

WHO ARE OUR STUDENTS? A PROFILE OF IS MAJORS

Completed Research Paper

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Abstract

The decline in IS enrollments since 2002 have been a cause of serious concern for IS departments. Many programs have closed IS departments, reduced in size or merged with other departments. IS faculty and associations have taken numerous steps to stem the tide of declining enrollments such as redesigning the IS curricula, forming partnerships with alumni and IS professionals, improved marketing and information dissemination to alleviate myths and stereotypes as well as apprise students of the global opportunities available in IS. An understanding of the IS student will help us better target programs and approaches to reduce the enrollment decline. This study seeks to answer this question about the academic standing, demographic profile and satisfaction levels of the IS student by analyzing the 277,238 exit surveys of which 13,910 are from IS majors from 344 US business schools for the period 1999 – 2007

Keywords: Students, IS education, IS majors, student satisfaction

Introduction

The magnitude and rapidity of enrollment declines in the computing and information systems fields has generated much research in the last few years (George, Valacich and Valor, 2005; Dick, Granger, Jacobson and van Slyke, 2007). Many schools have reportedly downsized, merged or completely shut down their MIS programs in the face of declining enrollment (Galetta, 2007). Declining enrollments have also impacted European countries but the availability of data is limited, at the same time research suggests that the role of global outsourcing may be much lower in Europe (George, Valacich and Valor 2004). Several causes have been attributed for this state of affairs, significant among them the dot com bust, outsourcing of IT jobs, and oversupply of IT graduates. Perceptions about lack of jobs is reinforced by parents who are influenced by media coverage about outsourcing to conclude that there is no future in IS/IT related jobs. Negative stereotypes of the IT profession abound: being geeky, nerdy, and that the IT jobs require sitting in front of the computer all day. Students may hold the belief that coursework in IT is hard and does not match their personality types and capabilities. This trend towards a negative effort/risk and reward perception of technology related fields may be emblematic of the general decline in enrollment in all Science, Technology, Engineering and Mathematics (STEM) related fields.

To address these causes, consortia, associations and IS departments have argued for and implemented many initiatives to improve IS enrollment. Understanding the student demographic that enrolls in our IS programs is critical to making evaluations about the causes of decline in enrollments. It would provide us with the impetus for and insights into what approaches may be appropriate to stem the tide of declining enrollment. An understanding of the IS student profile as compared to students in other majors in the business school would be the first step towards understanding the issues confronting the discipline.

This study examines the demographic and psychographic opinion data collected from 277,238 exit surveys of undergraduates at 344 business schools from 1999 - 2007. Analysis of this data provides us with broad brush insights into the makeup of an IS student, about their perceptions of the IS program, and how they stack up against their peers in the business school. We also examine the association of different factors on outcomes such as GPA, learning, satisfaction and employment. While some of the analysis may reinforce what we already know, we also get insights that would help us in developing appropriate initiatives to strengthen the major.

The rest of the paper is organized as follows. We first present the research in IS enrollment decline and initiatives taken to tackle the decline. The next section provides a description of the data collected from the exit surveys. The section on data analysis presents the preliminary results of the analysis of exit surveys in terms of the characteristics and opinions of IS students as compared to the other business majors. Finally the discussion section describes and outlines the implications of the results on the trends and initiatives in IS enrollment.

Research

Causes of Declining Enrollments

Enrollments continue to decline in IS programs, as much as 75 percent in some cases (Street, Wade, Bjorn-Anderson, Ives, Venable and Zack et al. 2008) even though the industry employment outlook remains good. IT careers are expected to be the fastest growing and highest paying careers in the next decade (Akbulut and Looney 2007). Many students chose to major in IS because of perceptions of accelerated market demand based on Y2K hiring, ERP rollouts and the dotcom boom (George et al. 2005). The market crash associated with the dotcom bubble, end of large scale ERP implementations and the end of Y2K created a downward pressure on demand. IT outsourcing and decline in corporate IT spending has also been linked to the decline (Lenox, Woratschek and Davis, 2005). Media coverage on outsourcing created concerns about poor employment by students and parents (Dick et al. 2007). Thus declining enrollments have to a large extent been attributed to this gap between perception and market conditions.

