

MIS versus Computer Science: An Empirical Comparison of the Influences on the Students' Choice of Major

James P. Downey

Ronnie McGaughey

College of Business

University of Central Arkansas

201 Donaghey Dr.

Conway, AR 72035

jdowney@uca.edu; ronmc@uca.edu

David Roach

Corley Building

Arkansas Tech University

Russellville, AR 72801

droach@atu.edu

ABSTRACT

A history of declining enrollments in university Management Information Systems (MIS) and computer science (CS) departments in the U.S. considerably impacts both college departments and business organizations that hire graduates. In order to reverse the enrollment trend, an understanding of the important similarities and differences that shape a student's decision to major in MIS or CS will allow departments to better promote their major, formulate more effective strategies for reaching interested and undecided students, and enhance the fit between student and career. This study directly compared important influences on choice of major for 205 MIS and CS majors at four US universities. Results indicate that the most important influences for both MIS and CS students are interest in technology and monetary compensation. MIS majors, however, are significantly more influenced by others, especially college instructors, parents, friends, and the desire to interact with others. They are also more interested in business and business organizations. CS majors, on the other hand, are more interested in the technology itself and tend to choose CS as a major either in high school or shortly thereafter. Based on these findings, recommendations are provided to aid college departments in attracting and retaining appropriate majors.

Keywords: Choice of major, Information technology, IT careers, Management Information Systems (MIS) departments, Computer Science departments, Careers.

1. INTRODUCTION

The recent history of declining enrollments has plagued Management Information Systems (MIS) and Computer Science (CS) departments in American colleges and universities. This trend is particularly alarming in light of the recent growing demand for employees to fill information technology (IT) related jobs (Locher, 2007). The growing demand for IT skills is driven by the continuing growth of consumer and business demand for IT related products and services. Given this demand, the declining enrollment in MIS and CS programs is ominous for both business organizations that hire college graduates to work in IT and the universities that educate them. To help reverse the declining enrollment in MIS and CS departments, to better support business and organizational interests, it is imperative

that college departments understand how and why students choose their majors, in particular, technology majors.

MIS and CS enrollments have not always been in decline, though the current trend reflects MIS and CS enrollment over the last seven years (Foster, 2005; Frauenheim, 2004; Locher, 2007; Vegso, 2005). In the early 1980s CS enrollment was booming; in fact some departments used GPAs and SAT/ACT test scores to limit enrollment because of resource limitations (Butcher & Muth, 1985). During that same period, business schools across the country were starting MIS programs, and most were also growing rapidly. Both MIS and CS achieved increasing growth during the 1990s (Goff, 2000) as the economy expanded, but that growth came to a halt when the dot.com bubble burst in 2000/2001. By 2004, CS enrollment was 70% lower than at its peak of 1982 (Vegso, 2005), and MIS

enrollment was falling as well (Aken & Michalisin, 2007). Enrollment in the authors' own MIS program went from over 360 in 2001, to 110 in 2007. MIS departments at some schools were dismantled (Aken & Michalisin, 2007).

Among other factors, declining enrollments have been attributed to perceptions that IT related jobs are not readily available (Foster 2005; Mahmoud, 2005), IT jobs are moving offshore (Foster 2005; Locher, 2007), IT is too difficult (Locher, 2007), and to poor high school preparation (Locher, 2007; Mahmoud, 2005). While these and other factors may have exacerbated this situation, evidence suggests that the need for technology skills continues to increase (Locher, 2007). There is currently a shortage of qualified IT workers, a situation not likely to improve in the near term (Aken & Michalisin, 2007). This explains, at least to some extent, the reason US companies hire foreign nationals or move the jobs offshore where qualified graduates can be found (Foster, 2005). It is noteworthy that the US Congress raised the H-1B visa quota to allow IT companies to hire more foreign workers to meet this need (Foster, 2005; Mahmoud, 2005).

In order to reverse enrollment declines, an understanding of why students choose their major is critical. College student choice of major has been studied rather extensively, especially the broad area of math, science and engineering, which includes CS. Other studies have looked at business majors, and MIS has been studied mostly in this context (Kim, Markham & Cangelosi, 2002; Mauldin, Crain & Mounce, 2000; Noel, Michaels & Levas, 2003; Pritchard, Potter & Saccucci, 2004; Strasser, Ozgur & Schroeder, 2002). Both MIS and CS majors have considerable similarities; they both like and are interested in technology, work with computing, and take similar classes. Because of these similarities, we believe students may be attracted to *either* major; therefore, there is at least an implicit competition among MIS and CS departments to attract and retain students. There are also differences between MIS and CS; an obvious one is that MIS majors are frequently in the business college while CS majors are typically in the science or engineering college. This and other differences suggest that some of the influences in choosing a major may be stronger (or weaker) for MIS versus CS.

What motivates students to pursue a degree in MIS or CS? Understanding the critical factors which persuade students to pick a particular major is extremely important, if departments wish to increase enrollment. Based on knowledge of these critical factors, departments can emphasize factors that appeal to students, promote more effective programs, and formulate more effective strategies for reaching interested students and undecided students. This study has two primary goals. First we wish to identify and examine the factors or influences important in choosing to major in either MIS or CS. We do this first by surveying the literature, but we also consulted other faculty members and students (see §3.2). Secondly, given these influential factors, we want to statistically determine if there is a difference in their strength between the two groups of majors, and the implications of such differences. To our knowledge, a study that compares the influences in choice of major between MIS and CS has never been attempted. The results should provide both MIS and CS departments with valuable information to help them develop strategies that are more effective for

recruiting and retaining students. This study is important for three reasons. First, it is important for students because understanding the factors important in choice of major will enhance the fit between student, major and career. Secondly, it is important for businesses and organizations who recruit graduates, from a quantity perspective (are there enough graduates?) and a quality perspective (do the graduates have the requisite skills?). Finally, it is critical for both MIS and CS departments to understand what attracts students, to understand what distinguishes the two groups in choosing a major, and to utilize those commonalities and differences to recruit and retain students. Forearmed with the knowledge gleaned from this study, both departments might better attract students from other majors or undecided students. The declining enrollments noted in both departments have had significant consequences for businesses and universities. Understanding the factors which prompt students to major in MIS and CS can help alleviate the growing shortage of IT professionals.

