ISSN: 1545-679X
Information Systems Education Journal
Volume 3, Number 45 http://isedj.org/3/45/ August 12, 2005

In this issue:

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Recommended Citation: Lopez (2005). Outsourcing? Offshore? Students Need to Know. *Information Systems Education Journal, 3* (45). http://isedj.org/3/45/. ISSN: 1545-679X. (Also appears in *The Proceedings of ISECON 2004:* §3453. ISSN: 1542-7382.)

This issue is on the Internet at **http://isedj.org/3/45/**

The **Information Systems Education Journal** (ISEDJ) is a peer-reviewed academic journal published by the Education Special Interest Group (EDSIG) of the Association of Information Technology Professionals (AITP, Chicago, Illinois). • ISSN: 1545-679X. • First issue: 8 Sep 2003. • Title: Information Systems Education Journal. Variants: IS Education Journal; ISEDJ. • Physical format: online. • Publishing frequency: irregular; as each article is approved, it is published immediately and constitutes a complete separate issue of the current volume. • Single issue price: free. • Subscription address: subscribe@isedj.org. • Subscription price: free. • Electronic access: http://isedj.org/ • Contact person: Don Colton (editor@isedj.org)

EDSIG activities include the publication of ISEDJ, the organization and execution of the annual ISECON conference 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.

Outsourcing? Offshore? Students Need to Know

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Abstract

Since the collapse of the "dot com" boom, there has been significant media attention given to outsourcing and the migration of information technology jobs offshore. Unfortunately, the story headlines and news sound bites have, for the most part, been less than precise. Some believe that this is contributing to the enrollment drops in the computing disciplines. This paper seeks to put overused terms such as outsourcing and offshore into proper perspective with respect to computing disciplines. It is intended to help faculty guide prospective U. S. college students to the realization that a degree in a computing discipline is very advantageous in many different career fields.

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1. INTRODUCTION

A headline is meant to entice the reader to read the article that follows. A news sound bite is meant to entice the listener to listen to the entire story. However, for many people, who do not go much beyond the headline or the sound bite, these communication techniques might be producing a second-order effect – creating misconceptions. Take for example the June 16, 2004 story headline that appeared in the *New York Times*, "High-End Technology Work Not Immune to Outsourcing" (Lohr 2004). At face value and without much thought, a reader of the headline might interpret "high-end technology work" as the work done by people with college degrees in a computing discipline and "outsourcing" as meaning offshore. So, it is quite plausible that a reader who does not have time to read the article might get the impression that jobs for people with degrees in the computing disciplines are going overseas. If the reader is a parent with a college-age child they might make the following mental note: "Suggest to daughter that she major in International Business because computing discipline jobs are all going overseas and if you can't beat them, be their U. S. business agent." Is that the real message of the article? To fully understand a message requires the sender and the receiver to have the same mental models, and any prior knowledge individuals possess will influence the process (Lehaney et al. 2004).

Human language, written or verbal, is imprecise often causing miscommunications that lead to misconceptions. It is important that educators, in particular, use language as precisely as possible. To this end, "computing discipline" is used in this paper to mean one of the following college programs that lead to a bachelor's degree: Computer Engineering, Software Engineering, Computer Science, Computer Information Systems, Information Systems, Management Information Systems, Information Technology, and the like. That having been stated, there is little doubt that the number of U. S. students entering a computing discipline has declined (Hoffman 2003, Niederman 2004). Also, there is little doubt that miscommunications are at least partially to blame for this.

Firmly lodged in the language of news reports, movies, novels, advertisements, and political speeches is the costly miscommunication that programming defines a computing discipline (Denning, 2004). This leads to a public misconception, specifically in the minds of prospective U.S. college-bound students and their parents. As Denning puts it when describing the thoughts of a prospective student: "If the heart and soul of computing (programming) is being auctioned off to the lowest offshore bidder, what is the future for me?" Is it any wonder with this programmer image and the additional media hype making little distinction between "outsourcing" and "outsourcing offshore" that U.S. students are opting for college degree programs other than those in a computing discipline?