Stereotyping and Perceptions

Other researchers have suggested that negative stereotypes of IS/IT related fields (Enns, Ferratt and Prasad, 2006; Granger et al. 2007; Lomerson and Pollacia 2006; van Slyke, Case, Dick and Granger, 2007; Zhang 2007) deter students from taking up the major. IS students and professionals are regarded as nerds who sit in front of a computer all the time and do not socialize and interact with others. Work of IS professionals is perceived to involve extensive programming requiring long hours combined with constant pressure of keeping up with new technology and upgrading skills (Joshi and Schmidt, 2006; Jennings, Mawhinney and Fustos, 2002; Sabherwal, 2010). High school and business school students have reported that they consider IT related careers as highly technical in nature that require an aptitude that they do not possess (Lomerson and Pollacia, 2006).

A limited number of studies have examined the perceptions of IS as a male centric field (Joshi and Schmidt 2006; Jennings et al. 2002; Mawhinney, Cale and Callahan, 1988). Joshi and Schmidt (2006) collected data about the perception of the IS field from college students who were not yet exposed to IS careers. Their results indicated that CS related gender stereotypes as being dominated by males carried over to the IS field. Studies do suggest that when exposed to IS, students recognize the changing nature of IS and that it requires managerial, communication and problem solving skills in addition to technical knowledge (Joshi and Schmidt, 2006).

Career Choice and Motivations

Akbulut and Looney (2007) develop a model of students' choice for IS major that consists of four factors: self-efficacy, outcome expectations, interests, and choice goals. Their study indicates that self-efficacy and outcome expectations influence interest which in turn influences career choice. Akbulut and Motwani (2009) investigated the role of gender in the IS career choice model and found that the role of gender is critical; consistent with prior research that indicated that women show higher levels of computer anxiety and have lower levels of self-efficacy (Venkatesh and Morris 2000). Other researchers have examined the issue of women choosing IS careers to find that self efficacy and interest is higher in men than in women (Beyer 2008; Ahuja 2002).

Tackling the Decline

Approaches to tackle the declining enrollments have focused on the issue from the outside as well as the inside (Baskerville, Adam, Krcmar, Peppard and Vanable, 2005). Marketing and information dissemination efforts have focused on students outside the network such as high schools, outreach to current business and university students, and marketing to minorities and parents. The substantive nature of marketing has included creation of media including brochures and websites, association and interaction with alumni and IS industry professionals to dissipate the myths about the IS profession and partnering with associations such as Microsoft, Society for Information Management, Association of Computing Machinery, and Association of Information Systems (AIS) (Galetta 2007).

Looking at the IS curriculum, one recurrent theme is the emphasis on the IS introductory course as a vehicle for changing student perceptions (Austin, Nolan and O'Donnell, 2009). Many suggest that the course be redesigned to provide a richer portrayal of the IS profession and that "star" faculty be assigned to teach the course. Certificate programs, minors in IS and cross functional degree programs have been suggested as ways to bolster enrollment. Other suggested approaches have been creating new and interesting courses with a mix of business and technical skills, improving managerial and communication content along with project management skills that would appeal to a broader business audience (Sabherwal 2010; Carmel 2010).

While structural changes to the curriculum will likely have a long term impact, they are not likely to change the perceptions of high school students and freshman in the short term (van Slyke et al. 2007). Advertising and promotion activities along with the knowledge and awareness of the academic advisors about the IS profession have the potential of educating students in a shorter period of time (Granger et al. 2007). Partnerships with other academic programs both within and outside the business school have the potential of providing short term change in enrollments with or without structural changes. Long term

changes could involve remodeling the IS curriculum based on demands of the information age (van Slyke et al. 2007). Programming is not one of the top technical job growth areas in the future and is outsourced relatively easily. Project management, business analysis, process design, and business intelligence have all been suggested as skill sets that should be taught to IS graduates and are likely to appeal to a wider community of business students.

Understanding the IS Student

Our understanding of the causes and approaches to stemming the tide of declining enrollment requires us to have a broader perspective on how the target group of IS students has changed in the last decade. Who are we addressing the marketing to? Are the marketing and promotional materials used to address the audience in line with our current referent group of IS students? What is the academic profile of the IS students? Is it just a matter of marketing and curriculum or are there other considerations at play? In addition we need to examine student satisfaction with learning outcomes and the environment provided by the school to target approaches that stem the decline.

