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In this issue:

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EDSIG activities include the publication of ISEDJ and JISAR, the organization and execution of the annual ISECON and CONISAR conferences held each fall, the publication of the Journal of Information Systems Education (JISE), and the designation and honoring of an IS Educator of the Year. • The Foundation for Information Technology Education has been the key sponsor of ISECON over the years. • The Association for Information Technology Professionals (AITP) provides the corporate umbrella under which EDSIG operates.

An Action Plan to Increase IS Enrollment Based on Recent Survey Evidence

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Abstract

The recent downturn in Information Systems enrollments and degrees granted has been a topic of interest in academia as well as industry. This downturn could negatively impact the future of the profession and negatively impact business in the 21st century, arguably still in the adolescence of the "Information Age." This paper catalogs the issues and causes of these enrollment declines from recent articles and proposes action items to address these issues on a local scale. Implementation of these action items has resulted in the uncovering of "hidden variables" that contribute to the enrollment decline. These hidden variables will also be addressed in this paper.

Keywords: information systems education, declining enrollment, outsourcing of technology jobs, information systems careers

1. INTRODUCTION

Information systems is taught under different titles depending on its focal points and the department in which it is housed. Some of these monikers include Computer Information Systems (CIS), Management Information Systems (MIS), Information Systems (IS), and Managerial Informatics (MI). For the purpose of this paper, the study of Information Systems as they relate to a business will be termed IS, gathering all disciplines under this heading.

Declining enrollment in IS programs and the number of graduates in the United States has been documented by the U.S. Department of Education as is illustrated in Figure 1.

The first peak (1985 – 1988) in Figure 1 can be attributed to the emergence of personal computers and networks. The second peak (2002-2004) is the effect of the "dot-com" boom, the emergence of the WWW and e-commerce in the early part of the century, and the following decline is the dot-com bust that occurred after the venture capitalists and angel investors pulled their support from e-commerce and other Internet ventures. Figure 1 also illustrates another problem the discipline faces – the gender gap is widening in the number of degrees awarded. This paper focuses on the current decline (2003 – forward), its causes and action items that can lead to increased enrollment.

Figure 1 has been presented in a number of papers on the topic of enrollment decline (Lenox, Woratschek, and Davis, 2005; Battig, 2008; Snyder, Slauson, Carpenter, 2008), but a question remains: Are CS and IS the only STEM disciplines being affected by this downturn? The answer, unfortunately, is "yes" as can be seen in Figure 2. Engineering, Biological Sciences, Physical Sciences, and Mathematical Sciences are all experiencing growth (some is slight), which makes the sharp downturn in CS and IS all the more evident.

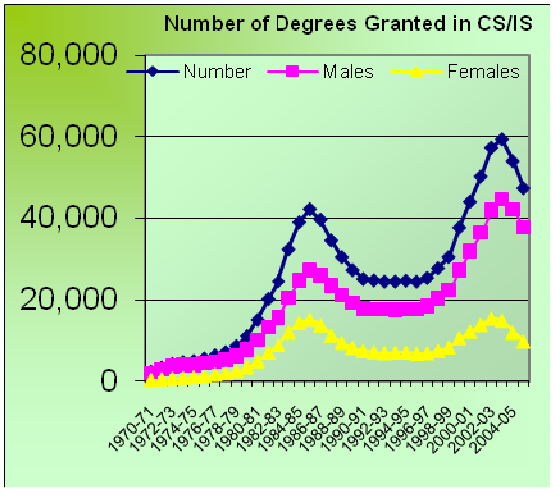

Figure 1, The Current Decline in Degrees Awarded in Computing Fields (U.S. Department of Education, 2007)

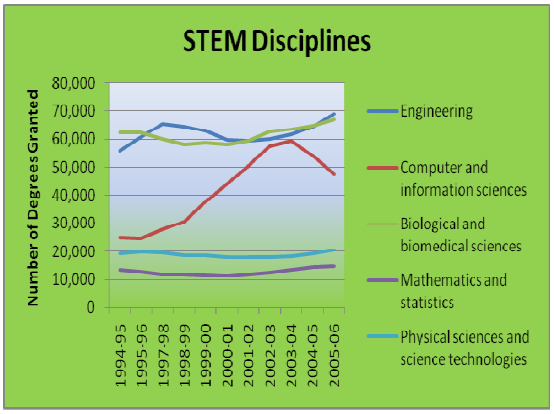

Figure 2, CS/IS Enrollment Compared Against Other STEM Disciplines (U.S. Department of Education, 2007)

The decline in IS enrollments can also be seen in Figure 3, the attendance figures at the National Collegiate Conference (NCC), where the best and most involved students compete in contests of interest to the discipline.