Writing or speaking about "computing discipline careers" is a convenience of language, but it too can cause a miscommunication that can lead to the misconception that careers for people with degrees in a computing discipline are solely in the computer industry. Computing discipline faculty should take their cue from non-industry specific college degree programs in connecting discipline to career (i.e., an occupation or profession

followed as one's life work). Do people with college degrees in English have careers in English? No, they have careers in education teaching English, or they become writers and produce books that the public enjoys reading, or they go on to Law School and have careers practicing law, or they do something else. Similarly, people with degrees in a computing discipline can have careers in education, entertainment, law, and other industries. What do U. S. college-bound students need to know about careers available to those with degrees in a computing discipline?

Finally, the computer industry provides "lenses" through which to view both the outsourcing and outsourcing offshore phenomena. First, it is divided into the hardware industry and the software industry each with corporate giants such as Intel and Microsoft, respectively. Second, within each of these subdivisions it is further divided into those businesses that produce general-purpose commercial products (COTS – Commercial Off The Shelf), and those that produce specialized products for global sale (e.g., hardware and software to manage air traffic control). Yet a different set of "lenses" is provided by those non-computer industries producing specialized computer products for their own use (i.e., restricted sales). Although corporate giants like Intel or Microsoft might employ a great many people having degrees in a computing discipline, far more are employed in non-computer industries (e.g., transportation, energy, finance, etc.). From this point of view, how do outsourcing and outsourcing offshore impact careers?

This paper endeavors to shed light on the outsourcing and outsourcing offshore phenomena that is being hyped to the U. S. public. It elaborates on the concept of a "career field" and gives reasons why faculty in the computing disciplines should discuss such a concept with their students and their prospective students. The paper is concerned with making sure that U. S. college students realize that a degree in a computing discipline is very advantageous in many different career fields. It presents what U. S. students need to know about the real impact on people having degrees in a computing discipline who work in industries that outsource or outsource offshore. It explains how U. S. holders of degrees in a computing discipline can remain in the U. S. with U. S. companies that have outsourced offshore. Finally, it characterizes those jobs requiring a degree in a computing discipline that U. S. companies cannot send offshore.

2. OUTSOURCING AND OFFSHORE

In general, outsourcing means that an organization has contracted with an outside service provider for the performance of some specific function. For example, many universities outsource the daily cleaning of their facilities to a janitorial service provider; the people who are doing the cleaning are not employees of the university. Outsourcing is done for a variety of reasons; however, the most often cited reason is that it saves the business money. In this paper the term outsourcing will presuppose that the employees of the service provider are living and working in the U. S. Note that it does not presuppose that the employees of the service provider are all U. S. citizens. There are U. S. companies that have outsourced functions to service providers whose employees are non-U. S. citizens living and working in the U. S. If the service provider's employees are non-U. S. citizens living and working outside of the U. S., the term offshore is added to outsourcing.

Microsoft, for example, has Indian employees from an outside service provider living and working in Redmond, WA (Lohr 2004). Hence, Microsoft is outsourcing the work being done by these people. Microsoft has also established facilities in India where Indian employees of service providers (Infosys and Satyam) are working. In this case, Microsoft is outsourcing offshore the work done by these people. Microsoft has not publicly stated its reason for outsourcing offshore to India. However, in June 2003, the average salary of an Information Technology (IT) worker in India was $8,593 whereas in the U. S. it was $80,286 (Niederman 2004).

For U. S. businesses and government agencies outsourcing has been a way of life for a very long time. U. S. Agri-businesses outsource the harvesting of crops grown here in the U. S. in order to keep food costs as low as possible. At NASA facilities throughout the U. S., various service providers are operating cafeterias, cutting the grass, maintaining desktop computers, and more. By eliminating the need to put more expensive federal employees on the payroll to perform these functions, NASA's outsourcing saves hundreds of thousands of taxpayers' dollars. Outsourcing builds second-tier economies that are important to U. S. small businesses and the overall health of the U. S. economy.