What are the gaps in the current IS programs according to the students? Do they perceive the programs as effective, providing them with the required technical, managerial and communication skills required for being successful in the information age? Are they satisfied with the choice of their major and placement services provided by their institutions? How satisfied are the IS students about their learning and support from their institutions as compared to the average business student?

An understanding of the current IS student, who they are, what is their level of academic performance and how they perceive their learning and support experience can provide us with deep insights about the nature of our IS programs from the students perspective and suggest loci for intervention. Towards that end, we examine a large data set from exit surveys to examine the demographic and academic profile of students, learning outcomes and satisfaction with the educational experience.

Data

The study uses a secondary data set provided by an education research firm at our request. The firm is not identified here at its request in order to protect the confidentiality of schools that use the firm to conduct exit surveys of undergraduate business students. Business schools depute the firm to conduct exit surveys of its undergraduate business majors sometime in their senior year. The firm administers a standard survey to all students at these institutions and analyzes the responses to provide feedback to the school along with comparisons with the peer group of schools selected by the individual institution. This specific data set is for the years 1999 - 2007 consisting of 277,238 undergraduate student responses from 344 different institutions. Not all school participate all of the years. For instance in 2007 the data set consisted of data from 149 schools surveying a total of 29,399 students of which 891 indicated that they majored in MIS. In fact only 40 schools participated in each of the nine years from 1999-2007 while 64 schools participated in only one year during the period. There are at least 150 schools for each year in the data set. Table 1 provides the number of schools, IS majors and total number of students who participated in the survey for each year in the data set. The schools are not individually identified and therefore cannot be matched with any demographic data such as size, public vs. private, region etc.

Table 1. Number of Schools, IS Majors and Students in the Dataset			
Year	Number of Schools	Number of IS Majors	Number of Respondents
1999	159	444	26,621
2000	164	422	28,066
2001	184	407	31,336
2002	181	3,651	32,482
2003	181	3,122	34,585
2004	173	2,166	32,687
2005	156	1,726	30,980
2006	162	1,081	31,082
2007	149	8,91	29,399
Total	344	13,910	277,238

Analysis

The number of IS majors as proportion total students, as is perhaps well known, increased rapidly from 2001 to 2002 to a peak of between 10 -12% and rapidly declined from 2002 to 2007 to about 4%. Most of the students who graduated in 2002, likely declared IS as their major in 1999-2000, indicating the absence of any major lag effects in enrollments as the dot com bubble burst. Conventional wisdom suggests that enrolments in the business school drop when the economy is good (Lomerson and Pollacia 2006). However, a 30 year study of business school enrollments indicated otherwise, and suggested that enrollment increased even when good economic conditions prevailed (Doti and Tuggle 2005). It is obvious that IS enrollments have not kept pace with business school enrollments or the economy. While the technology heavy NASDAQ suffered a rapid decline after the year 2000, the composite index values have increased steadily from 2003-2007. Note that larger schools (presumably ones with larger number of respondents), while still declining, have been able to maintain a better ratio suggesting scale effects and the likelihood that larger schools will continue to maintain the major.

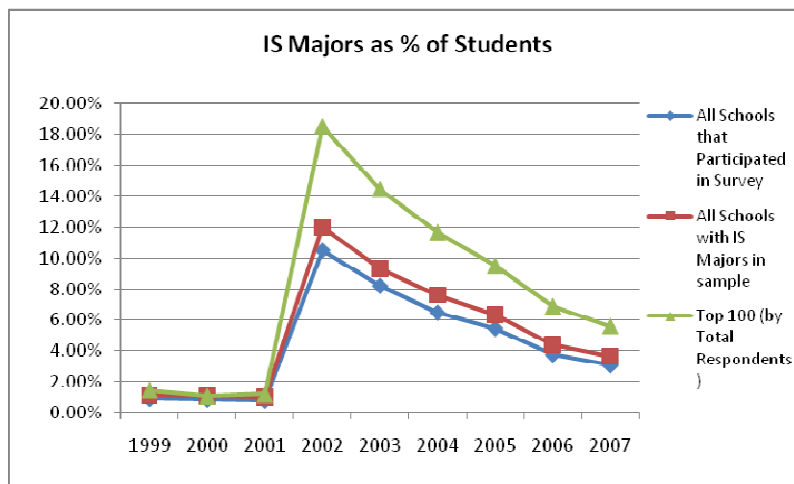


Figure 1. Proportion of IS Majors in Schools

Consistent with prior research (Ahuja, 2002; Akbulut-Bailey, 2009), the data shows that proportion of females is rapidly declining in IS programs at a comparatively rapid pace as compared to the rest of business school. While total IS enrollments begin their rapid decline in 2002, percentage of women in IS programs begins declining in 2003 from close to 40% to just above 20% of IS majors.

