minds of many women who avoid IT majors.

Examining learning organizations, Nielsen et al. [2000] conclude that the educational attainment of women in IT is negatively impacted by the social view of IT as masculine. Many freshman and sophomore business students still view IS careers as moderately gendered with a greater emphasis on masculine traits and abilities [Joshi and Schmidt, 2006]. In a study conducted on the millennial generation, Trauth, Joshi, Kvasny, Chong, Kulturel, and Mahar [2010] report that the social view of IT as masculine might be changing. They report that the millennial generation view three skill sets required of IT professionals: a set of masculine skills such as project management, enterprise integration, process analysis, programming skills; a set of feminine skills such as team, communication, and creativity skills; and gender-neutral skills such as leadership and problem-solving skills. Kvasny, Joshi, and Trauth [2011] posit that the emergence of gender-neutral skills signal a possible shift in the perceptions of IT among college students.

This leads us to ask our research questions

How have U.S. male and female college students' attitudes and perceptions of MIS changed from 2005 to 2009?

How do U.S. male and female college students' attitudes and perceptions of MIS differ over this same period?

The issues of gender diversity and supply of MIS graduates are being addressed on many fronts with increasing urgency over the last five to seven years. As president of The Association for Information Systems (AIS), Dennis Galletta made addressing enrollment downturns a top priority for AIS. From a pure supply perspective, the academy has been working to modify curriculum and market more aggressively to freshmen [Benamati et al., 2010]. Academia is also teaming with industry to improve the image of the field and educate high school students, parents, guidance counselors, and teachers about the opportunities and realities of careers in IS. On the gender front, concerted efforts to generate confidence in abilities and interest in the field for females continue. Organizations such as Women in Technology [www.womenintechnology.org], Computer Clubs for Girls [www.cc4g.net], and even the Girl Scouts (who now offer technology-related badges), are all hard at work changing the image of the field.

Due to the severe downturn in the supply of MIS graduates since the dotcom bubble burst (see Figure 1), many of these efforts to increase both overall supply and gender diversity started or increased in intensity in the last decade. A primary focus of the efforts is to change attitudes toward studying MIS and overall perceptions of the MIS field. Prior research suggests that attitude and perceptions about MIS influence students' selection of the major [Zhang, 2007; Beyer, 2008; Heinze and Hu, 2009] and that attitudes and perceptions about MIS differ across gender [Zhang, 2007; Beyer, 2008; McKinney et al., 2008].

The unanswered question is: Are the recent increased efforts having an effect? It may be too early to examine the IT workforce for answers, but some of the grassroots efforts in younger age groups should now show an effect at the post-secondary level. Comparing attitudes and perceptions of college students toward MIS over a recent five-year period may provide some insights into progress.

Hence, the objectives of the current study are twofold. The first is to develop reliable and valid construct measures of attitudes toward and perceptions of MIS. The second is to empirically examine changes in attitudes and perceptions across time and to understand the differences in attitudes and perceptions across gender and time in U.S. college students. To answer the research questions we outlined earlier, the study creates and validates a measurement instrument. In addition to serving this study, such an instrument will serve as a basis for future research into attitudes and perceptions of MIS. Answering the research questions will provide insight to the discipline and help understand how we are doing in our quest to change the image of MIS and attract a larger and more diverse workforce. Knowing this should help those concerned to make decisions about how best to proceed in this endeavor.

The following sections review the literature on attitudes toward MIS and other STEM disciplines, and discuss the selection of the scale based on the literature. The research methodology and analysis employed are then described. The article concludes with a discussion of the findings relative to the stated objectives and a summary of the contribution of this work.

II. LITERATURE REVIEW

As the U.S. workforce ages and retirements loom, the sense of urgency to increase the supply of MIS graduates has intensified. Accompanying this are increased efforts to attract and retain women in the discipline. Similarly, the gender imbalance in MIS is felt throughout all the STEM disciplines in the United States. MIS is recognized as a STEM discipline by the U.S. government [ESA, 2011]. Hence, developing appropriate measures of constructs operationalizing student attitudes toward studying MIS and perceptions of the field could draw from MIS research as well as literature from other STEM fields.

For the purpose of this study, attitude toward MIS is defined using a definition from the science literature. Osborne, Simons, and Collins [2003, p. 1053] define attitude toward science as "… feelings, beliefs, and values held about an object that may be the enterprise of science, school science, the impact of science on society, or scientists themselves." Replacing the word *science* with *MIS* and *scientists* with *MIS professionals* garners the definition applied here: feelings, beliefs, and values held about an object that may be the enterprise of MIS, the study of MIS, the impact of MIS on society, or MIS professionals themselves. Osborne et al. further argue that attitude toward science is not a single unitary construct, but rather a large number of sub-constructs that contribute in varying ways to individuals' overall attitude toward science. Psychology literature has a tripartite representation of attitude that includes affective, cognitive, and behavioral components [McGuire, 1985; Olson and Zanna, 1993]. It is not essential that all three components apply to any given attitude [Olson and Zanna, 1993].

Defining attitude toward MIS as formed by a set of beliefs or perceptions is consistent with the theory of reasoned action [Ajzen and Fishbein 1980]. TRA describes how beliefs, attitudes, and behavioral intentions influence an individual's behavior. TRA theorizes that the primary predictor of actual behavior is one's behavioral intention to perform the behavior. Behavioral intentions, in turn, are determined by an individual's attitude toward the behavior. Finally, attitudes develop from one's beliefs about the behavior. Thus, it follows that perceptions about and attitudes toward studying and pursuing a career in MIS influence an individual's likelihood of majoring in MIS.

