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The Market for Career Tracks in Undergraduate IS Curricula in the U.S.

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Abstract

The use of Information Technology (IT) in organizations is broad and rapidly growing. With so many technology topics to cover, Information Systems (IS) educators are faced with the challenge of having to design and develop an IS curriculum that best serves both students and industry. IS curricula often adopt a breadth-first and specialization-second approach in which students take a set of core courses in a fundamental body of knowledge followed by a number of electives in a specialization either by their own preference or by a track design offered by the program. The subject of track design has not been a traditional focus of information systems curriculum study, despite the IS Model Curricula 2010's effort to introduce a separation between core and track courses. The current study examines career track data from IS programs in business and management within the United States. The study performed a content analysis of the websites and university catalogs of 401 IS undergraduate programs and identified 241 career tracks in 82 programs. These tracks are analyzed to better understand their composition and anatomy. The results should help current information systems programs to better understand and structure their own curricula.

Keywords: IS Curriculum, Career Tracks, and Specializations

1. INTRODUCTION

As information technology (IT) continues to evolve, Information Systems (IS) educators have to regularly evaluate and revise their undergraduate curricula in order to produce graduates with the knowledge and skills required by a dynamic industry environment. Designing an adequate IS curriculum has become an ever more demanding duty for IS faculties. IS curricula often adopt a breadth-first and specialization-second approach in which a set of generalized core courses in a fundamental body of knowledge is offered and followed by a number of electives in a specialization area. The selection of specialized courses is determined either by student preference or by a track design offered by the program. Since the IT field is becoming far too broad for one individual to master, the IT workforce has been increasingly specialized with IT skills often categorized into an array of specialized skill sets. One of the major challenges in IS curriculum design is to find a proper balance between generalization and specialization in a wide spectrum of IT subjects and to effectively structure the electives into an intellectual arrangement of career tracks. The resulting tracks should be competitive in the

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marketplace, administratively manageable, flexible enough to change, and sustainable over time.

Many studies have been conducted to better understand the generalized aspects of IS curricula (e.g., common body of knowledge, core curriculum, core courses, etc.), while the subject of specialization in terms of career tracks has not been a traditional focus. At present, educators have yet to embrace a single curriculum design model and supporting guidance for IS career track development. Still needed is an improved understanding of career track design in practice and its implications for curriculum development.

A classic analysis of the IS literature by Jones (1997) indicates that the study of IS curricula can be approached normatively or descriptively. The normative approach seeks to determine factors for IS that would affect IS curriculum design or to develop norms or standards for IS curricula, while research taking the descriptive approach intends to depict IS courses or programs as they currently exist. This study takes the descriptive approach to the understanding of career track design in IS programs in business and management within the United States.

2. RELATED LITERATURE

Specialization-driven IS curriculum design received early attention from some educators. Lee, Trauth and Farwall (1995, p. 333) argued that "the concept of a generic curriculum to meet the needs of all future MIS professionals is obsolete, and different IS curricula should be tailored to meet the needs of different IS careers." In an analysis of the dilemma between the fad and the fundamental in IS education, Lightfoot (1999, p. 48) indicated that the "single career track" IS professional was outdated and that IS programs should be tailored to "allow students to select courses that emphasize the learning units most important to their chosen career path." The 2002 IS Model Curriculum suggested that “IS curriculum design must be driven by a clear vision of the career path for the graduates” (Gorgone et al., 2002). In a subsequent effort, the IS Model Curriculum 2010 devised a new curriculum model which recommends, for the first time, customization of IS curricula for variable local contexts through the specification of career tracks (Topi et al., 2010).

Proponents for IS curriculum with specialization have outlined a list of rationales and advantages for career tracks. As argued by Slazinski (2005), it is more productive for IT students to concentrate their studies in a specific interest area for the job market. In an empirical study, Downey, McMurtrey, and Zeltman (2008) further concluded that offering a career track is a must and will produce better-qualified hires. In Ehie’s (2002) survey of industry’s expectations for IS curriculum development, it was found that although IS concentrations were located primarily in graduate level programs, a majority of practitioners favored niche areas (or concentrations) in undergraduate curricula. In a study on the decline in IT enrollments by Lenox, Woratschek, and Davis (2008), creating new career tracks was found to be one of the common attempts made by respondents to increase enrollments in IS programs. Offering specialized fields through career track also helps address the local employment needs (Kahn, 2011).