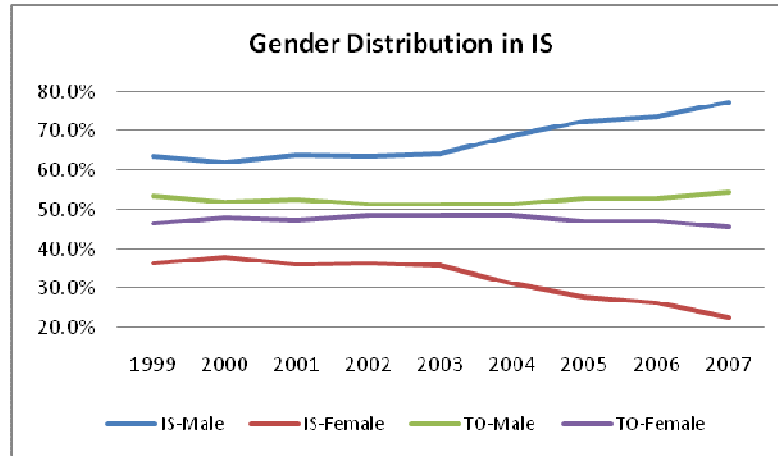


Figure 2. Gender Distribution – IS vs. All Students

While females as a percentage of total IS graduates has been declining, ethnic diversity presents a different picture (Figure 3). We find that the percentage of African-Americans, Hispanic and multi-racial students in IS have increased steadily as compared to their percentage in the rest of the business school. The percentage of Asian students has declined steadily since 2003 (the same year that the percentage of women in IS trends downwards). African-Americans and Hispanics have been generally considered as underrepresented in the IS profession and efforts have been addressed to improve their numbers in the IS profession (van Slyke et al., 2007). Our numbers would indicate that efforts to draw minorities into IS programs has been successful for all minorities except women.

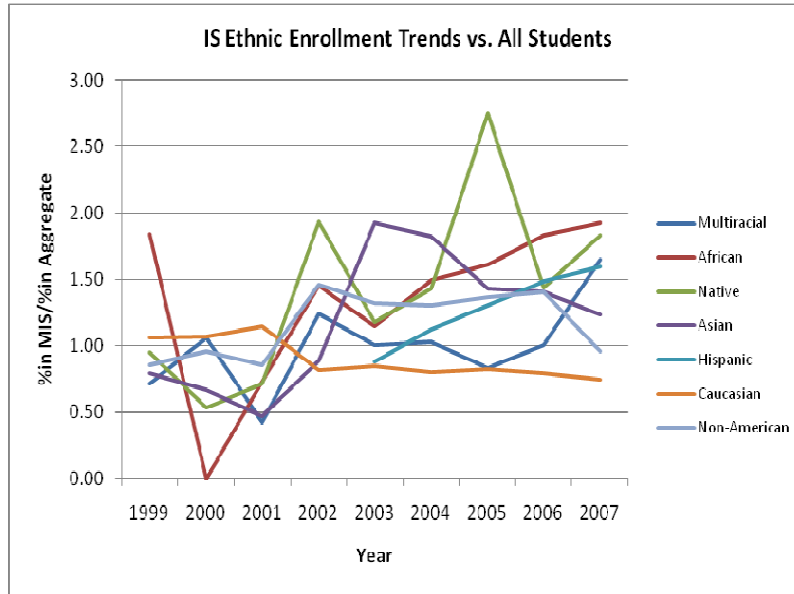


Figure 3. Racial Diversity – IS vs. All Students

Respondents were asked to indicate their SAT/ACT scores in different ranges, for example they could check that their score fell in the range 820-880. We took a weighted average for each year and compared it with the all students. The data indicates that average incoming SAT/ACT score of IS students is lower as compared to all majors (figure 4). The average academic performance of the IS Students declined from 2003 to 2004 and while it has increased since, a gap of about 30 points persists.