The decline due to the dot-com bust is evident in Figure 3, and since then attendance has not rebounded to previous levels. In fact, the current trend in enrollment is paralleled by attendance at the NCC – it is in decline.

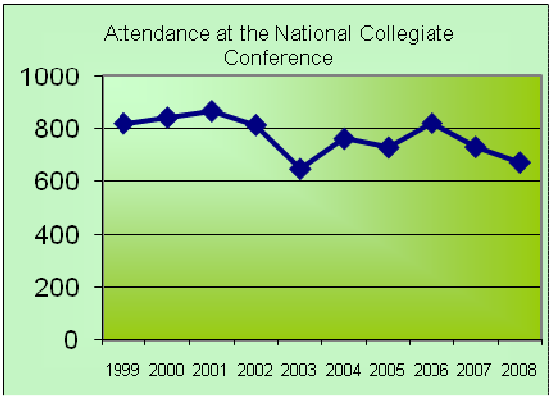

Figure 3, Attendance at the National Collegiate Conference (AITP NCC History, 2008)

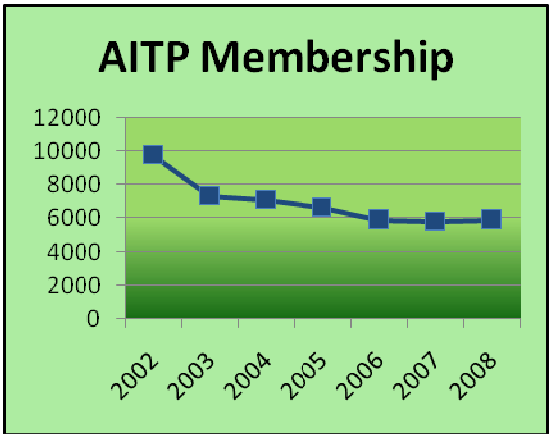

Figure 4, Membership in the Association of Information Technology Professionals (Lapsansky, 2008)

Further, membership in professional organizations that represent IS workers is declining as can be seen in Figure 4. With the proliferation of technology in the home and workplace, Figures 1-4 paint a drab picture of the future of information technology and information systems workers in the United States.

Many authors have stated reasons for the decline in IS enrollments (Lenox, Woratschek, and Davis, 2005; Lomerson and Pollacia, 2006; Pollacia and Lomerson, 2006;

Walstrom, Schambach, Jones, and Crampton, 2008).

One survey (given to undergraduate faculty) administered by Lenox et al. (2005) points toward outsourcing of jobs in the field, the economy, the cyclic nature of business, and the decline in students' analytic abilities as the major contributors to the decline in IS enrollment.

A study completed by Lomerson and Pollacia (2006) identified pre-collegiate factors that contribute to the decline in IS enrollment. Their survey, administered in a freshman level class, indicated three levels of interest in a computer related degree: currently studying for one, thought about one but did not pursue it, and did not consider a computer related career. The latter two categories gave the following reasons for their choice:

Did not pursue it: no information about career, too hard or technical, did not perceive the work positively, did not think employment prospects were good.

Did not consider it: no information about career, not interested, do not like using computers, did not think employment prospects were good, no access to a personal computer.

Another interesting result from the Lomerson and Pollacia paper is that the students perceived their high school counseling experience as "lacking" in the area of advising toward a career in a computer related industry. The students also graded themselves low on their knowledge about career opportunities in computer related fields.

A more recent paper by Walstrom, Schambach, Jones, and Crampton (2008) surveyed students in an introductory business course to determine important factors in choosing their majors and what sources of information most influenced their choices. The top factors in choosing a major were: personal interest in subject, work availability, salary, prestige of profession, occupational growth forecasts, job security, opportunities for professional development, ease of subject matter, family members, performance in high school courses, performance in college courses, difficulty of subject, and professors. The information sources that were most important to them were: the college / department web site, brochures about major, information on the Internet, and newspaper articles.

Summarizing the results of the surveys mentioned above, trends in the decline in IS enrollment appear on two levels, the high school level and the college level. These are summarized in Table 1.