Taking a more focused perspective, some studies looked deeper into the design and development of individual career tracks including business analysis (Sidorova, 2007), database management (Slazinski, 2009), enterprise resource planning (Boyle, 2007), healthcare systems (Khan, 2011), information security (Foltz & Renwick, 2011), and telecommunications (Hawk, 2005). From another perspective, two studies collected a wide range of career track data and presented a landscape view of the career design in the U.S. (Hwang & Soe, 2010) and the U.K. (Stefanidis, Fitzgerald, & Counsell, 2013). The U.K. study utilized the IS Model Curriculum 2010 to develop a method for ranking career tracks of undergraduate IS offerings. Finally, from the operational perspective Soe and Hwang (2007) documented an internal curriculum evaluation process aiming at creating proper career tracks.

The creation and maintenance of career tracks is not an easy task. Such an approach is usually constrained by constant technology advances, available department resources, faculty specialties and interests, and credit hour limitations (Tesch, Elaine, & Gerald, 2003; Soe & Hwang, 2007). Owen (2003) also pointed out that as the number of areas of specialization grows and the student’s individual desires for their own education factor in, offering career tracks could become more difficult and unmanageable. In the aforementioned individual career track studies, concerns were frequently raised in regard to the adequate depth (i.e., course content) and coverage (i.e., number of courses) of an individual track and the optimal structure of multiple tracks.

The studies reviewed indicate that the importance of career track in IS curriculum development has been increasingly recognized by the industry and the academics. Although studies exist which focus on individual IS areas of specialization, the current understanding of overall design and arrangement of career tracks in practice is still very limited.

3. METHODOLOGY

This study uses the Web as its primary data source. Use of online information from university websites has three advantages: the return rate is 100%; the respondent’s memory or interpretation is irrelevant; and it is timely and cost-effective. This form of content analysis, as a popular research methodology in the electronic age, made it possible to accurately collect and verify career track data by analyzing relevant web-based text with a vast array of IT acronyms, concepts, and themes without the need for researcher intervention (Kim and Kuljis, 2010).

To the best knowledge of the authors, an official list of IS undergraduate programs in business and management does not exist. However, a comprehensive list of business and management schools can be compiled from a thorough Google search using websites such as univsource.com, wikipedia.com, allBusinessSchools.com, and so on. The resulting list of business and management schools can then be further refined using Google to provide a roster of 401 IS undergraduate programs within the United States. Since the purpose of this study is to examine career track design in the United States, both public and private AACSB-accredited and non-AACSB-accredited schools are included. These academic institutions all require students to take a set of pre-defined business courses along with courses in the IS major. The data collected is a snapshot in time from February to May 2013.

Using the compiled list of schools, this study performed a content analysis of the websites and university catalogs of these IS programs to identify those with specializations or career tracks as part of their curriculum structure. When necessary, course listings and contents were carefully reviewed to clarify ambiguous track names and to provide a categorization basis for career track profiling. The data items of each track, including university name, program title, department name, were entered into Excel worksheets for the purpose of categorizing, summarizing and ranking.

4. RESULTS: THE MARKET FOR CAREER TRACKS

This study identified 241 career tracks in 82 or 20.5% percent of the 401 IS undergraduate programs in business and management within the United States. These career tracks, also called *emphases*, *concentrations*, *options*, *models*, *specializations*, *specialties*, *paths*, *certificates*, or *support areas*, have a distinct title and offer a number of cohesive but constrained electives. Many of the IS programs were also found to offer a large number of electives without being grouped into career tracks.

Career Track Names

Because career track names convey information about the graduates' preparedness for the IT workforce, choosing proper words for the name is an essential task. Proper track names also enable career track advisors to conduct appropriate advising. The names of the identified tracks are generally combinations of keywords from the IT discipline. The tracks are named after either common IT job titles or subject areas in which the program faculty members specialize. In some cases as explained in the next section, the naming variations also reveal how faculty chose to fashion their career tracks to differentiate or to convey special meanings for their constituencies. However, too much variation would lead to inconsistent track representation and cause confusion for students.

Programs and Number of Tracks

As shown in Table 1, of the 82 programs with track design, the most common offering was two career tracks (42.7%) with slightly more than half offering either one or two tracks (52.5%). This is probably because these designs still offers students a choice while a larger numbers of tracks would require greater academic resources and foster a more complex curriculum design. The median number of tracks offered was two. Only one program offered as many as nine tracks (1.2%).