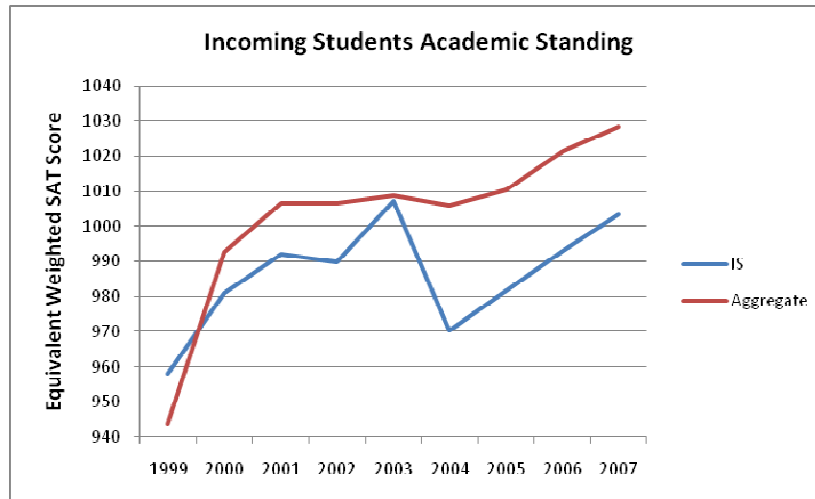


Figure 4. Incoming Standardized Test Scores IS vs. All Students

The average GPA of business students at the time of the survey has diverged from the GPA of the IS students in 2003 (figure 5). While the decline in itself may not be substantial (a difference of .08 in 2007),

the trend is not healthy. Combined with the decline in test scores of incoming students and a drop in percentage of women, it provides an insight into the mix of the IS students. It is critical to find out how much of these declines are related to incoming academic standing and how much to the degree of difficulty, “hardness” and grading in IS related courses.

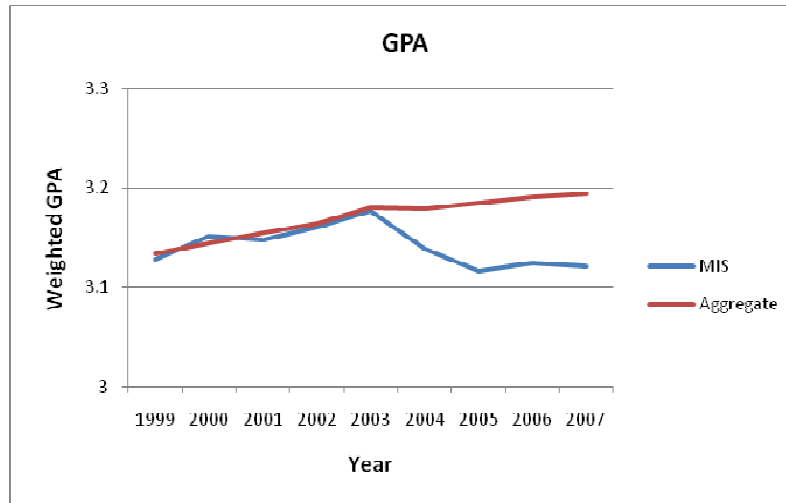


Figure 5. Incoming Standardized Test Scores IS vs. All Students

The exit survey also captured information about when the students joined the program. If we consider all students who did not join the business school as freshmen as possible transfers, we find that IS majors are more likely to have transfers, on an average about 4% more compared the all of business school (figure 6). Like all other enrollment trends, the difference spiked in 2000 to nearly 15% more than all students combined.

Respondents also indicated average number of hours per week devoted to study in the past academic year while attending school. We find that IS students on average report studying longer hours than the average business student since 2002 (figure 7). It is interesting to note that the average number of hours studied is less than one hour per credit hour per week for a standard 15 credit load. However there is no clear upward or downward trend in the number of hours studied by the IS student since 2002. The numbers may support students' perception that the MIS major is hard and difficult and more so when looked at in combination with diverging GPA trend (Granger et al., 2007; Lomerson and Pollacia, 2006). A similar trend is seen in the number of hours students work. IS majors work longer hours on average and the difference between hours worked between the IS student and the average business student has increased steadily from 2002 to 2006. There has been some research on the hours worked per week and academic performance of students (Orszag, Orszag and Whitmore, 2001) which have shown that while some amount of work is related to good academic performance, long hours of work, typically more than 30 hours per week can create a downward pressure on academic performance.