Two recent U.S. studies established that college students' beliefs (perceptions) and attitudes about an MIS major influence their intention to pursue the major [Zhang 2007; Heinze and Hu 2009]. Zhang studied 114 students with undeclared majors taking an introductory IS course, and Heinze and Hu studied 382 undeclared students in lower-division business or general education classes. Their finding that perceptions and attitudes influence selection of the major is important because it lends credence to recent efforts to change perceptions and attitudes about MIS. If perceptions and attitudes can be improved, more MIS majors should result.

However, the operationalization of attitude toward MIS differed in the two studies. In contrast to attitudes being determined by a set of sub-constructs as suggested in other STEM research [Osborne et. al., 2003], Heinz and Hu used a single, three item, affective construct to operationalize attitude in their study. Measures included liking the MIS major, enjoying the major, and how positive the experience would be. Zhang's attitude measures consisted of two items that measured perceptions of the major being a good idea and a wise choice. More consistent with STEM studies, he also found two precursor beliefs that contribute to the formation of attitude toward MIS. The first was the belief about the difficulty of the MIS program, and the second was genuine interest in the field. Interest in the field included more affective measures such as liking IS and finding IS interesting.

Zhang also found that male students were significantly more interested in MIS than females. Differences between genders in perceptions of MIS and attitudes toward MIS are a focus area in MIS research as a potential way to help explain the severe gender imbalance. This research stream has intensified with the projected inconsistency between supply of and demand for MIS graduates, but more research is called for [Adam et al., 2004; Howcroft and Trauth, 2008; Riemenschneider et al., 2009].

Science researchers view gender as one of the most significant variables influencing attitude toward science [Gardner, 1975; Schibeci, 1984; Becker, 1989; Weinburgh,1995]. In other STEM disciplines, similar to MIS findings, males are typically more confident in their abilities and generally have more positive attitudes about subjects such as computer science [Beyer and Haller 2006], math [Fennema and Sherman, 1978; Else-Quest, Hyde, and Linn, 2010], and science [Osborne et al., 2003].

Survey Scale Selection

Some stereotypical images of computer science also permeate the MIS field and are not completely removed even after the students are exposed to IS careers [Joshi and Schmidt, 2006]. It is clear from workplace research that perceptions and attitudes about the field effect the participation of women. Moreover, the gendered work force perceptions and attitudes toward MIS are likely to manifest themselves in the perceptions and attitudes of younger individuals making career and education decisions.

A number of studies from STEM disciplines have utilized the model of task achievement motivation as a theoretical background to explain the lack of interest in women to pursue technology-related studies [Sáinz and López-Sáez, 2010]. This model has a subjective task value and an expectancy component; people choose studies that they think they can master and that have a high value for them [Wigfield and Eccles, 2000]. This aligns with theories of gender in that the subjective task value is the measurement of attitude, and the social constructs used in our study are the perceptions of the discipline and IS professionals.

The use of TRA as the basis of attitudes toward technology and technology usage outcomes is well established in the IS discipline. Adya and Kaiser [2005] suggest that a limitation of using attitude toward technology as a basis for career choice is that there are a number of intervening social, structural, and economic variables between positive attitudes toward technology and career choice. Hence, we looked at attitude measures from other disciplines.

Compared to MIS, there is more attitude-focused research in the other STEM disciplines [Osborne et al., 2003], and, thus, measures of attitude constructs are more established than in MIS. One of the most applied measures is the Fennema and Sherman Mathematics Attitude Scale (FSMAS) [Fennema and Sherman, 1976, 1977]. The scale measures eight affective dimensions of attitude as described in Table 1. The measures were originally established and validated to study attitudes toward math in secondary school students. All the measures used in FSMAS have also been used to study differences in gender attitudes to either study math achievement or in the selection of math courses [Fennema and Sherman, 1976, 1977].

Shortened forms of the FSMAS have been developed and employed in both science and math [Mason and Khale, 1988; Mulhern and Rae, 1998]. Measures for four of the FSMAS dimensions of attitude have also been used to study college undergraduates—Confidence in Learning, Usefulness, Attitude Toward Success, and Effectance Motivation [Wikoff and Buchalter, 1986; Croft, 2000; Jennings and Onwuegbuzie, 2001]. A computer science attitude survey measuring attitudes toward computer science has also been derived from FSMAS and used to study paired programming in undergraduate computer science courses [Williams, Wiebe, Yang, Ferzli, and Miller, 2002; Wiebe, Williams, Yang, and Miller, 2003]. The use of FSMAS to measure gender differences and attitudes in undergraduate courses and computer science is well established.

Table 1: Attitude Constructs and Definitions [Fennema and Sherman, 1976]	
Construct	Definition
*1. Attitude Toward Success **	The degree to which students anticipate positive or negative consequences as a result of success in math
2. Stereotyping of Math as a Male Domain	The degree to which students see math as a male, neutral, or female domain
3 & 4. The Mother/Father influence	Students' perception of their mother's/father's interest, encouragement, and confidence in the student's math ability
5. The Teacher influence	Students' perception of their teacher's attitudes toward them as learners of math
*6. Confidence in Learning **	Confidence in one's ability to learn and to perform well on MIS tasks
*7. Effectance Motivation **	Intrinsic joy from doing math
*8. Usefulness **	Usefulness of math currently and in relationship to their future education, vocation, or other activities.
*Italics indicate constructs previously used to study college undergraduates.	

The Mason and Khale [1988] shortened version of the FSMAS studied attitude toward science of ninth-grade students. It included five of the original attitude constructs. Four of the five (effectance motivation, attitudes toward success, usefulness, and confidence in learning) were the same four that have been previously validated and applied to study attitudes toward computing and math in college undergraduates. Thus, to accomplish the stated objective of this study—develop reliable and valid construct measures of attitudes toward and perceptions of MIS in college undergraduates—the Mason and Khale instrument served as the foundation.