2. INFLUENCES ON CHOICE OF MAJOR

The choice of major is an extremely important decision that every student makes at least once in their college career. The choice is one that most students give due consideration and will likely have an important influence on future employment opportunities, compensation, and job enjoyment. Each choice, no matter when it is made, is the product of numerous influences, both major and minor. These influences are critical because of the subsequent impact they have on the individual's life during and particularly after college. They are important for the businesses that hire graduates, particularly if there are shortages of qualified graduates, and very important for the colleges involved, especially the specific departments, from an enrollment and funding standpoint.

There is extensive literature concerning why students choose their majors. Much of it focuses on specific majors or on important areas, such as science and engineering majors (or the lack thereof). In the discussion of potential influences on choice of major below, we examine only those students pursuing four-year bachelor's degrees, rather than technical or associate degrees. In examining this literature, the influences which shape the choice of major may be broadly categorized in three ways: internal influences, influences involving people and influences relating to the major or job/career.

2.1 Internal Influences on Choice of Major

Internal influences are those that emanate from personal beliefs and a personal assessment of abilities. Students tend to choose majors based on what they think they are good at or where a fit exists. For example, students with high standardized scores in math and science tend to choose technical majors, while those with lower scores tend to choose majors such as one in liberal arts (Carter, 2006; Maple & Stage, 1991). Perception of individual ability or aptitude can be just as important. Studies have found that those students who *believed* they had high technical abilities tended to choose math, science, or engineering majors (Farley & Staniec, 2004; Lapan, Shaughnessy & Boggs,

1996). Business students also tend pursue a fit with perceived ability (Kim et al., 2002).

The line between internal and other (external) influences is not well-defined. There are few, if any, internal influences which have no external input. Ability, perception of ability, and perceived fit are all related to other people. Likewise, all external influences (covered next) shape internal motivation, thoughts, beliefs, and desires. The distinction between the two, while not rigorous, does provide a convenient way to examine different influences.

2.2 External Personal Influences

Other people can be very influential in a student's choice of major. A student's beliefs about which major to choose are bolstered by salient individuals' opinions about this belief, labeled subjective norm in the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980). This theory suggests that human behavior, in this case choosing a major, is influenced by attitudes toward the major as well as subjective norm, the beliefs or opinions on choice of major of individuals important to the student. One study using TRA found both parents and professors to be significant contributors to a student's subjective norm in choosing an IS major (Zhang, 2007). A variety of individuals in a student's life have demonstrated influence on this choice, including parents (Calkins & Welki, 2006; Farley & Staniec, 2004; Zhang, 2007), high school teachers or counselors (Calkins & Welki, 2006; Mauldin et al., 2000), college instructors (Saemann & Crooker, 1999; Strasser et al., 2002; Zhang, 2007), and friends or other students (Bartol, 1976; Calkins & Welki, 2006; Mauldin et al., 2000). Socio-economic status, such as parental income, occupation, and education can be influential (Farley & Staniec, 2004; Leppel, Williams & Waldauer, 2001), albeit indirectly. Students choose majors based in part on the influence of others.

2.3 External Influences for Major or Career

This set of influences concerns the content, context and quality of the college experience and subsequent potential career. What a student feels or understands about the potential college degree, the department/college, and their future employment helps determine choice of major. One key influence noted in the literature is compensation, such as starting salary and expected future earnings (Berger, 1988; Farley & Staniec, 2004; Felton, Buhr & Northey, 1994). One study found that "career opportunities" was the most important influence for a population consisting of accounting students and other business majors (Mauldin et al., 2000).

Another important influence is interest in the major and its related fields (Malgwi, Howe & Burnaby 2005; Mauldin et al., 2000; Strasser et al., 2002). One study found that interest in the field was the most important factor in choosing a business major, above monetary compensation and job opportunity (Kim et al., 2002). Another study found a correlation between interest in technology and majoring in technology fields such as CS (Moorman & Johnson, 2003). Another influence on choosing a major is the perceived degree of difficulty. Some students choose their major based in part on how difficult, or easy, they think it will be (Calkins & Welki, 2006).

2.4 MIS vs. CS Majors and Research Questions

How important are these influences on the choice of major for MIS and CS students? To set the stage with an example, consider the importance of starting salary. How much does probable starting salary influence a student to major in MIS and CS? Is it more important for MIS majors than CS or less (or is the influence similar in strength)? As no known study directly compares these two groups, we make few predictions on the strength of any particular influence for the two majors. Therefore we pose these influences as research questions rather than hypotheses.

While this study focuses on MIS and CS majors, there are similarities common to all college students, coming from the literature cited herein. College students in general are influenced by other people, significant others in their lives. These influences include teachers (high school and college), counselors (high school and college), parents, peers, co-workers, and friends. We therefore pose our first research question:

What is the impact of other people, including parents, teachers, counselors, and friends, on the choice to major in MIS or CS? Is there a difference in that impact between MIS and CS majors?

Most students assume that after graduation they will seek employment in a field that has some similarity to their chosen major. The perception of what the work is like, career potential, financial rewards, challenge involved, prestige and lifestyle, etc. can all influence the choice of major. This leads to our next research question:

What is the impact of the perceived career characteristics (monetary compensation, challenge, prestige and lifestyle) on choice of major? Is there a difference in that impact between CS and MIS majors?