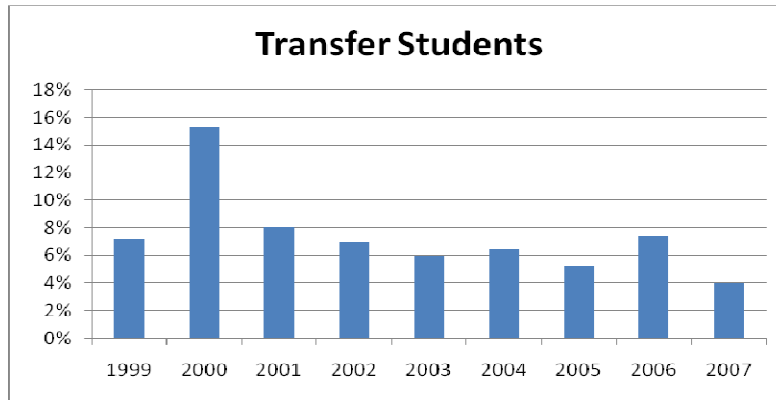


Figure 6: Percentage More Transfer Students in IS as compared to overall Business School

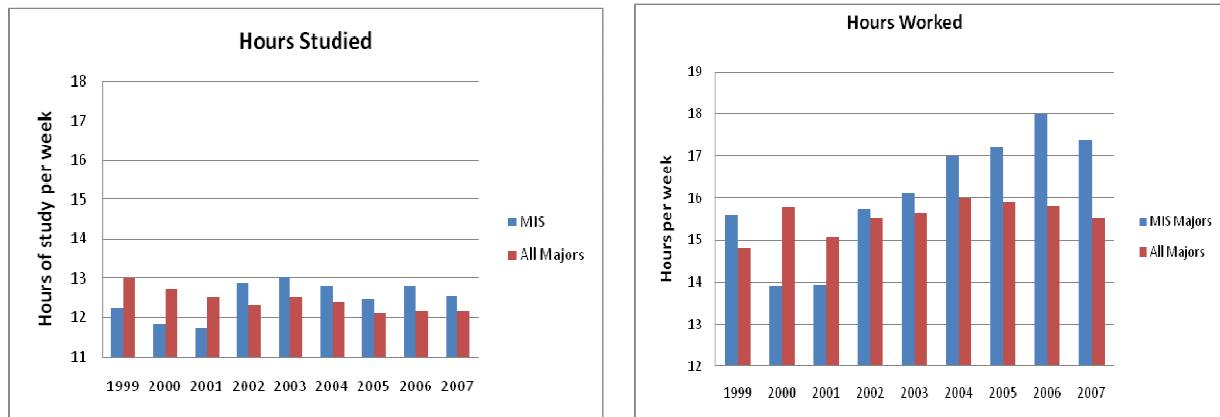


Figure 7. Hours of Study and Work IS vs. All Students

Analyzing Outcomes

In addition to demographic data the exit survey polled the students on satisfaction with various attributes of their educational experience and learning outcomes. The research firm holds copyright on the specific questions but Appendix 1 provides modified versions of the individual items and measures to give a feel for the measure. To examine the influence of different factors on various outcomes we aggregated the measures for each school for each year, making the combination of each school year the unit of analysis for the regressions shown in Table 2. We eliminated schools that did not include any responses from IS majors and those that had less than 10 responses from IS majors in a given year. All of the regressions are significant at $p < .001$ level. The results indicate that the driver impacting all learning outcomes is the characteristics of fellow classmates, followed by the quality of teaching in the IS major. IS class size and satisfaction with facilities and computing resources impacts very limited number of learning outcomes, while the satisfaction with advising does not impact any learning outcomes. Size and growth rate of the IS program also had no impact on the learning outcomes. IS programs are beginning to emphasize the development of soft skills such as communication and team work, management and leadership and critical thinking and problem solving. Our results indicate that factors that impact the perception of all the

soft skill based learning outcomes include GPA and the average hours studied per week. SAT scores and average hours worked per week had no impact on the students' perception of soft skills.