III. RESEARCH METHODOLOGY

A survey methodology was used to collect data for the study. Data were collected from 1,102 students attending a university in the Midwestern United States. Students taking a three-credit Introduction to MIS course that was a core business class required for all business students completed the survey once at the end of the semester. Most students in the class were sophomores (86 percent) and were not far through the required core classes taken in the sophomore and junior years. Typically, these students did not yet have internships that related to their business studies. Very few students (<5 percent) had declared their intent to major or minor in MIS prior to taking the class. Students completed a hard copy survey in class. They were instructed to think about the field of MIS and not the introductory IS course itself. Participation was voluntary, and students were not rewarded in any way for their participation.

Data was collected at the end of the spring semester in four different years, from 2004 to 2009. During this period, class sizes were fairly constant at around forty, and pedagogical approaches used in the different sections of the class taught by different instructors were very similar. Each spring semester there were sixteen to twenty offerings of the introductory course; five to seven full-time IS faculty with either a Masters or Ph.D. in IS taught the class, mostly using a lecture format, with some lab sessions sprinkled throughout the course. The survey was not administered in every section of the course. The course content was closely coordinated in bi-monthly meetings, to ensure consistency across sections. To help address declining enrollments in the MIS program, a career day in MIS was added to the introductory classes' curriculum in 2006. The career day of class was devoted to having a panel of IT professionals discuss career paths and what it's like to work in MIS.

Table 2 summarizes the number of useful responses by year and gender. Of the 1,102 participants, males composed 57 percent of the sample. The subjects were also predominantly sophomores (86 percent); juniors represented 11 percent of the sample and the remaining 4 percent were spread across other class standings. Most, 87 percent, reported their age to be nineteen or twenty, which is consistent with students ending their second year of college studies. The vast majority (95 percent) of the subjects identified themselves as Caucasian/non-Hispanic.

Table 2: Responses by Year			
Year	Total N	Female N	Male N
2004	200	109	91
2005	400	177	223
2008	223	77	146
2009	279	110	169

The cultural homogeneity of our sample matches directly to information on the population of business students at the university. Population data is gathered from a survey conducted annually by the university that students complete voluntarily during the freshman year. The business school population was 95 percent white, 2.5 percent Asian, 1.5 percent Black, and others 1 percent. About 98.5 percent of the students were U.S. citizens and another 0.6 percent of students were permanent residents. Other demographic information about our subjects can be gleaned from the university survey. The students came from a middle class to upper middle class background, with about 83 percent of students reporting family income of $75K and above. Both parents of the students were also well educated. About 80 percent of students' fathers had completed a degree or possessed a graduate degree. About 75 percent of students' mothers had completed a degree or possessed a graduate degree. There were no significant differences between the genders regarding any of the above data. Thus, the cultural diversity of the student population at the study site was limited, and the students were predominantly U.S. citizens. Therefore, the study was unable to include culture as a variable and focused primarily at understanding the role of gender and student attitude toward MIS within the context of the U.S.

Measures

The research used a modified version of two established scales developed to study attitudes toward and perceptions of science and scientists [Mason and Kahle 1988]. For both scales, questions were changed to ask about MIS and MIS professionals instead of Science and Scientists. For example, the item "Being regarded as smart in science would be a great thing" became "Being regarded as smart in Management Information Systems would be a great thing," and "Scientists often work as a team to solve problems" became "Management Information Systems professionals often work as a team to solve problems." Consistent with prior STEM studies, all items used a 1 to 5 scale where 1 meant strongly agree and 5 meant strongly disagree. For clarity, all analysis in the article reversed the scales because intuitively higher numbers are viewed as increases, not decreases.

The Mason and Kahle [1988] attitudes scale was a shortened version of the Fennema and Sherman Mathematics Attitudes Scale [1976]. Items for the four constructs previously validated as applicable to undergraduates were converted to MIS items: Attitude Toward Success, Confidence in Learning, Effectance Motivation, and Usefulness. Of the Mason and Kahle [1988] items measuring these four constructs, twenty-one of the twenty-four were converted to MIS items. One original item, "Science is one of the most worthwhile and necessary subjects to take," was split into two items, one asking about how worthwhile MIS is and the other about how necessary MIS is, resulting in twenty-two total attitude items.

The Mason and Kahle [1988] perception scale measured two constructs: how students view science and how they view scientists. The scale consisted of sixteen items for student perceptions of science and twenty-three for perception of scientists. For brevity, eleven items were converted to perceptions of MIS items and six to perceptions of MIS professional items. Items not converted included those less relevant when applied to MIS, such as "Scientific research is done using rats, mice, and chemicals" and "Scientists usually wear white laboratory coats."

IV. CONFIRMING THE MEASUREMENT MODELS

Confirmatory factor analysis (CFA) using SAS version 9.2 and the data from 2004 (N = 200) was performed to test the proposed measurement model. Due to expected high correlations between some of the items across the two scales for the perception and attitude constructs, the measurement models were confirmed separately. A strictly confirmatory use of CFA would test the fit of the data collected to a proposed measurement model and accept or reject it. However, model generation is a more commonly used application of CFA [Joreskog, 1993]. In this approach, an initial model is tested for fit against collected data. If the fit is not adequate, the model is adjusted and retested. This process iterates until an appropriate level of fit is obtained. The analysis in this study employed such a model generation approach, since it employed modified measures from a prior study to measure attitudes and perceptions of MIS. Table 3 contains the initial indicators of fit for both proposed measurement models.