Outsourcing offshore began in the textile industry and spread to the manufacturing industry. However, there are physical and political limits as to what can be outsourced offshore. U. S. Agri-businesses cannot outsource offshore to Republic of China companies with Republic of China employees the harvesting of crops grown in California. NASA cannot outsource offshore to North Korean companies the construction of a three-stage booster rocket.

IT outsourcing has been defined as "the contracting of various information systems functions such as managing of data centers, operations, hardware support, software maintenance, network, and even application development to outside service providers" (Chandhury et al. 1995). IT outsourcing has been a key means of managing costs since the early 1990s (Loh and Venkatraman 1992). However, it attracted media attention only after the collapse of the "dot com" boom when large numbers of "IT workers" were laid off. The media attention continued as certain "IT jobs" followed the path well trod-

den by the textile and manufacturing industries offshore. Yet, no reliable statistics have been published giving the percentage of those "IT workers" holding a computing discipline degree and what those lost "IT jobs" were. In fact in March 2004, the Institute of Electrical and Electronic Engineers-USA (concerned about computer engineering jobs as well as other electronic jobs) published a position paper on outsourcing offshore (IEEE-USA 2004), and the first recommendation is: "The Federal Government must collect and publish reliable statistics on the kinds and numbers of manufacturing and service jobs that are being moved offshore." Many questions go unanswered because no data has been collected.

When the concern is layoffs and offshore outsourcing, a distinction must be made between high-level, "computing discipline degree required" IT jobs and those IT jobs below that level. An article in *Business Week Online* (2004) tells the story of a high school programming whiz who in 1999 was stopped by his mother from trying to find his fortune in the dot com craze. Instead, he went to college and recently graduated with an advanced computing discipline degree. He is forming a company with three colleagues to develop custom software for businesses in his hometown of Omaha, Nebraska. His computing discipline degree supports his company so offshore outsourcing is not a concern.

Many IT jobs outsourced offshore are help desk jobs. People who hold such jobs typically do not have computing discipline degrees. They are well trained and well versed in the product that they are supporting but in-depth questions regarding the internal workings of the product usually require that a person with a computing discipline degree be summoned to assist. Murphy and Chabrow (2003) argue that the IT jobs outsourced offshore were the routine, repetitive, and largely uninteresting ones.

In an attempt to show data is now being collected, a Labor Department report indicated that in the first quarter of 2004 only 4,633 U. S. jobs were lost to outsourcing offshore (Associated Press 2004). This is about 2% of all jobs lost. The report does not provide the granularity to determine which of those jobs, if any, required degrees in a computing discipline. Furthermore, the figures only included those layoffs at companies employing 50 or more workers, where at least 50 people filed for unemployment benefits during a five-week period and were out of work for more than 30 days. At this stage with little official evidence, what U. S. students need to know is that IT outsourcing and IT outsourcing offshore should not deter them from pursuing computing discipline degrees. In particular, IT outsourcing might not be a negative thing at all but an opportunity for the entrepreneurial spirit that is rooted in the American Dream.

3. CAREER FIELDS

Problems that people solve as part of their work are mostly context specific within a particular field (i.e., an area drawn on or serviced by a business or profession). The skills and talents as well as the machines and tools brought to bear on problems in a field typically create industries. Thus far, this paper has noted seven different industries, but a few more are agriculture, space exploration, and medicine. A career field is an area of personal interest where one is willing to devote a lifetime of work (Lopez 2003). A career field is a human endeavor in an industry. A computing discipline is supportive of career fields in many different industries. For example, in the medical industry, one of Pittsburgh's noted hip surgeons is Dr. Tony Gioia who began his college pursuits in a computing discipline at Carnegie Mellon University (Morris 2004).