High School Level Problems	**College Level Problems**
No information about careers in IS	Perception of outsourcing in the field
Too hard or technical	Employment prospects/salary
Employment prospects	Job security
Do not like using computers	Professional development opportunities

Table 1, Overriding Problems Contributing to the Enrollment Decline in IS Fields

For the past two years, Bill Gates has addressed the US Congress and pleaded his case for the raising of the H-1B visa cap so that he (and others) can recruit abroad and bring talented individuals to work in this country. Gates has also requested that the government increase funding for mathematics and science, warning that the center of [technological] progress will "shift to other nations that are more committed to the pursuit of technical excellence." (Gates, 2008b)

Most of the problems in Table 1 can be addressed through education and communication about this (emerging) discipline. This communication should originate at the college level, due to the central role colleges play in the IS field. Communication ideas along with problem analysis and problem solutions will be addressed in the next section. However, the irony of the situation is summarized in the following quote:

"This generation, which is noted for its pervasive use of technology, has little interest in, or awareness of, the occupations that drive the digital age." (Crampton, Walstrom, and Schambach, 2006, p. 227)

2. PROBLEM ANALYSIS AND PROPOSED SOLUTIONS

In light of the summary quote from the previous section, generating interest in the IS field is a matter of awareness of the field and what work in it entails…for those who are interested in the field. Anecdotal evidence from a mid-sized college in the central U.S. indicates that more students would have majored in IS related fields, had they been aware of them upon entering the institution. (This points to other problems, that of advising and recruitment in the college environment, as well as IS awareness generated from within the department/college where the IS programs are housed.)

In the analysis phase, problems will be labeled HS# for high school (pre-collegiate) problems, with # representing their position in Table 1 and a similar notation for college problems, C#. Stakeholders will be identified who can assist in solving the problems, and data will be identified to assist in making convincing advice about the problem at hand.

- HS1 - No information about careers in IS: IS is not taught in the high school curriculum. (Walstrom, et al., 2008) College faculty can interface with business instructors and high school counselors to inform them of the differences between a traditional computer science discipline and the more contemporary information systems discipline. Leave a brochure, refrigerator magnet <IS, it's not your parent's computer science!>, or some other informative (and fun – see p.5 of Lenox et al.) gizmo to draw attention to the field with the teachers and counselors most likely to interact with the students.
- HS2 – Too hard or too technical. High school teachers and counselors can identify promising students and inform them of the potential for a rewarding and lucrative career in IS. Establish a dual credit course that introduces the students to software tools and integration of these tools. Illustrate to them through hands-on exercises that IS is not too hard. When addressing HS1 with the teacher and counselor group, this topic could be addressed.
- HS3 – Employment prospects. Employment surveys, the Department of Labor web site, and the Bureau of Labor Statistics all point to continued growth in the field. Illustrate to all parties involved that computers are involved in all transactions in retail, food service, gas purchases (credit card enabled pumps), and ski lift tickets. A table to aid the discussion will be incorporated into the brochure mentioned in HS1 and is Appendix A of this paper.
- HS4 – Do not like using computers. A difficult problem to address. Hopefully, with a well-designed introduction to software/computing class (as mentioned in HS2), this barrier can be overcome by some of the student audience. Further, IS can be "sold" as working with people at least as much if not more than working with computers.
- C1 – Perception of outsourcing (off-shoring) in the field. Outsourcing is not new – it has become a topic of great media interest in the past decade, especially with the advent of the Internet, and how corporate entities are using the Internet to ship data overseas to utilize a less expensive labor market. However, a great many components of IS cannot be outsourced. Again, a table in a brochure (or a PowerPoint slide) can be utilized to illustrate this. See Appendix A.
- C2 – Employment prospects/salary. See HS3. Incorporate an employment projections column and a salary column in the table. Use this arena to differentiate between outsourcing (which could be done by a US company) and off-shoring, which is where the concern lies.
- C3 – Job security. This aligns with growth, non-outsourcable jobs, and the fact that the information age is here to stay and technology is embedded in all facets of the enterprise, along with the PC being the latest "living room appliance" to infiltrate households since the television. Hopefully communication and information in the brochure will aid in illustrating the positive employment situation in IS.
- C4 – Professional development opportunities. Where to begin!? The multitude of certificates, security concerns and certifications, new technology, new integration events, new operating systems, a life-

> cycle of 3-5 years, … the list is endless of professional development opportunities in the IS field. As working professionals in the field we are aware of this, but students interested in the field might need to be informed of the growth potential and learning opportunities.

The problems identified in this section are not new. Some quotations from a computer expert (Bill Gates!) illustrate the effects that a lack of students and home-grown talent is having on the industry and corporations that rely on technical expertise.