Table 3: Initial Fit Indicators for Both Measurement

Fit Indicator	Attitude	Perceptions
RMSEA	0.084	0.091
GFI	0.80	0.84
AGFI	0.75	0.80
NNFI	0.83	0.78
chi-square	501.44	326.12
df	203	118
chi-square/df	2.47	2.76

The chi-square to degrees of freedom ratios for both models were above the recommended acceptable value of 2.0, but below 3.0, which is often used as a cutoff. The GFI, AGFI, and NNFI values were below the recommended 0.90, and the RMSEA values were above 0.06. However, the fit of both models was close enough to indicate the potential that, with adjustments, satisfactory models could be generated.

Problems of fit result when the observed covariances between items differ from those predicted in the model. This occurs when an item does not covary with its proposed factor. In this situation, the covariance between this item and others measuring the same factor will be over-predicted in the model. Predicted and actual covariances may also differ if an item actually measures a factor other than its proposed factor. In this case, the model will under-predict the covariance between an item and the items measuring the other factor. The item may indeed measure both factors, but it is highly desirable to have unidimensional items. The preferred remedies for over-predicted covariances are to remove the item in question. For under-predicted covariances, the item could be moved to the other factor or removed from the model. Since the items in these scales were adapted from established scales, under-predicted items were also removed from the model.

Problems of fit are thus determined through comparing predicted verses observed covariances. SAS provides a residual matrix that illustrates the difference between predicted and observed covariances. Large residuals indicate poor fit. Large negative residuals indicate under-predicted covariances and positive residuals indicate over-prediction. Model respecification decisions can be made based on patterning these residuals [Anderson and Gerbing, 1988; Hatcher, 1994].

In the model generation process for the attitude measurement model, six items were dropped (one at a time) due to large residuals. For the Perceptions measurement model, five items were dropped. Both processes resulted in models that fit the data well, as illustrated in Table 4. The chi-square to degrees of freedom ratios were below 2.0 for both models. The GFI and NNFI values were greater than 0.9 and both models had an RMSEA below 0.06. Therefore, the models were accepted [Bentler and Bonett, 1980; Hatcher, 1994]. Appendix A lists the items for each of the six factors.

Table 4: Final Fit Indicators for Both Adjusted Measurement Models

Fit Indicator	Attitude Measurement Model	Perceptions Measurement Model
RMSEA	0.059	0.028
GFI	0.90	0.95
AGFI	0.87	0.93
NNFI	0.92	0.98
chi-square	194.08	61.61
df	113	53
chi-square/df	1.72	1.16

Table 5 lists the Cronbach alphas and composite reliability values for each factor. Coefficient alpha is one of the most widely used internal consistency reliability indices in the social sciences [Hatcher, 1994]. A widely used rule of thumb is that alphas and composite reliability values should preferably exceed 0.70 with values above 0.60 considered minimally acceptable [Hatcher, 1994; Nunnally, 1978]. For this model, all alphas are greater than 0.70 except that of attitude toward success (alpha 0.66 and composite reliability 0.67) which was well above the minimally acceptable 0.60. Thus, the factor items in the model demonstrate acceptable internal consistency.

Table 5 also lists the loadings and t-test values for each indicator variable for its posited factor. Factor loadings were all above 0.39 and significant at $p > .001$ indicating convergent validity in the items [Hatcher, 1994]. To test discriminant validity, separate models where run constraining each pairwise correlation between the factors to 1. The resulting chi-square values for each constrained model were compared to the chi-square value in the original CFAs for the appropriate measurement model. A significant degradation in the resulting chi-square value with one degree of freedom provides evidence that the constructs are in fact discriminant. The chi-square values differences based on one degree of freedom were highly significant ($p < .001$) for six of the seven constrained models. The final constrained model was significant at the .025 level. Based on model fit and the examination of alternative models, construct unidimensionality and discriminant validity are confirmed.

Factors/ Indicator Variables	Coeff. Alpha/ Standardized Loading	t	Composite/ Indicator Reliability
Table 5: Reliability and Validity Summary Information			
Attitude Toward Success	0.66		0.67
A1	0.708	10.64	0.501
A2	0.619	9.09	0.383
A3	0.581	8.43	0.338
Usefulness	0.83		0.83
U1	0.806	13.42	0.650
U2	0.800	13.27	0.640
U3	0.713	11.29	0.508
U4	0.554	8.20	0.307
U5	0.601	9.06	0.361
Confidence in Learning	0.74		0.74
C1	0.652	9.49	0.425
C2	0.770	11.63	0.593
C3	0.632	9.14	0.399
C4	0.524	7.32	0.275
Effectance Motivation	0.77		0.77
E1	0.558	8.29	0.311
E2	0.725	11.54	0.526
E3	0.538	7.92	0.289
E4	0.868	14.81	0.753
MIS	0.82		0.84
M1	0.835	14.31	0.697
M2	0.425	6.11	0.181
M3	0.401	5.75	0.161
M4	0.694	11.01	0.482
M5	0.802	13.47	0.643
M6	0.856	14.85	0.733
MIS Professionals	0.71		0.71
P1	0.391	5.15	0.153
P2	0.400	5.27	0.160
P3	0.534	7.27	0.285
P4	0.721	10.25	0.520
P5	0.687	9.70	0.472
P6	0.489	6.55	0.239

After using the 2004 data to set the scales, Cronbach alphas were calculated for the data from all subsequent years to further demonstrate the reliability of the measurement models. All alphas except one, attitude toward success in 2009, were above .60. Although results for attitude toward success will continue to be reported throughout the paper, the results are in question due to the weaker reliability in the scales for that factor. Table 6 lists the alphas for all factors for all years.