In the computing disciplines, there are at least two advantages to having faculty speak with students about career fields as early in the student's college pursuits as possible. First, such discussions can be used to improve the teaching and learning environment. Second, it can help draw the computing discipline away from the programming misconception.

If a computing discipline faculty member can ascertain a student's area of personal interest, the faculty member can teach the student using that context. Furthermore, the faculty member can help guide the student toward a career field where the student can use the computing discipline degree.

Industries are calling for computing discipline graduates to have better communication skills both verbal and written (Kishore et al. 2003). There is no better place to start developing or exercising those communications skills than in communication between computing discipline faculty and their students, and the conduit of that communication can be areas of personal interest and career fields. For example, on the first day of teaching an introductory course, a computing discipline faculty member might discuss the concept of career fields and assign the students a two-page paper that describes their areas of personal interest. Taking a similar approach in an advanced course, the faculty member might assign a paper that describes how an area of personal interest might be moving the student toward a career field.

Faculty members talking about career fields and varying among different industries the problem scenarios presented in demonstrating computing concepts and techniques can broaden the student's awareness of the many different possibilities for employment with a computing discipline degree. Furthermore, faculty can assign team projects and insure that project management is given to the student who might be interested in a career field in the industry from which the project is drawn. Communication is critical in team projects, and communicating

in the language of the industry adds an educational dimension.

Implementing these ideas support the curricula changes that are starting to appear in the literature. Educators are calling for curricula restructuring into a ladder of competencies in best practices (e.g., programming, systems, modeling, and innovation) as well as project management integration throughout the computing discipline, expanded industry knowledge, and a globalization component to include study of a foreign language (Denning 2004, Ferguson 2004). The nature of western economies has shifted permanently from physical assets to one where knowledge is at a premium (Lehaney et al. 2004). Business knowledge – and in many cases industry-specific knowledge – has never been more vital (Murphy and Chabrow 2003). Computing discipline faculty must unveil some of this knowledge to their students, and discussions of career fields can be the conduit through which this knowledge can flow.

A computing discipline is more than programming (Denning 2004, Morris 2004). What is needed in every industry are people with computing discipline degrees who are well versed in an industry and can solve specific computing problems that save an organization money, increase the organization's productivity, and provide an organization with a competitive edge (Murphy and Chabrow 2003). Although programming is fundamental to producing a software product, ask any computing discipline faculty member or any practicing software developer what it the most critical phase of the software development life cycle and the vast majority will say the requirements and specification phase. The faculty member might also add that it is the most challenging phase to teach.

By focusing a discussion on a career field, requirements and specifications for difficult problems take center stage. For example, a career field in the space exploration industry might be launched with the question: How can robots be given sufficient intelligence (initial problem) to survive and explore for long periods of time without human intervention (initial requirements) in the hostile environment found on the surface of Mars (initial specifications)? In the energy industry, a career field might be sparked by the question: How can the power grid be configured to effectively and economically distribute electrical energy yet be robust enough to withstand or even defeat terrorist attempts to bring the entire power grid down? A career field in law might be inaugurated by the question: How can a free and open U. S. society with its billions of megabytes of data passing through or stored on the Internet each day enact meaningful and timely laws that insure the privacy of individuals while allowing the capture and prosecution of terrorists who would use the technology and data to destroy U. S. society?

Questions such as the ones presented in the previous paragraph have much less to do with programming and much more to do with serious problem solving. Graduates with degrees in a computing discipline must be technically competent, but the educational emphasis must be placed on the problems that an industry and businesses in that industry want solved (Ferguson 2004). The paradigm shift from learning the business via programming to having an understanding of the business via its problems (i.e., requirements and specifications) and having the wherewithal to solve them has occurred.