"When we want to hire lots of software engineers, there is a shortage in North America – a pretty significant shortage. We have this tough problem: If you can't get the engineers, then you have to have those other jobs be [relocated to] where the engineers are." (Gates, 2008a)

Gates (2007) stated, using international test statistics, that the problem with science and mathematics begins in high school. Gates, in the same speech, also stated:

> *The percentage of college freshmen planning to major in computer science dropped by 70 percent between 2000 and 2005. In an economy in which computing has become central to innovation in nearly every sector, this decline poses a serious threat to American competitiveness.*

These concerns by one of the leading figures in technology indicate that our competitive edge and our highly skilled jobs might be heading overseas unless these enrollment trends can be reversed. If we cannot reverse this trend, who but ourselves will be to blame for the outsourcing (off-shoring) of IS jobs?

3. ACTION ITEMS AND REPORTING

The fundamental action item that would address all of the problems identified using survey instruments is communication. Through various types of communication, the enrollment problem can be addressed as illustrated in the following list:

- Media coverage – Although beyond the scope of influence of the general IS faculty, national media coverage is occurring and can be publicized to students as a positive factor for pursuing a career in IS. For example, see the recent (June 16, 2008) article in Newsweek titled "Revenge of the Nerdette." This article illustrates the successes of females pursuing degrees in science and technology fields. Articles such as these can be brought to the attention of high school counselors and educators, as well as presented in the freshman college classroom. Closer to home, local newspapers are running technology columns and articles on technology. A recent example is *Technically speaking, today's teens want it all – In a technological world, 'geeks' are now chic* (Ho, 2008). This newspaper article illustrates that teens crave the latest in technology and are using these gadgets to define their lifestyles and their level of "cool." Any activity by faculty to encourage this local (or national) coverage can only help the recruitment cause. (Targets HS1)
- Local coverage – This is an action item that faculty can accomplish. By interfacing with high school counselors and instructors, as suggested by Walstrom, et al. (2008) and Lenox, et al. (2005), faculty can advertise the positive aspects of the IS curriculum and stimulate interest in the field. Action items to be explored in the fall semester of 2008 are listed here:
  - Produce a brochure that illustrates the differences between CS and IS. As a "newer" discipline, many people do not know how different IS is from a traditional computer science discipline. (Targets HS1, HS3, C1, C2)
  - Arrange early semester meetings with high school instructors and counselors to inform them of the differences between CS and IS. Attempt to have the high schools teach a dual credit course in "Business Information Technology" where software integration is the capstone experience for the students. (Targets HS2 and HS4)
  - Produce a departmental web page that addresses the issues of concern for the students (both high school and college). (Targets HS1, HS2, HS3, C1, C2, C3, C4)

- Require all college students in business disciplines to take "Fundamentals of Information Systems" where jobs in IS are presented, the role of IS in business is discussed, and other topics such as outsourcing versus off-shoring, job prospects, job growth, professional societies, and professional development are addressed. (Targets C1, C2, C3, C4)

Antidotal evidence from the authors' institution illustrates another recruiting issue. This is the perception of "computing" by the advising and recruiting staff. Computing is equated to computer science, and computer information systems is not a major considered when advising incoming students. In addition to the aforementioned action items, the faculty will interact with the recruiting and advising staff (aided by the brochure) to illustrate the differences between the two disciplines. This will aid in advising students into the correct course sequences (and department) based on their interests.

The authors have begun to meet with representatives of area high school counseling offices and technology teachers. The message of communication has been well-received, with all parties involved expressing a concern about enrollments and a desire to attempt solution strategies. Results from meeting with high school personnel and college personnel will be presented and discussed in the following section.

4. HIDDEN VARIABLES

In discussions with high school counselors and high school teachers of information systems (while implementing the action items from section 3) some hidden variables have come to light that contribute to the downturn in enrollment in IS disciplines.

- 0.5 credit of technology education (office applications mandated by the state) taken in freshman year
- scheduling conflicts with higher level technology education classes
- high school students waiting until college to enroll in business related classes

These issues keep high school students from pursuing IS classes and hence, from acquiring an interest in the IS field while deciding on a major for college. These hidden variables contribute to problems HS1 through HS4 mentioned in section 2. By having IS classes in high schools, beyond the mandatory office applications class, students could be informed as to the nature of the discipline, the job potential in IS careers, and gain experience in a technical subject.

Scheduling conflicts arise due to IS classes competing with state-mandated classes and sports interests. When a cohort of students is identified for an advanced IS class, conflicts lower the enrollment to the point at which the class is cancelled. In future meetings with high school personnel, discussions about scheduling will be brought up in hopes that a solution can be found. As an avenue around scheduling issues, online dual-credit classes could be offered to area students who are interested in the discipline. Online classes for "Business Information Technology" and "Introduction to Information Systems" will be offered online in the future, and hopefully be available to high school students.

In discussions with college counselors and the advising office, more hidden variables arose:

- lack of interest/aptitude in college freshmen (remedial mathematics)
- no technology teacher education program at college.