Table 6: Alphas for the Constructs Across the Data Sets

Construct	Alphas 2004	2005	2008	2009
Attitude Toward Success	0.66	0.63	0.61	0.58
Usefulness	0.83	0.81	0.85	0.87
Confidence in Learning	0.74	0.72	0.78	0.78
Effectance Motivation	0.77	0.73	0.76	0.78
MIS	0.82	0.80	0.84	0.86
MIS professionals	0.71	0.64	0.64	0.72

V. ANALYSIS TO ANSWER THE RESEARCH QUESTIONS

To answer the two research questions (How have U.S. male and female college students' attitudes and perceptions of MIS changed from 2005 to 2009? and How do U.S. male and female college students' attitudes and perceptions of MIS differ over this same period?), the sample was split based on gender. Paired t-tests were then used to test differences across time periods for each gender and to test differences between males and females within time periods.

For the first research question, Table 7 summarizes and Figure 3 illustrates the differences in attitudes and perceptions of females across years. Likewise, Table 8 and Figure 4 summarize and illustrate the difference for males across years. The tables and figures indicate that for females (Table 7) from spring 2005 to spring 2008, significant ground was lost in three of the four attitude constructs (usefulness, confidence in learning, and effectance motivation) as well as in their perception of MIS. For males (Table 8), although only marginally significant, results are similar.

Table 7: T-test Comparisons of Female Views of MIS

Construct	2005 Mean	2008 Mean	2009 Mean	05 to 08 t-test significance	05 to 09 t-test significance	08 to 09 t-test significance
Attitude Toward Success	2.68	2.58	2.69	0.255	0.853	0.227
Usefulness	2.51	2.24	2.44	0.006***	0.463	0.108
Confidence in Learning	2.47	2.24	2.38	0.016**	0.353	0.221
Effectance Motivation	1.81	1.51	1.79	0.003***	0.797	0.022**
Perception of MIS	1.94	1.68	1.90	0.008***	0.660	0.061*
Perception of MIS Professionals	2.55	2.48	2.70	0.388	0.020**	0.011**
*** p< 0.01, ** p < 0.05, * p< 0.10						

Table 8: T-test Comparisons of Male Views of MIS

Construct	2005 Mean	2008 Mean	2009 Mean	05 to 08 t-test significance	05 to 09 t-test significance	08 to 09 t-test significance
Attitude Toward Success	2.54	2.54	2.61	0.942	0.320	0.327
Usefulness	2.35	2.20	2.38	0.063*	0.763	0.061*
Confidence in Learning	2.51	2.52	2.50	0.857	0.932	0.801
Effectance Motivation	1.83	1.67	1.87	0.058*	0.588	0.026**
Perception of MIS	1.88	1.73	1.90	0.050*	0.798	0.047**
Perception of MIS Professionals	2.37	2.39	2.53	0.700	0.006***	0.019***
*** p< 0.01, ** p < 0.05, * p< 0.10						