The above two questions involve impacts that all students consider when choosing a major. In the discussion below, we consider other influences with the MIS and CS majors particularly in mind. This is not to say that all students do not consider these influences; in general they do, but we limit our discussion of the impact of these influences to the two majors of MIS and CS. First we examine influences which stem from similarities between the two majors, followed by influences based on potential differences.

Of the many commonalities between the two majors, one obvious one is that both majors are technical in nature. Granted, MIS does not generally require the same level of math and science. Still, both directly involve technology, computing in particular, and actual performance in computing and on computers is required in both majors. The literature suggests that students of both majors typically "like" computers and enjoy working with them—they like and are comfortable using technology. Based on this and the studies cited, we expect that interest in technology and computers will be common to both. This leads to our next question:

What is the impact of student interest in computers and technology on choice of major? Is there a difference in that impact between CS and MIS majors?

MIS and CS students have some similar courses, including database, networking, and programming courses. The courses that a student takes can influence their choice of major. One study found that the first course in the CS major was a significant influence on major choice (Taylor & Mounfield, 1989). Other studies reported that high school course work influenced choice of major for MIS majors (Saemann & Crooker, 1999) as well as CS majors (Olivieri, 2005). The perceived degree of difficulty of courses in the major can also influence choice of major (Calkins & Welki, 2006; Saemann & Crooker, 1999), although to what extent and how the two majors compare is unclear. Some students are influenced by the perceived quality of education available in the major. One study reported faculty reputation to be important (Calkins & Welki, 2006); another found that the university's reputation important in the choice to major in business (Kim et al., 2002). The influences of coursework and the university and/or department lead to the next research question:

What is the impact of early or first courses in a major, degree of course difficulty, quality of education, and reputation of department in choosing MIS or CS? Is there a difference in that impact between CS and MIS majors?

Despite these similarities between MIS and CS students, there are of course also differences. Because most MIS departments (and all of the ones studied herein) are in the business college, MIS majors typically take the common business core curricula that all business majors take. That core generally includes courses in accounting, management, marketing, finance, and economics. The MIS major should understand how business organizations function and create value. These courses are quite different from those taken by CS majors. In the universities that were included in this study, CS majors averaged almost 18 computer science courses, over double that of MIS major courses required. CS departments required 4-5 math courses (the first being Calculus I), and on average, three "other" science courses; therefore, the curricula are quite different, despite the common emphasis on technology.

These differences should produce different impacts for some influences important in choice of major. Business majors, including MIS majors, should be more interested in business, business organizations, and working within that context. One study, for example, found that the desire to own a business was influential in some students choosing a business degree (Kim et al., 2002). Another study found that positive attitudes toward business influenced career choice (Bartol, 1976). Still another area of potential difference between the two groups is the desire to interact with others. Carter (2006) found that female students tended to not choose CS because of their desire for a more people oriented major. Males, on the other hand, did not share this desire. Business students, including MIS majors, might be more interested in interaction with others. One study found that business majors thought interpersonal skills quite important in their chosen field, more important than such criteria as computer usage (Strasser et al., 2002). These differences suggest that the influence of business criteria will be stronger for MIS majors than for CS majors, and is the only research question where an outcome is expected:

What is the impact of business criteria, such as interest in business organizations, managing people, and interacting with others, in the choice to major in MIS/CS? Will MIS majors be more influenced by these as expected?

3. METHODOLOGY

3.1 Participants and Methodology

The participants chosen for this study were college students from three public and one private university in the South and lower Midwest. Each student in the study had a declared major of either Computer Science or MIS. The universities were selected as a convenience sample, with the following two stipulations: each university must offer Bachelor's degrees in both MIS and CS, and the MIS department must reside in the Business College. We wanted every participant to have a choice of MIS or CS at their university to avoid the possible confound of someone selecting one (either MIS or CS) because the other was not offered. The universities selected had with an average enrollment of 13,770 (low of 4,085; high of 21,805). The departments averaged 123 majors in MIS and 170 majors in CS.

To gather data, we received permission from the department and distributed it to a small number of faculty members who actually gave the survey in class. At one school, the attempt was made to collect data from *all* MIS and CS majors. We did this to avoid a possible confound in our data, where students not surveyed could potentially change results. This was done by targeting classes that all majors had to take, at the different grade classification levels. This process did not actually include all majors, since some were absent the day of the survey or not taking any of the required classes that particular semester, but did include most of the majors (MIS: 61%; CS: 87%). Seventy percent of the participants in this study came from these two departments at this one university.

A total of 245 participants completed the survey, but forty were discarded, primarily because their majors were something other than MIS or CS. This left a sample of 205, of which 93 were MIS and 112 were CS majors. The majority of respondents were male (84%), which supports previous findings that these majors attract more men than women (Carter, 2006; Foster, 2005; Vegso, 2005). MIS majors in the study were on average 1.9 years older than their CS counterparts. Demographic data are presented in Table 1.

3.2 Survey

In order to determine the influences in the choice of major, MIS or CS, we consulted the literature, faculty members in both disciplines, and select students. Previous useful surveys were found in Kim et al. (2002), Mauldin et al. (2000), Pappu (2004) and Worthington and Higgs (2004). The items in these surveys and in the literature cited formed the beginning of our potential list of influences. Next, we gathered input from faculty members at several institutions, as well as students. Most of the influences mentioned by faculty and students were part of the initial list. A preliminary survey was developed based on the foregoing, which was presented to several faculty members (in both

	MIS	CS	Full Sample
Age	22.9	21.0	21.8
Gender	M: 74 (44% of males; 37% of total) F: 21 (66% of females; 10% of total)	M: 96 (56%; 48%) F: 11 (34%; 5%)	M: 170 F: 32
Class	FR: 2 (<1% of total) SO: 5 (3%) JR: 24 (12%) SR: 60 (30%) Grad: 2 (<1%)	FR: 31 (16%) SO: 25 (12%) JR: 26 (13%) SR: 24 (12%) Grad: 1 (<1%)	FR: 33 SO: 30 JR: 50 SR: 84 Grad: 3

Table 1. Demographic Information

MIS and CS) at two different colleges. Following minor modifications, the survey was pilot tested on twenty students MIS and CS majors. This testing led to the rewording of some questions to enhance clarity. The final version consisted of twenty-one items of influence, information on when students chose their major, and demographic information. For each item, influence was measured on a seven-point scale, with 1 = “Completely Unimportant” and 7 = “Very Important”. The survey is presented in Appendix 1.