One of the most interesting results of the study was that GPA was negatively related to all soft skills based learning outcomes but positively related to overall program effectiveness. In addition satisfaction with quality of teaching in major was negatively related to student GPA. While average number of hours worked per week was related to overall program effectiveness, average number of hours worked per week was not related to program effectiveness.

Discussion

The demographic profile constructed from the dataset and analysis of outcomes provides several insights and raises several questions for further investigation. The trends mostly reinforce the decline in enrollments that have generated much debate and research. We also see that gender disparity has increased over the past decade although racial diversity has improved when compared with the diversity in business schools. One can speculate several reasons for the emerging makeup of IS majors which need further investigation. Is the major lowering admission standards under pressure from declining enrollments? Does the major's relatively higher technical knowledge platform attract diversity? It is interesting note that IS majors seem to work more and study harder for lower GPA as compared to peers from other majors in the business school. The fact that developing technical skills such as programming often requires more time may well be a disincentive for students to take up the major. We also note that IS major is more likely to have transfer students that may have numerous gaps in their knowledge and an inconsistent educational experience. Of particular concern is the divergence in the average GPA of the business student and IS major which needs further investigation.

The drop in standardized test scores beginning in 2003 alludes to the likelihood that colleges have had to cast a wider net in maintaining enrollments in the major. It is a matter of discussion whether admitting students with lower test scores could have impacted the shifting and/or lowering of standards in the IS curriculum. The fact that IS major report studying longer that their non-IS counterparts may be because of the gaps in their prior education that prevents them from being ready to absorb the material offered in their IS courses. This may also be related to the result that while they indicate that they are studying harder, their average GPA's tend to be lower than the rest of the business school.

The IS major has been very successful in attracting various group of minorities, except women. This could be attributed to the programs casting a wider net and focusing on attracting a diverse student population. It is also possible that the technical knowledge platform associated with IS conveys an impression of objectivity and minority students may perceive their chances of career success in the field to be relatively fair. One would have to compare the enrollment of minorities in other science and technology fields over the last decade with IS to understand the nature of this demographic shift. It is how-ever interesting that the gender gap in IS persists. Anecdotal evidence suggests that girls do better academically in school compared to boys. Is the low GPA of IS majors related to fewer female majors or does the low GPA/effort ration act as a disincentive to potential female majors?

The demographic shifts may also have some relationship to the outcomes analysis. Student GPA is negatively related to learning outcomes. Does it mean that the students who receive a higher GPA are not satisfied with the instruction that they receive because of the possible "flexibility" of curricular standards because colleges are casting a wider net to enroll students? Or is it the dichotomy in the cohort group because of the disparate test scores that prevents the development of the soft skills in the classroom?

Table 2. Outcomes						
Outcome Variables	GPA	Learning Outcomes				Overall Program Effectiveness
		Effective Communication and Team Work	Use and Manage Technology	Effective Management and Leadership Skills	Critical Thinking and Problem Solving Skills	
Independent Variables						
SAT Score	.226**	-0.075	-.022	-.039	-.036	.155**
GPA		-.186***	.033	-.166**	-.137**	.031
Avg. Hours Worked/Week	.084	.023	-.045	-.015	.012	.152**
Avg. Hours Studied/Week	.128**	.252***	.000	.102**	.129**	.068
Number of IS Majors	.013	-.006	.065	-.047	.013	-.020
Increase in IS Majors next year	-.030	.029	.050	-.014	.048	-.078
Satisfaction with						
Quality of Teaching in Major	-.258**	-.016	.366***	.164**	.205**	.306***
Class Size	-.059	.110*	.055	.122**	.063	.071
Faculty Responsiveness, Grading and Student Effort	.468***	.102	.051	.134	.248**	.147*
Student Organizations and Extracurricular Activities	-.018	.105	.179**	.148**	.116*	.084
Facilities and Computing Resources	-.007	.162**	.027	.084	.087	-.059
Characteristics of Fellow Classmates	.221**	.437***	.325***	.279***	.148**	.230***
Placement and Career Services	.141*	-.187**	-.122*	.005	.064	.208***
Advisor	-.041	-.069	-.096	-.057	.030	.007
N (schools)	229	229	229	229	229	229
R ² (Adj R ²)	.191 (.143)	.428(.391)	.430(.393)	.469(.435)	.533(.503)	.542(.512)
*** p<0.01, ** p<0.05, * p<0.1						