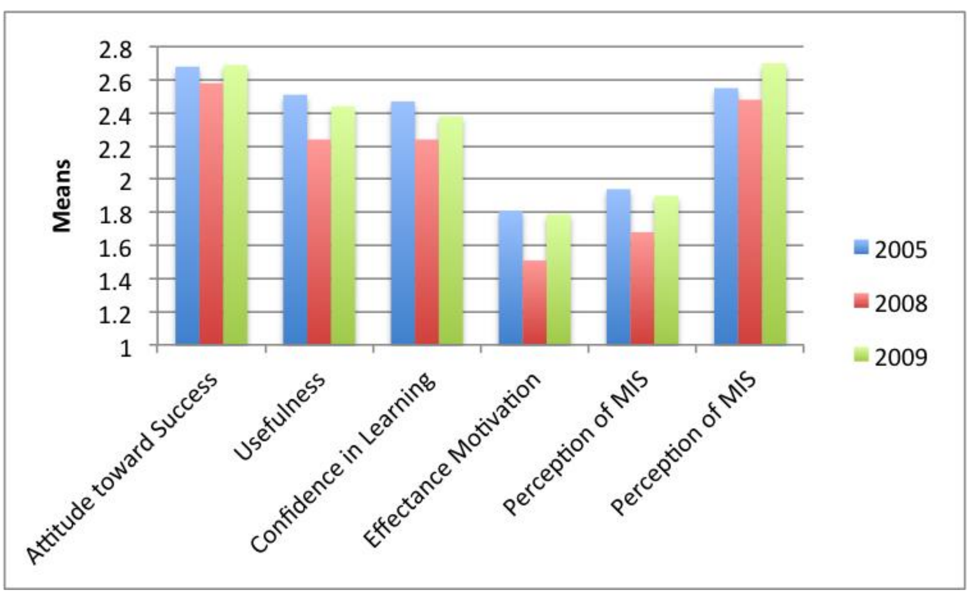

Figure 3. Changes in Female Construct Means

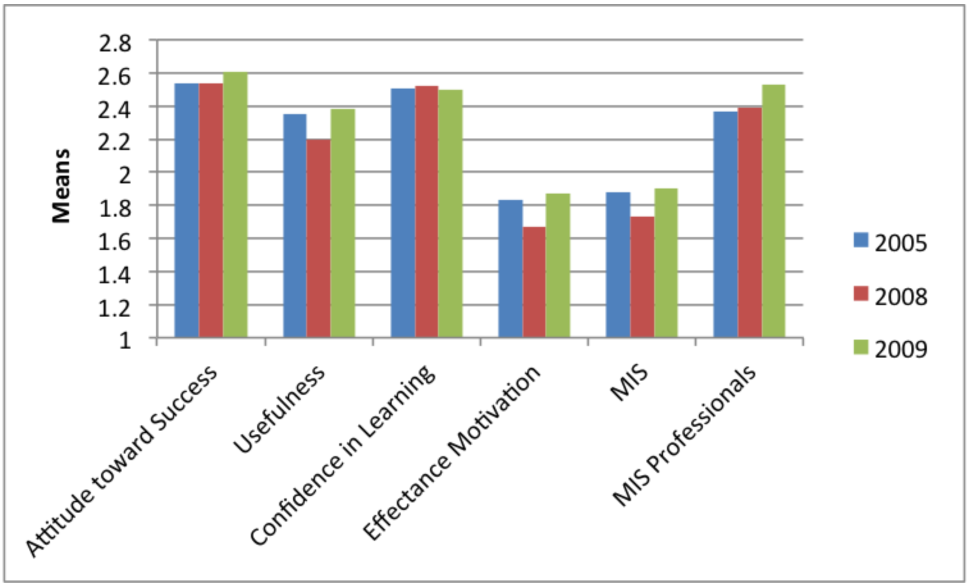

Figure 4. Changes in Male Construct Means

Interestingly, between spring 2008 and spring 2009, a significant improvement had taken place in both genders for effectance motivation as well as perceptions of MIS and MIS professionals. Additionally, there was marginal improvement in males' attitude about the usefulness of MIS. Moreover, the changes from 2008–2009 resulted in the only significant change across the entire period (2005–2009) being improved perception of MIS professionals for both genders.

Paired t-tests were also performed to answer the second research question. Table 9 summarizes the results of the t-tests. Females felt more positively about attitude toward success, usefulness, and MIS professionals than males in 2005. In 2008, the only difference between the genders was that males had more confidence in learning MIS. Finally, by 2009, females again perceived MIS more positively than males did and confidence was again not significantly different.

Table 9: T-test Comparisons of Male and Female Views Each Year

	2005 Female Mean	Male Mean	Signif.	2008 Female Mean	Male Mean	Signif.	2009 Female Mean	Male Mean	Signif.
Attitude Toward Success	2.68	2.54	0.043*	2.58	2.54	0.59	2.69	2.61	0.333
Usefulness	2.51	2.35	0.025*	2.24	2.20	0.61	2.44	2.38	0.392
Confidence in Learning	2.47	2.51	0.963	2.24	2.52	0.01**	2.38	2.50	0.328
Effectance Motivation	1.81	1.83	0.996	1.51	1.67	0.29	1.79	1.87	0.963
Perception of MIS	1.94	1.88	0.531	1.68	1.73	0.23	1.90	1.90	0.930
Perception of MIS Professionals	2.55	2.37	0.002**	2.48	2.39	0.18	2.70	2.53	0.023*

** $p < 0.01$, * $p < 0.05$

VI. DISCUSSION

CIOs are concerned about an inadequate supply of entry level MIS talent [Benamati et al., 2010]. Forecasts project increasing demand, while supply of graduates has decreased drastically since the dotcom bubble burst. Increasing female participation in the field is one way to increase supply. Thus, a sense of urgency has been placed on both the overall supply of MIS graduates and gender issues in U.S. IT workforce. Many of these efforts focus on changing beliefs about the field.

In spite of efforts on both fronts, the answer to the first research question (How have male and female college students' attitudes and perceptions of MIS changed from 2005 to 2009?) is not promising. It appears that the only significant movement in either gender between spring 2005 and spring 2008 was for the worse (see Figures 3 and 4). Perhaps this should not be surprising, given the accompanying 51 percent drop in MIS degrees awarded over the same time period (see Figure 1).

What is surprising was the across-the-board degradation in female attitudes and perceptions of MIS. All the means were worse in 2008 than they were in 2005. Four of the six constructs—usefulness of MIS, confidence in learning MIS, effectance motivation, and perceptions of MIS—significantly worsened. This finding was unexpected, given recent increased focus on attracting females to the field. It appears those efforts were less than effective and perhaps should be further explored. Male attitudes did not change as drastically from 2005 to 2008, but also did not improve. Three of the attitude and perception means were virtually unchanged, and the others—usefulness, effectance motivation, and perceptions of MIS—marginally deteriorated.

Perhaps more startling was the drastic improvement in attitude toward and perceptions of MIS from spring 2008 to spring 2009. Nothing in the delivery of the course was changed during the period of the study. This twelve-month period, 2008 to 2009, was globally one of the most difficult ever from an economical standpoint. In spite of that, from 2008 to 2009, the means improved across the board for female attitudes and perceptions of MIS and for all male attitudes and perceptions except confidence in learning, which remained unchanged. Both sexes significantly enjoyed MIS more (effectance motivation) and held MIS (marginally significant for females) as well as MIS professionals in higher regard. Males also marginally viewed MIS as a more useful subject.

The net of the 2005 to 2008 decline in combination with the improvement from 2008 to 2009 is that the only significant change in attitudes toward and perceptions of the field across the entire time period is an increased perception of MIS professionals by both females and males. This potentially indicates progress in the desired direction. Despite that potential progress, the means for the attitude and perception constructs across the time periods were predominantly below 2.5, the median of the five-point scale. The single best mean across all time periods is 2.70 for female perception of MIS professionals in 2009. Two-thirds of the means were below 2.5 and one-third below 2.0. This general negativity perhaps indicates that, in spite of increased efforts to change perception of MIS, much work remains to be done. Improving the perception of MIS is critical to attracting more students into the field.