4. RESULTS

To assess which influences were most important to students choosing their major, we first examined each item individually and compared the means for each item for both MIS and CS majors. Next we factor analyzed the items to determine if there was an underlying structure of influences, and if so, what the differences were between the group of MIS majors and that of CS majors with respect to this structure.

There were twenty-one separate items of influence in the survey. Descriptive statistics for both groups are presented in Table 2. The most important influences for both MIS and CS majors were interest in computers and

technology. These two items ranked highest and had the top two means for both groups. Monetary considerations were next in importance for both groups, including both career earnings potential and starting salaries. Interestingly, the sixth most important influence for both groups was “Interacting with people”, expected of MIS majors but not expected to be as important for CS majors (Carter, 2006; Noel et al., 2003). The important influences for the two groups diverge after this somewhat, with MIS majors rating more highly interest in business organizations, management, prestige, and the influence of workers in the IT field or actual previous work experience. For CS majors, quality of education, prestige, and IT lifestyle were more important. For both groups, more distal influences included high school influences and the fact that their major was hard (it appears neither group considered theirs to be an easy major).

To determine if group means for each item were significantly different, a t-test was used. Results are also provided in Table 2, where a positive t-test value indicates the MIS majors had a *higher* mean for that item (a negative value indicates CS majors had a higher mean). P-values are also provided, based on the t-test. There were eleven influences in which MIS majors differed significantly from CS majors (at the .05 level). For all eleven, the influence of

	MIS Majors		CS Majors		Difference	
	Mean	SD	Mean	SD	t-test	p-value
Interested in computers	6.32	1.01	6.56	.72	-1.80	p < .10
It is interesting work	6.15	1.04	5.99	.98	3.21	p < .01
High career earnings	5.87	1.11	5.65	1.30	1.42	ns
High starting salary	5.66	1.17	5.44	1.33	1.41	ns
Challenging work	5.49	1.27	5.18	1.51	1.89	p < .10
Like interacting with people	5.35	1.29	4.93	1.73	2.43	p < .05
Interested in business organizations	5.08	1.60	4.22	1.90	4.55	p < .01
Quality of education in major	4.96	1.44	4.78	1.69	.98	ns
Opportunity to manage people	4.84	1.60	3.78	1.77	5.79	p < .01
IT prestige	4.83	1.55	4.33	1.82	2.70	p < .01
Influence of someone in field	4.73	2.02	3.94	2.01	3.91	p < .01
Previous work experience in IT	4.56	1.76	4.11	1.75	2.4	p < .05
IT lifestyle	4.45	1.65	4.21	1.79	1.27	ns
Influence of first course in major	4.18	1.81	3.98	2.01	1.03	ns
Influence of college instructor	4.14	1.94	2.79	1.90	6.89	p < .01
Department’s (MIS or CS) reputation	3.82	1.85	3.60	1.96	1.12	ns
Influence of parents	3.23	1.92	2.61	1.76	3.21	p < .01
Influence of friends or other students	3.22	1.80	2.76	1.63	2.46	p < .05
Influence of HS teacher(s)	2.74	1.73	2.81	1.95	-.37	ns
It is an easy major	2.62	1.52	2.23	1.40	2.31	p < .05
Influence of HS counselors	2.09	1.38	2.09	1.47	-.04	ns

Table 2. Descriptive Statistics for Influence Items

Factor	College	Business	High school	Nature of work	Money	Interest
Influence of friends/other students	.59	.08	.47	.16	-.01	-.01
Department's (MIS/CS) reputation	.77	.14	.25	.05	.12	.01
Influence of college instructor	.68	.27	.32	.05	-.03	-.05
Quality of education in major	.75	.10	-.01	.20	.27	-.03
Influence of first course in major	.75	.20	-.05	.16	.18	-.07
Influence of someone in field	.62	.25	.30	-.01	.18	.12
Interested in business organization	.21	.79	.18	.13	.20	.06
Opportunity to manage people	.20	.83	.11	.19	.10	.04
Like interacting with people	.26	.70	-.02	.04	.06	.18
Influence of parents	.47	.17	.49	.23	-.05	-.16
Influence of high school teacher(s)	.12	.02	.87	.10	.12	.05
Influence of high school counselors	.27	.14	.78	.14	-.06	-.14
Challenging work	.24	.33	-.25	.50	-.24	.36
IT prestige	.21	.07	.07	.75	.25	.05
Previous work experience in IT	-.06	.31	.15	.69	.14	.01
IT lifestyle	.24	-.04	.30	.59	.10	.12
High starting salary	.21	.12	.04	.21	.88	.03
High career earnings	.23	.20	.01	.14	.87	.12
It is interesting work	-.04	-.01	.03	.14	.04	.87
Interested in computers	-.06	.23	-.11	.01	.10	.79

Table 3. Factor Analysis of Influential Items

the item was greater for MIS majors (i.e., they had a higher mean than CS majors). The item with the greatest difference between the two majors was influence of a college instructor, with a t-value of 6.89 ($p < .01$). MIS majors credited college instructors with influencing their choice of major, while CS majors ranked that influence much lower. The opportunity to manage people and interest in business organizations were the next items in which MIS majors attributed significantly greater influence in choosing their major. MIS majors were influenced more by someone working in the field, parents, and interest in the work than their CS counterparts. In addition, there were two other influences which did not quite reach the $p < .05$ significance level: MIS majors were more influenced by the challenge of IT work ($p < .10$) while CS majors were more interested in computers and technology ($p < .10$).