4. INDUSTRY LENSES

New jobs have been created as some U. S. companies have outsourced the production of computer hardware, software, and services to other U. S. companies and to firms in other countries (Mann 2004). In the computer industry, some hardware and software developers of products having global appeal and use (e.g., Intel, HP, Microsoft, Sun, etc.) have reduced the cost of those products through outsourcing and outsourcing offshore. However, in 2002 over 67% of the people using their computing discipline degrees worked outside the computer industry (Mann 2004). In fact, large sectors in the U. S. economy need more workers with computing discipline degrees. Health services and education, which contribute 5% and 2% of the U. S. Gross Domestic Product respectively, are just two such sectors (Mann 2004). U. S. small businesses also need people with computing discipline degrees because they require more tailored computer solutions that the computer industry is not interested in developing and they need the more direct customer care. All of this not withstanding, U. S. government (i.e., collectively local, state, and federal) is by far the largest employer, directly or indirectly (i.e. through outsourcing), of people with computing discipline degrees. In 2003 more than half of these workers were between the ages of 45 and 69, and these jobs, for the most part, cannot be moved offshore (Neiderman 2004).

Product Focus

As students pursue computing discipline degrees and determine their career fields, they need to be aware of the freedoms or constraints products impose. For example, general-purpose software products (e.g., word processors, database management systems, operating systems, etc.) give the software companies that develop them maximum flexibility in deciding who will do the work to improve or maintain the product. For such companies, the booming offshore option makes productivity critical and cost effective. Consequently, by 2003 12% of them had already moved jobs offshore (Niederman 2004). For the most part, these companies are treating programming as a capability that is best bought on an "as-needed" basis, but as previously argued in this paper, people with computing discipline degrees have much more to offer than just programming skills.

Back in 2001, Microsoft contracted with two Indian outsourcing companies (Infosys and Satyam) to provide skilled "software architects"; this appears to be more than just programmers (Lohr 2004). Yet, a Microsoft spokesperson quoted in the article made the point that building the "core intellectual property" in Microsoft products is still left to full-time company employees. Computing discipline faculty members need to make their students aware of such core intellectual properties. This can be facilitated through discussions about various career fields. Core intellectual properties are the business knowledge elements that no U. S. business would be able to outsource offshore or even outsource to another U. S. company and still remain in business. This knowledge is the life's blood of the business, the reason that new employees are asked to sign non-disclosure agreements before they begin working for the company.

Outsourcing work especially outsourcing it offshore requires some scrutiny on the part of U. S. companies. There is work (e.g., programming) that is routine in its nature given a well-defined and structured design, and there is work (e.g., requirements, specifications, and design) that has reached a restricted level because of the business knowledge elements involved. Businesses that make computer products where there is a concern about the security of the data or the product itself are less likely to outsource offshore because foreign countries have different laws regarding privacy and copyright. For example, LeonardoMD is a U. S. company that develops hosted practice management software products for physicians. In the U. S. the misuse of such products has serious legal ramifications. Health services providers need such computer products to maintain sensitive patient data and to perform specialized tasks for medical personnel. Hence, U. S. physicians typically outsource to U. S. companies like LeonardoMD.

In considering career fields in which to use their computing discipline degrees, U. S. students need to know the products being developed by various companies for the particular industry. Outsourcing offshore still allows U. S. students seeking computing discipline degrees to obtain the business knowledge elements that will support their choice of career fields where they will remain in the U. S., even in the computer industry. Outsourcing work to U. S. companies is a way of life in many different career fields, most of which exhibit high degrees of specialization. Understanding this can help computing discipline students better prepare themselves for specialized career fields and avoid frustration after graduation trying to find employment with companies that produce general-purpose computer products.

U. S. Small Businesses

U. S. small businesses are important consumers of computer products and services. They are also providers of such products, and as such are continuously creating jobs and supplying electronic resources to other small businesses (Williams 2000). The U. S. Small Business Administration (SBA) defines a small business as those firms having fewer than 500 employees. U. S. small businesses represent 99.7% of all employers, employ half of all private sector employees, and pay 44.3% of total U. S. private payroll (See www.sba.gov).