The most recent year indicates traction in the right direction, and there are many possible explanations for the profound recent upturn in attitudes and perceptions. Perhaps there was merely a lag effect in expanded efforts by the discipline to increase participation, and they are finally having the desired effect. It is also possible that the economic disaster of 2008/2009 provided a boost the field needed. The recent tough economic climate led to very difficult job markets for college graduates from all business disciplines. However, those impacts seem to be felt less in MIS where placement rates held strong. Additionally, the myths about all MIS jobs going offshore and the pain experienced from the downsizings associated with the bursting of the dotcom bubble may finally be subsiding. Most likely, all of the above, as well as other factors, contributed to the more favorable views of the field.

When comparing attitudes and perceptions across gender to answer the second research question (How do male and female college students' attitudes and perceptions of MIS differ over this same period?), comparisons were done within time periods. Again, some surprises were found. In 2005, females had significantly better attitudes toward success in and usefulness of MIS, as well as better perceptions of MIS professionals than males (see Table 9). For the other three factors, no differences were found. This contradicts earlier research that indicates males hold MIS in higher regard than females.

Moving forward to 2008 and 2009, males' and females' attitudes and perceptions differed very little from each other. In 2008 males were more confident about learning MIS, consistent with the findings of other studies in both MIS and other STEM disciplines. This is attributable to a large drop in the confidence level in females from 2005 to 2008. After the improvements from 2008 to 2009 discussed previously, the only significant difference was that females held MIS professionals in higher regard than did males. Once again the lack of difference contradicts earlier findings about gender differences.

Prior studies indicate that attitude toward and perceptions of MIS differ across gender, with males holding the field in higher regard. This did not hold true in the current study and is similar to the findings by Kuhn and Joshi [2009] who report that within IT, male and female aspiring IT professionals are more similar than different, and some commonly accepted stereotypes do not apply. The lack of significant current differences found in this study could indicate that efforts to change female perceptions in the field are having desired effects. It is important to point out that the only female attitude or perception that improved significantly from 2005 to 2009 is their perception of MIS professionals. Furthermore, while not significant, four of the six means indicate slightly worse attitudes and perceptions.

VII. CONTRIBUTIONS TO PRACTICE

The results inform practice. This is based on both the comparison across genders as well as the overall low means for the attitudes and perceptions toward MIS found. Some prescriptions for MIS faculty based on three of the constructs follow.

Confidence in Learning

Males indicated higher confidence in learning MIS. Actual performance of the students would add to our understanding of this. Since the survey was administered anonymously to the students, course grades for only the students who participated in the survey are not reported. Instead, Table 10 shows the average for the entire student population that took the introductory course by gender in 2005, 2008, and 2009. The source for Table 10 is the university registrar's grade recording system.

Table 10: GPA by Gender and Year (All students)

Year	Female	Male
2005	2.95	2.79
2008	2.97	2.90
2009	2.98	2.98

Female students (population) performed slightly better in class grades in almost all years, even though survey sample males were more confident of their learning than women ($p < .01$ in 2008). Houtz and Gupta [2001] found differences in how men and women rated themselves in their ability to master technology skills. Even though both rated themselves positively in their ability, men rated themselves higher. In domains they believe to be masculine, women in general hold themselves to higher standards [Trauth, 2002] and self-assess themselves lower [Hill, Corbett, and Rose, 2010]. Correll [2004] has shown that cultural beliefs about gender, not actual gender differences, influence this difference in self-assessment.

Self-efficacy theory suggests that students' beliefs about their ability to perform tasks successfully influence their choice of goals and decision to major in specific domains [Croasdell, McLeod, and Simkin, 2011]. Perhaps faculty and departments can make it clear that female students have traditionally performed at par or better than male students in the IS curriculum. This could potentially boost their confidence in learning and encourage female students to enroll in additional IS classes.

Effectance Motivation

There was no significant difference in the means for effectance motivation and perception of MIS between the genders during the years 2005–2009. In addition, the mean values for both effectance motivation and perception of MIS were below 2.0 (on a 5 point scale) through the years showing general negativity toward the field. Effectance motivation is the engagement in an activity purely for the joy derived from that activity [Deci and Ryan, 1985]. Effectance motivation has characteristics of exploration and experimentation and is closely related to problem-solving attitudes [Fennema and Sherman, 1977]. Mastering an activity successfully brings about positive feelings of efficacy [Bandura, 1997]. Efficacy beliefs influence the choices people make, the effort they put forth, and the degree to which they persist in the face of obstacles [Hutchinson, Follman, and Bodner, 2007].

When effectance motivation is low and, as seen earlier with confidence in learning, self-assessment is not necessarily related to performance; faculty can perhaps build problem solving and mastery attitudes into the subject. Faculty may need to continually remind students to narrow their focus to a step-by-step, systematic process, to persist and to acknowledge and reinforce persistence [Ironsmith, Marva, Harju, and Eppler, 2003]. A second option that might be open to faculty is to use IDGIT theory and remind students that they each come from a different social and educational background that possibly prepares them to take different approaches to the IT coursework [Hutchinson-Green, Follman, and Bodner, 2008], and that mastery of the subject might appear at a different rate to different individuals. Faculty must be sensitive and flexible to accommodate the different rates of learning by individuals in the classroom.

Perception of MIS

It is troubling that the perception of the MIS field in both genders is below 2.0, while simultaneously the usefulness attitude has higher means (roughly 0.5 higher in all years) in both genders. Prior research indicates that there is a significant difference in perceptions about IT students and IT professionals of students within and outside of the IT discipline [Berry, Rettenmayer, and Wood, 2006; Lewis, Johnson, Dishon, and Firtion, 2008]. Schlee, Curren, Harich, and Kiesler [2007] report that these substantial differences in undergraduate business students perception of the different business majors or concentrations exist due to perception biases, wherein students rate their own major higher. A finding that they report is that MIS suffered the most bias from other business majors, in that MIS did not epitomize any positive stereotypes for other business majors. Our study used students from all majors. Perhaps the low mean scores for the perception of MIS is just a reflection of such perception bias. Nonetheless, the discipline must work to improve its perception by students and other business majors if it is to attract more students of both genders into its fold.