Following the initial pair-wise examination of each item of influence, we next tested for an underlying structure among the items of influences. Our objective was to take any underlying structure or factors and test the difference among the two majors. The twenty-one items were factor analyzed, resulting in six-factors after rotation. One item, "it is an easy major" cross-loaded significantly and was deleted from the analysis. The other twenty items loaded in six understandable factors, including interest in IT, monetary influences, business influences, nature of the work, college influences, and high school influences. The loading was not seamless, but for an exploratory study the results were acceptable. Only one item loaded below .50, three items loaded between .50 and .60, three items loaded between .60 and .70, with the rest above .70. The one item which was not at the .50 threshold was "influence of parents"; it loaded almost evenly in two factors, high school influences (.489) and college influences (.468). This suggests that parents exert influence on choice of major in both time-frames. We

placed this item in the factor where it loaded highest (high school influence), and post-hoc testing revealed no significant differences in results were it placed in the college influences factor. Factor analysis is presented in Table 3.

The six factors which emerged from the factor analysis, in order of importance (for MIS majors) was interest in IT, monetary influence, business influence, nature of IT work, college influence, and high school influence. For CS majors, the order was almost the same with one exception: business influence ranked fourth while the nature of IT work was third. Table 4 presents descriptive statistics and a comparison of the two groups (the number of items for each factor is given in parenthesis). Interest in technology and computers was the most important factor in choosing a major for both groups (MIS and CS). This supports previous literature, which suggests that interest in the subject matter is critical in major choice (Kim et al., 2002; Malgwi et al. 2005; Strasser et al., 2002). Money matters as well, both starting salary and potential career earnings. This factor ranked second in choice of major. It is perhaps interesting that there was no significant difference between MIS and CS majors for either of these two factors. Both groups were consistent in their reporting that interest in the work and money were important factors in their choice of major (in that order). There was one additional factor where the two groups were not significantly different, that of high school influences. This was the most distal influence, and included three items: influence of parents, influence of a high school teacher, and influence of a high school guidance counselor. Although MIS majors reported parental influence as more important, there was no difference between MIS-CS majors for the other two items, and the two groups did not differ significantly overall for high school influences.

There were three areas in which the two groups differed significantly in what they considered influential. The factor

	Mean-MIS	Mean-CS	SD-MIS	SD-CS	t-test	p-value
Interest in IT (2*)	6.24	6.28	.91	.71	-.04	ns
Monetary Influence (2)	5.76	5.54	1.09	1.27	.23	ns
Business Influence (3)	5.09	4.31	1.29	1.48	4.67	p < .01
Nature of IT Work (4)	4.83	4.46	1.11	1.18	2.44	p < .05
College Influence (6)	4.17	3.64	1.39	1.43	3.18	p < .01
HS Influence (3)	2.68	2.50	1.38	1.41	.18	ns

*Numbers in parentheses indicate number of items in that factor

Table 4. Descriptive statistics for influence factors

with the greatest difference was business influences. This factor includes three items: interest in business organizations, opportunity to manage people, and a liking for interacting with people. For each of these items, the MIS major had a significantly higher mean. MIS majors clearly thought this more important in their choice of major. This is not surprising, given that the MIS departments surveyed are in the business college and take a business curriculum (either they study it because they like it, or learn to like it as they study it). This suggests that CS majors' interests differ in some ways from MIS majors (Carter, 2006) and supports previous literature which holds that CS majors, especially males who represent the largest proportion of CS majors, tend simply to like the technology itself, and applications like games rather than business applications (Carter, 2006; Pearl et al., 1990).

The second factor, consisting of six items, which differed between the two groups was the influence of the college experience. In examining which items contributed to this difference, three were significant, including influence of college instructor, influence of someone working in the field, and influence of friends. This result suggests that MIS majors are much more influenced by what happens at college, particularly with respect to personal relationships. Of the six items, the three college influences concerning "others" were significantly more important to MIS majors. There was no difference between MIS and CS majors for the other three items, quality of education, departmental reputation, and first course in the major. CS majors seem less influenced in their choice of major by other people, while MIS majors are influenced by others, particularly those encountered during the college experience.

The final factor which differed significantly between the two groups was a factor we labeled "nature of IT work". For three of the four items in this factor, MIS majors had a significantly higher mean. These included prestige associated with IT (p < .01), previous work experience in IT (p < .05), and the challenge of the work (marginally significant p < .10). For only one item, IT lifestyle, was there no difference between the two majors. MIS majors considered the nature of IT work (or its characteristics) a more important influence than did CS majors.

5. DISCUSSION

The purpose of this study was to examine the influences that are important to students in making the decision to major in either MIS or Computer Science. Because of declining enrollments in both majors the past several years, identifying the influences which shape that decision permits both MIS and CS departments to assess student needs and desires,

reach and retain those students, and formulate better avenues to attract uncommitted students. Armed with this knowledge, MIS and CS departments can make more informed decisions about how to attract and retain students, as well as promote a better fit between student and major. Since both majors attract students who like technology, this information will be readily useful to administrators in both areas.

In the discussion which follows, there are two broad findings which are of particular interest in this study. First, there are the critical influences in choosing either MIS or CS--those things that sway or persuade a student to major in either MIS or CS. It is of crucial importance to identify these items so that both departments know what attracts potential majors from the general student population. Secondly, how do the two majors compare with respect to these influences? In other words, is a particular influence or set of influences more important to one major than the other? This we analyzed by statistically comparing means and examining the underlying structure of the influences. These analyses provide insight that will permit departments to exploit differences in recruiting students. The better we understand the fit between MIS/CS students and their respective major, the better we can attract appropriate students who will thrive in the major.