Typically, small businesses provide a "personal touch" to their customers, and when they are the customers they expect the same type of customer care from those who are servicing them. Small businesses that produce specialized computer products understand this culture. Customer care in developing computer solutions for small businesses involves a great deal of real-time collaboration between developer and end-user. Small business customers need to have direct contact with the developers of their computer solutions during the course of a normal business day so they will have rapid end-user feedback as well as industry specific knowledge that might have been previous overlooked. In such cases, both the customer and the small business providing the computer solutions (i.e., the beneficiary of outsourcing) are able to keep their intellectual capital and proprietary technology in-house. Yet they can both work together to implement future business solutions. Small businesses have a great advantage in making computer products and offering computer services in integrated groups; they are agile, lean (i.e., low overhead costs), and provide solutions that larger companies find difficult to produce because of their more global proprietary issues. Computing discipline students need to know that such small businesses exist in every industry and offer the best entrances into career fields that will not be outsourced offshore.

Lest the impression be left that small businesses only deal with small businesses, computing discipline students need to know that small businesses can have very large organizations as their customers. For example, the U. S. government is the world's largest purchaser of goods and services to the tune of more that $200 billion annually. Congress has mandated SBA to ensure that U. S. small businesses obtain an appropriate percentage of U. S. government business. According to SBA, in fiscal year 2003 U. S. small businesses supplied over 23% of the total value of federal prime contracts and were the employers of 39% of scientists, engineers, and computer workers.

A recent *Government Computer News* survey (Walker 2004) found that the top three outsourced services are: Helpdesk (65%), Desktop support (64%), and Application development (59%). This report does not indicate if any of these outsourced services have been outsourced offshore. Given the 9/11 attacks on the U. S. homeland it seems illogical that any of this outsourcing would find its way offshore. However, this is not the case. A recent article indicates that several U. S. states have unwittingly outsourced offshore millions of dollars of computer work (Riberiro 2004). This is not politically wise and 19 state legislatures have introduced bills to restrict

and regulate offshore contracting and call centers (GCN 2004). If these laws are enacted, the computer work that the states will outsource will go to U. S. companies, most likely U. S. small businesses. So U. S. students seeking computing discipline degrees will have additional employment opportunities if they wish to pursue career fields in government.

The federal government is also restricting its requests for proposals. For examples, the Citizenship and Immigrations Service Division of the Border and Transportation Security Directorate in the Department of Homeland Security recently requested from vendors fully outsourced IT solutions including case management, electronic filing, Web applications, knowledge management, and data mining for fraud detection (Dizard 2004). The outsourcing of these IT solutions will eventually go to a U. S. company employing U. S. citizens; these outsourced IT jobs will not go offshore.

5. SUMMARY

Human language can often lead to miscommunication that results in a misconception. Equating a degree in a computing discipline with programming is one of those misconceptions. This misconception is compounded when the terms outsourcing and outsourcing offshore are thrown into the mix by an excitable media. The media is reporting that programming jobs are being outsourced offshore, a trend that is bound to continue. This in turn is being cited as contributing to the decline in student enrollments in computing discipline programs.

This paper presented what U. S. students seeking computing discipline degrees need to know about outsourcing and outsourcing offshore phenomena. It calls upon computing faculty to engage in discussions of various career fields with their students. These discussions can have an impact on teaching and learning as well as on the way that requirements and specifications are viewed. Students need to determine their career field as early in their college program as possible and use their college years to prepare themselves with basic industry knowledge for that choice of career field. The paper also reveals industry lenses through which career fields must be viewed, and suggests that better jobs for graduates can be found in U. S. small businesses. What cannot be bought offshore is the business knowledge that such companies have. The paper points out that the U. S. government is a major outsourcer and small businesses service it. Finally research needs to be done on exactly what type of IT jobs are being outsourced offshore, so future computing discipline students can have a clearer picture of their career options upon graduation.

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