As a first step toward changing the perception, Hirscheim, Loebbecke, Newman, and Valor [2007] suggest it is important for students and their parents to realize that there are not only plentiful jobs, but also that the jobs span multiple business areas. A number of studies have found that parents and family play a significant role in the student's choice of a major and deciding to continue to major in IT [Croasdell et al., 2011, Ashcraft et al., 2012]. In addition, when marketing to students, faculty must make outreach efforts to communicate with parents to attract students of both genders to the discipline. The fact that the IS discipline is interesting and exciting might be obvious to faculty and professionals in the field, but is not necessarily obvious to students. The passion for the field and its positives must be accentuated and conveyed in no uncertain terms to students by both faculty and visiting professionals.

VIII. CONTRIBUTIONS TO RESEARCH

This article contributes to both research and practice. Primarily it develops an instrument from research based in other STEM disciplines to study students' attitudes toward and perceptions of MIS. The scales developed here have applications to MIS research going forward. This instrument can provide the basis for further research into changing perceptions and gender issues in MIS. Future research should also further validate and refine the instrument.

The constructs from this study could be antecedents in a variety of theoretical studies, especially those rooted in TRA's belief, attitude, intention, action-based models. Studies could explore alternative methods to influence these attitudes and perceptions to help the field determine optimum approaches for the investment of time and resources toward improving future supply problems and increasing diversity in the MIS workforce. This is true for studies focusing on the supply of MIS graduates in general, as well as gender-based studies.

Changes in attitude may be influenced by simple things such as the gender makeup of the senior professionals who attend the career days in the classroom. Controlling the number of male and female senior participants over a number of semesters or across sections would make an interesting future study.

The results of this study also provide some insight into how well we are doing as a field in addressing the need for a continual and gender-diverse supply of IT talent into the workforce. They indicate that male and female college students do not view the field so differently and that for a time (in 2005) female perceptions were actually better. The workforce gender gap does not seem to be closing, and the question of why it continues is left for future studies. The instrument developed here should facilitate that research as well.

It also seems that the economic crisis of the last twelve months had a positive effect on student attitudes toward and perceptions of MIS. Future research will need to be done to understand this positive effect and how to leverage it more effectively going forward. In the meantime, the academy and industry should both seek to capitalize on this positive momentum to the extent possible.

A limitation of the current study is that we used the short form of the FSMAS scale as developed by Mason and Kahle [1988]. The original FSMAS scale [Fennema and Sherman, 1976] includes gender stereotyping, parental, and teacher influences on the attitude toward Math. These constructs might provide significant influences in the social construction of the gender identity. The adequateness of the short form in MIS gender-based studies must be further validated.

Both individual differences and social construction theories suggest that culture plays an important role in gender-based attitude differences. A second limitation of the current study, due to the homogeneity of the sample, is that cultures' effect on gender differences was not included. Future research should also more closely examine culture both at the group and individual level of analysis.

IX. CONCLUSION

Perhaps some progress has been made in the mismatched supply and demand curves for MIS graduates. At least females appear to not significantly differ from males in their views of the field. Going forward, this could be an important first step in fixing both gender diversity and supply workforce issues. There remains, however, general negativity among college students toward the field that will require continued effort. The economic crisis of

2008/2009 may have given the field momentum that is important to capitalize on. How well the field does remains to be seen.

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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 article on the Web, can gain direct access to these linked references. Readers are warned, however, that:

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APPENDIX A: FINAL INSTRUMENT ITEMS

Attitude Scale Constructs and Items
Attitude Toward Success
A1 One of my highest priorities is to be an outstanding student in Management Information Systems.
A2 Being regarded as smart in Management Information Systems would be a great thing.
A3 It is very important for me to get top grades in Management Information Systems.
Usefulness
U1 Management Information Systems is one of the most worthwhile subjects to take.
U2 Management Information Systems is one of the most necessary subjects to take.
U3 I study Management Information Systems because I know how useful it is.
U4 I see Management Information Systems as a subject I will rarely use in my daily life as a business person.
U5 I will use Management Information Systems in many ways as a business person.
Confidence in Learning
C1 I'm not the type to do well in Management Information Systems.
C2 I have a lot of self-confidence when it comes to Management Information Systems.
C3 For some reason, even though I study, Management Information Systems seems unusually hard for me.
C4 I am sure that I can learn Management Information Systems.
Effectance Motivation
E1 When a question is left unanswered in Management Information Systems class, I continue to think about it afterward.
E2 Figuring out Management Information Systems problems does not appeal to me.
E3 I would rather have someone give me the solution to a difficult Management Information Systems problem than to have to work it out for myself.
E4 Management Information Systems are enjoyable and stimulating to me.

Perception Scale Constructs and Items
Perception of MIS
M1 Working in Management Information Systems is very exciting.
M2 Working in Management Information Systems is very frustrating.
M3 Management Information Systems is mostly unrelated facts which you have to memorize.
M4 Management Information Systems is often boring.
M5 Management Information Systems is fun to think about.
M6 Management Information Systems is very interesting.
Perception of MIS Professionals
P1 Management Information Systems professionals often work as a team to solve problems.
P2 People who work in Management Information Systems careers don't have the opportunity to travel much in their work; they spend most of their time at their workplace.
P3 Like artists and musicians, Management Information Systems professionals are very creative in their work.
P4 A Management Information Systems professional must be able to talk with many different people.
P5 Those who work in Management Information Systems careers frequently use their listening skills.
P6 In order to work in Management Information Systems, one needs good writing skills.

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