The five research questions summarized the important influences which shape a student's decision to major in either MIS or CS. Each question posited two or more similar influences concerning five different categories of influence and asked whether the influence was important and if the importance differed between MIS majors and CS majors. How important a specific influence is and whether its strength is different for the two majors is directly answered in Table 2. For the sake of brevity, we will not repeat that information; rather, below we summarize the important findings from this study.

5.1 Important Findings

1. **The most important influences for both majors are interest in IT and compensation.** In order, for both MIS and CS majors, the most important influences included interest in computers, interesting work, high career earnings, and high starting salary. The top two influences, both involving interest, were the only ones which had means at or above 6.0 (of 7) for both majors and strongly suggests that interest plays a key role in determining choice of major. Compensation, both in terms of starting salary and future earnings, was the next in importance for both majors. That interest in the field and compensation are important is not all that surprising, in that these are important for almost all majors, assuming we change interest in computing to interest in whatever the major field of study (Mauldin et al., 2000),

but it does underscore what departments should use in reaching out to undecided students.

2. MIS and CS majors are quite similar in some respects. Both MIS and CS majors typically like technology, take some similar courses, and work with computers in their classes; so, perhaps it is not surprising to see similarities among them. The top six influences (of the 21 items) in choosing a major are the same for both MIS and CS. These include the four discussed above (two each in interest and compensation) and these two: IT is challenging work and a desire to interact with others. It would appear both majors enjoy the challenge of computing and both feel that IT presents such opportunities. Perhaps the most surprising finding, however, was that both MIS and CS majors ranked interacting with people as the sixth most important influence in choosing their major. While this may not be surprising for MIS majors, it suggests that CS majors may not be so different from MIS majors in their desire to interact with others (but see discussion in next section).

The most distal influences were the same for both groups and revolved around high school influences (influence of parents, influence of high school teachers, and influence of high school counselors/advisors). While this may be true of other majors, these influences were reportedly the least important in choice of major for MIS and CS majors.

3. MIS majors are more influenced by personal relationships. MIS majors are much more influenced in their choice of major by other people, than are computer science majors. In almost all of the personal influence items, MIS majors had significantly higher means than did CS majors, including the influence of someone working in IT ($p < .01$), influence of college instructor ($p < .01$), influence of parents ($p < .01$), desire to manage people ($p < .01$), like interacting with people ($p < .05$), and influence of friends ($p < .05$). The only personal relationship item not significantly different between MIS and CS majors was the influence of high school teachers/counselors. Students entering MIS or the business college appear to be more socially oriented and more interested in personal relationships (Grubb, Harris & MacKenzie, 2006/2007; Noel et al., 2003). Computer science majors, on the other hand, seem more independent of the influence of others, at least in choice of major. However, since CS majors listed the desire to interact with others as the sixth most important influence, this presented an interpretation problem. To the degree interacting with others is a personal relationship, this appears contradictory. We suspect that this influence (stated in the survey as “enjoy interacting with others”) was interpreted differently by respondents. CS majors may desire interaction in a context different than MIS majors, such as playing computer games with others or engaging in “tech talk” with like-minded friends (Carter, 2006; Pearl et al., 1990). MIS majors, on the other hand, probably perceived this interaction in a business sense, as evidenced by the factor analysis which placed this item in the business influence factor. One limitation in this study was not specifically defining the context (e.g., social, business, personal, etc.) for interaction in this item; indeed, perhaps more than one context for interaction should have been included.

4. MIS majors are more influenced during college; CS majors are more influenced prior to college. MIS majors make the choice to major in MIS much later than do CS majors. This study found that the influences during college were significantly more important to MIS majors, in particular the influence of someone working in the field ($p < .01$, and presumably this influence occurred during college), college instructor ($p < .01$), and college friends ($p < .05$). Although this is related to personal influences as mentioned above, additional items in the survey suggest that CS majors make the decision to study CS much earlier. One item in the survey asked respondents when they made the decision to major in MIS or CS, with the following choices: during high school, in college before the first MIS/CS course, during the first MIS/CS course, or after the first MIS/CS course. The resulting averages were significantly higher for MIS majors ($t = 6.37$, $p < .01$). Computer science majors typically decided to major in CS either in high school or prior to their first CS class. MIS majors, on the other hand, decided on their major during or after their first course. In the survey, 61 (57%) students decided to major in CS in high school, compared to 6 (6.5%) for MIS majors. 44 (47%) decided on MIS during or after their first MIS course, compared to 20 (18.6%) CS majors who decided during that timeframe. Students were also asked in what year they actually declared their major (freshman to senior). Again, most CS majors formally declared their major in their freshman year, while most MIS majors declared it during their sophomore year ($t = 6.43$, $p < .01$). Because MIS majors are more significantly influenced by others in college than are CS majors, and make their decision to major much later than CS students, this would seem to provide MIS departments much greater opportunity to recruit undecided students.

5. MIS majors are more interested in business and business organizations. MIS majors were influenced more strongly in their choice of major by all three items relating to business (all in the business factor group), including interest in business organizations ($p < .01$), desire to manage people ($p < .01$), and enjoy interacting with people ($p < .05$). This was not surprising given that MIS majors in this survey take a business core curriculum. This also ties in with the previous finding that MIS majors are more influenced by personal relationships (Carter, 2006; Pearl et al., 1990). MIS majors seem to be drawn more strongly to business organizations and the more formal organizational relationships inherent in such organizations. While this is not surprising, it does present opportunities for recruiting students who are interested in technology and in business.

5.2 Implications for MIS/CS Departments

The results of this study provide some critical intelligence for both MIS and CS departments. Both majors attract students who are interested in technology, interested in compensation, and enjoy the challenge of IT. Both take some similar courses and compete for similar student majors. Computer science attracts students who are still in high school (or very early in college). MIS, on the other hand, has a greater opportunity for influencing potential majors in college, because students typically choose MIS as a major during college. This probably makes the interaction between MIS faculty and prospective students more important than

for CS. These similarities and differences suggest three critical imperatives for both MIS and CS departments interested in increasing the number of majors.