The regression analysis provides interesting insights into student academic performance as well as their perceptions on learning outcomes and overall program effectiveness. The results not only establish the importance of certain factors for certain outcomes but are also interesting in terms of factors that are not significant and the direction of their association. One of the interesting findings is that satisfaction with characteristics of fellow classmates is significant in all regression models. This is something that has not attracted much attention in all the research on IS enrollment and its decline. The finding suggests that schools need to pay closer attention to the makeup of cohorts, reducing variance in academic levels and creating a more collegial environment in the educational experience. While it is not surprising that standardized test score are significant when regressed on GPA and perception of overall program effectiveness, it is interesting to note that GPA is negatively associated with certain learning outcomes as reported by IS majors. It seems to suggest that students who perform well feel that they have not received adequate training in some of the softer skills such as communication and teamwork, leadership and critical problem solving skills.

Interestingly the average number of hours worked per week is only associated with perception of overall program effectiveness could mean several things from program that are better at accommodating student work schedule to the possibility that curriculum reinforces their work experience. It should also be noted that the quality of placement and career services is a significant factor in how student perceive the overall effectiveness of the program. This is perhaps an important area for IS programs to take initiative and work proactively to place students and improve their overall levels of satisfaction. In contrast, satisfaction with advising is not associated with any of the outcomes and perhaps could be an area where the student educational experience could be improved with informed advising and career planning. None of this takes away from the importance of the quality of teaching in the major which is positively associated with 4 of the 6 outcomes examined here and surprisingly, negatively associated with student GPA. The importance of student organizations and extracurricular activities cannot be underemphasized especially for managerial and leadership skills. The need for AIS student chapters and consistent investment in their success has never been more imperative.

One of the questions on the survey was that if the student was seeking employment, whether they had received a job offer. We ran a Logit regression with some of the demographic factors controlling for school effects across 3708 IS majors from 158 schools. The results as expected show that students with higher GPA and incoming scores are more likely to have received a job offer. More interestingly, students who worked more were also likely to receive employment offers highlighting the importance of work experience in the discipline and the need to have formal internship and coop programs. It was also interesting to note that students who joined the program as a junior or senior were less likely to receive job offers.

Limitations

The study provides several interesting insights into the makeup of our IS majors. It suggests that we need a broader and more balanced approach in moving forward. In addition to changes in the curriculum there is a need to focus on issues like placement. If there is a disconnect between market demand for IS professionals and perceptions about the profession than what better way to address it than placing students? Similarly other considerations such as the cohort, student organizations, and practical experience all need attention.

There are several limitations to the study. As with any secondary dataset, there are numerous gaps and limitations in how the data was collected. At the outset we have no information about schools the use the survey or on how it is administered at each school. We also do not know if all students at a school participate in the exit survey. However, given the large sample size and the number of schools participating in the survey, the results should at least be indicative if not representative.

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Appendix

Measures

- Increase in IS majors next year = Respondents_{n+1}/ Respondents_n

Satisfaction with

- Quality of teaching in major (2 items)
- Class size – Average size of major courses (1 item)
- Faculty responsiveness, grading and student effort – grades reflect effort, instructor accessibility, responsiveness and relevance of instruction (4 items)
- Student Organizations and Extracurricular Activities – student organization and leadership opportunities (2 items)
- Facilities and computing resources – quality of classrooms, availability of computers, remote access to network and training for computing resources (4 items)
- Characteristics of Fellow Classmates – academic quality, ability to work in teams, camaraderie (3 items)
- Placement and Career Services – help in preparation for job search, access to alumni, number and quality of firms recruiting on campus (4 items)
- Advising – Advisor availability, knowledge, helpfulness and interest in student progress

Learning Outcomes – the extent to which the program enhanced

- Effective communication and Team Work – presentation and writing skills, ability to work in teams (3 items)
- Use and Manage Technology – ability to use and manage technology (2 items)
- Effective Management and Leadership Skills – ability to be an effective manager and leader (2 items)
- Critical Thinking and Problem Solving – ability to think critically, define problems, solve problem, analyze and interpret data.
- Overall Program Effectiveness – extent to which expectations were fulfilled, overall value and recommend program to others (3 items)