According to the latest estimates from the state, over half of the entering college freshmen need remediation in reading, writing, or mathematics (Hewlings, 2008). This makes taking technical classes difficult for the entering class. Bringing the problem full circle, there are no technology or business education training programs in this half of the state, forcing local high schools to recruit from outside the local community, perhaps affecting the potential effect of local students becoming role models or mentors.

As for the lack of interest and concerns about off-shoring (issues C1-C4), all business students will be required (beginning fall 2009) to take CISB 210, Introduction to Information Systems. This will allow instructors to address these issues and communicate accurate information about the IS field and opportunities within the field to students.

Leaving the brochure (Appendix A) with the college's advising staff will help to identify

students who are interested in computers in a business environment. The brochure will act as a focal point for discussing major selection. All individuals contacted (both high school and college) have found the brochure a useful tool for advising students.

5. CONCLUSION

Enrollments in IS programs are declining. This paper presented the causes of the decline based upon recent survey evidence and proposed action items for reversing the enrollment trend on a local level. These action items included:

- Interacting with local high school counselors and teachers to inform them of IS careers and to listen to their perspectives on enrollment trends.
- Soliciting local high schools to teach dual credit courses in business information technology, priming these students for interest in IS careers. Addressing issues C1-C4 in the Introduction to Information Systems classes at the college level and gauging the student response.
- Working with the local recruiting and advising staff to illustrate the differences in traditional computing disciplines and the 21st century study of information systems to more effectively advise students into the correct discipline.

These action items have yielded greater interest in information systems as a field of study locally with high school counselors, teachers, and college advising staff. After communicating with these groups, hidden variables (not revealed from the survey instruments mentioned in section 1) were identified as potential issues in recruiting students into IS majors. These hidden variables will require more work, and creative solutions to overcome. However, if IS educators do not play a proactive role in identifying, addressing, and solving enrollment problems, who will?

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Network systems and data communications analysts	262,000	402,000	53.4	Very High	Bachelor's
Computer software engineers: applications	507,000	733,000	44.6	Very High	Bachelor's
Computer systems analysts	504,000	650,000	29.0	Very High	Bachelor's
Database administrators	119,000	154,000	28.6	Very High	Bachelor's
Computer software engineers: systems software	350,000	449,000	28.2	Very High	Bachelor's

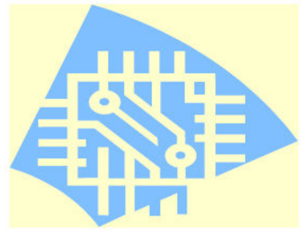
Computer information Systems is (usually) housed with a business department.

Knowledge needed in **Information Systems:**

- Electronic Commerce
- Information Management – Database Skills
- Analysis of Business Requirements
- Organizational Theory and Behavior
- Human-Computer Interaction – psychology and sociology
- Project Management
- Business Models
- Functional Business Areas
- Evaluation of Business Performance

Skills needed in **Information Systems:**

- Define Information Systems Requirements
- Design Information Systems
- Maintain and Upgrade Information Systems
- Model and Design a Database
- Configure and Manage a Database
- Schedule and Budget Resource Upgrades
- Configure e-learning Systems
- Develop Business Solutions
- Communication Skills – Oral and Written
- Interpersonal Skills
- Web Page Design and Construction
- Word Processing



Skills and knowledge needed in both fields:

Networking

Security

Software Use

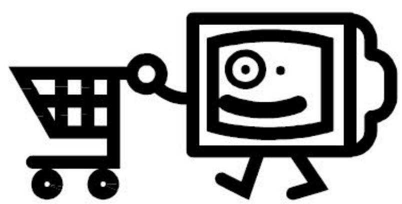
Legal and Ethical Issues

Computer Install and Upgrade

Interpersonal Communication

Internet and Web Skills

Note: Many of these skills and knowledge sets are <u>not outsourcable!!</u>



Computer Science is (usually) housed with a mathematics department.

Knowledge needed in **Computer Science**:

- Mathematical Foundations
- Programming
- Algorithms and Complexity
- Operating Systems
- Graphics and Visualization
- Intelligent Systems
- Scientific Computing
- Software Design

Skills needed in **Computer Science:**

- Prove Theoretical Results
- Develop Solutions to Programming Problems
- Determine if Faster Solutions are Possible
- Produce Graphics
- Design a Database Management System
- Troubleshooting computer problems

This graphic is adapted from items found in Tables 3.1 – 3.3 in "Computing Curricula 2005 – The Overview Report" Produced by "The Joint Task Force for Computing Curricula 2005"