1. Departments must increase high school presence.

Both departments must do more to attract high school students. In many ways CS departments face issues that are shared by math, science, and engineering programs, a lack of interested and qualified high school students, at least in the US (Gates, 2008). CS departments must find ways to link with students not yet in college, promote their interest in technology, and encourage them to pursue technology degrees. This task is formidable, because the degree requires more math and science. One relatively new initiative by Association of Computing Machinery (ACM) was the establishment of Computer Science Teachers Association (CSTA), which supports the teaching of CS in high schools and below (see <http://www.csta.acm.org>). College CS departments may be able to link with this organization to find prospective interested students. Departments should also find other ways to influence prospective students outside of personal relationship influences, such as through computer games. Research suggests that gaming is particularly important in attracting young men to CS (Carter, 2006; Natale, 2002). Focusing more on the creative aspect of computer science such as graphics, robotics, and virtual reality might help attract students.

For MIS, the problem seems to be one of student awareness. Few future MIS students decide on that major in high school. While the lack of such a decision may have many other causes, it appears that lack of awareness is one of the issues. It seems that few high school students even know what MIS is and what it offers. When informally asking students at one of the universities if they considered MIS in high school, the answer is usually that they never even heard of MIS in high school. Such anecdotal evidence is supported in this study; the vast majority of MIS majors certainly did not choose MIS while still in high school, and one reason may be awareness. MIS departments should alleviate this information deficit through efforts to expose high school students, particularly those interested in technology and business, to MIS. There are many potential avenues for carrying this out, including MIS faculty involvement in high school clubs and conferences, such as FBLA (Future Business Leaders of America), Oracle Academy, and even computer science clubs. One possible method is making presentations to high school classes (business classes, computer classes, or others). Most high school teachers and administrators are very receptive to having a college instructor visit their campuses to discuss career options with their students. For both CS and MIS departments, involvement while students are in high school is a must!

2. MIS/CS faculty must get more involved with college students. The involvement of MIS faculty with college students is critical. They teach the classes and understand their field. Competent and charismatic faculty should teach early introductory classes and attempt to present MIS in a positive light, emphasizing the interesting nature of the work, the financial rewards, and how MIS relates to and supports other parts of the business. Faculty should take a lead role in visiting conferences and other college venues where potential majors are present. Since

most MIS departments teach a core business class (such as Introduction to MIS) that all business majors take, that course is also fertile ground for recruiting MIS majors. The choice of who to teach these critical classes, both core business classes and introductory classes, is an important issue for every MIS department that would like to increase enrollment. Finally providing students--all interested students, not just MIS students--with opportunities to be involved in an active MIS club can produce results. Those clubs can attract students who have no major, or from other majors, to meetings and field trips where they can learn more about MIS. Something as simple as offering free food at monthly meetings is one way to attract potential majors. Arranging to have interesting and dynamic speakers who work in MIS at club meetings is another way to insure good turnout for meetings, and to expose students to MIS.

For CS departments, the problem is more acute, because they appear to have less influence once students enter college and students interested in CS are less influenced by personal relationships. Still, some of the same recommendations apply. CS faculty must find innovative ways to attract undecided majors, through clubs, games, and similar venues. They must be more active in pursuing students taking math and science courses. It may be helpful to stress the applied nature of CS, such as through robotics and graphics, to appeal to students who may be new majors in math or science. Unlike MIS, where a business major could change to MIS late in college and still graduate on time, CS departments must attract incoming students by the end of the third semester in order for those students to realistically graduate on time. Therefore reaching students in their freshmen year is particularly important to CS departments.

3. Involve MIS/CS professionals and businesses in the academic process. Graduates of MIS and CS programs are frequently hired by a cadre of local (or larger) organizations who recruit at local colleges. These businesses are absolutely essential to MIS/CS departments and should be fully exploited. The relationships are reciprocal; they hire our graduates and we (as MIS/CS departments) must provide qualified graduates. While it is beyond this study to examine this relationship in detail, departments must remain current on what these companies need in graduates, especially the skill sets required. These organizations can provide significant assistance for both departments, such as guest speakers (carefully selected for a positive impact) who can be invited to visit campus and talk to students in classes. This is particularly important for MIS and any MIS class taken by all business majors or for club meetings. Field trips to these organizations may also be helpful and educational.

Some companies are willing to provide funds for activities and programs that benefit the university and the company. At the authors' university, for example, one organization funds a four-day, on campus, IT Careers Camp for high school students in the summer, which promotes careers in IT—it may soon be used for concurrent college credit (college credit while still in high school). Another company funds the food (pizza) at all monthly MIS club meetings.

Another possibility for interaction is through internships. Many internships allow students to earn limited course credit as well as monetary compensation. While some companies

offer internships, many do not unless encouraged to do so. Both MIS and CS departments should actively search out and recruit such opportunities. Opportunities abound to promote business organizations involvement in the educational process. The more MIS/CS majors and prospective students are exposed to dynamic businesses and charismatic IT professionals, the more potential majors. As an added bonus, the quality of education will be enhanced.

6. SUMMARY AND CONCLUSION

The goals of this study were to identify influential factors important in a student's choice to major in either MIS or CS, to determine if those influential factors were significantly different between majors, and finally to draw implications from these differences. Using mainly previous literature, we identified 21 influential factors (presented in Appendix 1), then found several significant differences in the importance both groups (MIS and CS majors) assigned to the factors. The underlying objective was to better understand these influential factors and extrapolate from that how they can best promote their respective majors. The findings should help departments better publicize their own program and enhance the fit between student and major.

We found that MIS and CS students share some similarities. They are interested in technology and motivated by compensation, challenge, and the nature of the work. But they are also different. MIS students are influenced much more by personal relationships and are more business-oriented. CS majors are less influenced by others and make the choice to major in CS much earlier than their counterparts in MIS. We identified six factors of influence, including interest in IT, compensation, business influence, nature of IT work, college influence, and high school influence. The first two, interest in IT and compensation, were the most important influences for both CS and MIS majors (with no significant difference between the two majors). The least important for both majors was high school influences. For the other three factors, MIS majors considered the influences significantly more important, including business influences, college influences, and the nature of IT work. CS majors were little interested in business, more independent of personal influence, and less enamored with the prestige of IT.

Based on these findings, both MIS and CS departments should increase their presence in high schools. High schools are the primary suppliers for colleges and universities, and departments (MIS or CS) in some cases have not worked very closely with them. Secondly, departments must do a better job of attracting undecided students in college. Since most students (including MIS, but less so for CS) decide on their major later in college, the opportunity is present to reach this pool of potential majors. Finally, both CS and MIS should work closely with outside businesses and organizations to ensure they know the skill sets in demand at these firms, to promote careers in technology, and to obtain support (such as funding, internships for students and guest speakers) from the businesses both to attract and educate students in IT related careers.

6.1 Limitations

Like any empirical study, this one had limitations. First, we surveyed MIS/CS majors from four colleges, located in the mid-South and lower Midwest. Our conclusions realistically only apply to those schools and perhaps that area of the United States. We only surveyed MIS Departments that were housed in the College of Business; we recognize that there are others in other colleges. In addition, while this study surveyed most of the students from one campus, more complete surveys should be undertaken to ensure there is no non-response bias. So generalizability must be approached with caution. Secondly, we pulled twenty-one items of influence from the literature and discussions with colleagues/students, and respondents in essence ranked these items. There are, of course, other items that could have been included. This study concentrated on student perceptions, rather than other outside influences, but we recognize that we could have included other influences.

In this study the issue of gender was mostly ignored. The percentage of females that participated in this study was only 16%, and may be considered a limitation, though both MIS and CS Departments are primarily male. We believe the gender findings in this study merit a separate paper.

6.2 Directions for Further Research

A comparison of MIS/CS majors should be generalized to other areas of the US and in other countries to determine if influences are similar. For both CS and MIS, comparisons with other majors to determine influences should be undertaken. In addition to MIS, competitors for CS departments include math, engineering and science majors. Are there influences which are different between students majoring in each of these? Similarly, students who choose any business major can be potential MIS majors. Finding out what influences accounting, marketing, finance, etc. students to choose that major, and the comparison to the influences for MIS students, could reveal important information that can be used to attract students to MIS. It could well be that other business majors are more critical competitors for MIS majors than are CS majors.

6.3 Conclusion

Both MIS and CS departments have faced declining enrollments in the past several years. Although this trend is hopefully improving, recruiting willing and qualified students is important for both the departments and for businesses and organizations who hire graduates. Similarities seen in this study suggest that both MIS and CS departments compete for similar students.

While there are other potential competitors for both MIS and CS departments, this study examined just these two to enhance our understanding of the influences which shape a student's choice to major in either of these two fields. We found similarities as well as differences. What is important is that MIS and CS departments use these findings to promote their departments and majors, attract more students, and provide the best fit between student and career choice. Technology is here to stay in businesses and other organizations; providing an adequate supply of graduates who can work and thrive in this field is the imperative for MIS/CS departments.

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AUTHOR BIOGRAPHIES

James P. Downey is an assistant professor in the MIS Department in the College of Business at the University of Central Arkansas. He received his Ph.D. in Management Information Systems from Auburn University. He spent 25 years as a Naval officer, including a tour at the U.S. Naval Academy, before leaving the Navy in November 2004. His current research interests include project management, database management, and individual differences in behavior in human-computer interactions and end-user computing. He has presented his research at various national conferences and has been published in several journals.



Ronald E. McGaughey (Ph.D., Auburn University) is a Professor of Management Information Systems at the University of Central Arkansas. His research appears in the *Journal of Systems Management*, *Information and Management*, *International Journal of Production Economics*, *International Journal of Computer Integrated Manufacturing*, *Journal of Information Technology Management*, *Production Control*, *Benchmarking: An International Journal*, *Journal of Electronic Commerce in Organizations*, the *European Journal of Operational Research* and more. He is the Internet Editor for *Benchmarking: an International Journal* and serves on the editorial board of numerous journals. He has practical management experience in the textile, construction and logging industries. His current research interests include advanced manufacturing technology, E-Commerce, M-Commerce, and IT Careers.



Dave Roach is a Professor of Management at Arkansas Technical University. He teaches leadership, organizational behavior, and statistics. His research interests include critical thinking in organizational behavior and ethics, goal-setting, gender and technology, and perceptual accuracy. He has published articles in a variety of journals including the *Journal of Applied Psychology*, the *International Journal of Computer Integrated Manufacturing*, the *Journal of Information Technology Management*, *Human Relations*, and the *Journal of the Academy of Marketing Science*.



APPENDIX 1. SURVEY ITEMS

All items were measured on a Likert scale with anchors at 1 (Completely Unimportant) to 7 (Very Important)

1. It is interesting work
2. It is challenging work
3. Prestige associated with IT
4. Previous work-related experience in IT
5. High expected starting salary
6. High career earnings
7. Interested in business organizations
8. Opportunity to manage people
9. I like interacting with people
10. Interested in computers and related technology
11. Parental (guardian) influence
12. Influence of friends/students
13. Univ. department’s reputation
14. Influence of high school teacher(s)
15. Influence of high school guidance or career counselor
16. Influence of a college instructor

17. Perceived quality of education in major
18. Influence of introductory course in major
19. Influence of someone working in field
20. It is an easy major
21. Lifestyle that goes with IT

When did you decide on your current choice of major?

- High school
- College before any courses in the major
- College during a course in the major
- College after a course in the major

In what year did you declare your current major?

- Freshman
- Sophomore
- Junior
- Senior



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