Career Track Categories

Number of Tracks	Number of Programs	% of Total
1	8	9.8%
2	35	42.7%
3	14	17.1%
4	12	14.6%
5	5	6.1%
6	7	8.5%
9	1	1.2%
Total	82	100.0%

Table 1. Number of Tracks in Programs with Career Tracks

Track Category	Program Count	% Total
Business Functional Applications	41	17.0%
Information Assurance, Security and Forensics	35	14.5%
IS Disciplines	33	13.7%
Applications Development	27	11.2%
Networking/ Telecommunications	27	11.2%
Web Development	21	8.7%
Business Intelligence	13	5.4%
Systems/Business Analysis	13	5.4%
E-business/E-commerce	11	4.6%
Data/Information Management	10	4.1%
Specialized Information System Studies	10	4.1%
Total	241	100%

Table 2. Track Categories and Number of Offering Programs

One of the major tasks in profiling career tracks is to develop an intellectual and adequate categorization scheme for the tracks. The IS 2010 Model Curriculum (Topi et al., 2010) suggests a group of sixteen career tracks (i.e., application developer, business analyst, business process analyst, database administrator, etc.) which tend to reflect common IT job titles, not careers. Unfortunately, this study found it difficult to usethese job title-denoted tracks to categorize the 241 identified career tracks in practice. Instead, the current study followed an approach used by a previous survey on career tracks by Hwang and Soe (2010) to develop a more practical categorization framework. Such an approach uses track name, track description, track course listing, and individual course content of the tracks as the basis for classification. This approach aims for the right granularity level, so that categories will represent meaningful groups that correspond to IS subfields and topics and represent the content of the track offerings.

Some categories represent more established IS specializations such as Applications Development, Networking/Telecommunications, Systems/Business Analysis, and Data/ Information Management. Some represent relatively new areas emerging within the last decade such as Information Assurance, Security and Forensics, Web Development, and E-business/E-commerce. A significant number of tracks appear in the IS Discipline (IS, MIS, or IT) category which is purposefully created to distinguish the program's other more specialized tracks. The Business Functional Applications category consists of tracks that address the development and use of information systems in various business domains or application scopes. Finally, the Specialized Information Systems Studies category includes tracks emphasizing a variety of specific information systems or studies that individually do not have a sufficient number to constitute a separate category. Appendix Table A-2 shows a detailed list of track names within category.

In general, career tracks were found to have a technical orientation echoing a similar finding from a recent study by Stefanidis, Fitzgerald, and Counsell (2012) on career track design in the U.K. Technically oriented career tracks were also found to be more aligned with the industry demand. In an empirical study (Downey, McMurtrey, and Zeltmann, 2006) that compares the critical knowledge and skills offered by IS curricula and those sought by the industry, a practical IS curriculum is the one that is designed "to make the major technically robust while simultaneously providing a core foundation in both business and IT."

The following subsections briefly discuss each track category in order of size from largest to smallest.

Business Functional Applications

Forty-one tracks (17.0%) specialize in the development and use of information systems in such business functional areas as *Accounting*, *Finance*, Marketing, *Enterprise Computing, Operations*, and Office Administration. The goal of these tracks is to prepare students to bridge the gap in organizations between the IT function and the other particular business functions. Besides the more established specialty tracks such as *Geographic Information Systems* (GIS) and *Healthcare systems*, other niche tracks include *Industrial Computer Applications, Organizational Information Systems*, and *Managerial Applications*.

Information Assurance, Security and Forensics

There are 35 programs (14.5%) offering career tracks specialized in *Information Assurance, Security and Forensics*. The emergence of these tracks could be a result of the recently increased demand for graduates knowledgeable in information security due to the 9/11 event and information auditing required to comply with the Sarbanes Oxley Act, a legislation enacted in response to the high-profile Enron and WorldCom financial scandals to protect shareholders and the general public from accounting errors and fraudulent practices in the enterprise. As a newer IS subfield, variation of track names in this category is inevitably wide. Another explanation is that the terms *information security*, *computer security* and *information assurance* are frequently used interchangeably. To make the track name more distinguishable, the study also found that "cyberbase" as a more modern word is used in the *Cyberbase Security* track and "digital" as another flashy term is used in the *Digital Forensics* track.

Graduates from these specializations assist businesses in the design, implementation, and management of secure information systems and networks. Fundamental subjects include networking, data communications, network security, information security, database security, data recovery, e-commerce, and ethics. More specialized courses include encryption, cryptography, computer forensics, computer crime, risk management, emergency management, penetration testing, intrusion detection and incident response, and access control.

Tracks in IS Auditing prepare students to audit computer-based systems. Since the knowledge required in this area includes accounting practices and accounting information systems, students pursuing this specialization usually take some accounting courses. In fact, accounting majors may make this concentration one of their study options, while IS students may consider a second major or minor in accounting with auditing as a concentration.

IS Disciplines

Thirty-three (13.7%) tracks were identified in this category. These tracks serve to distinguish the program's other more specialized tracks. For example, a particular IS program may offer an Information Assurance track to separate its Management Information System track.

Further content analysis on the course offerings indicate that *Management Information System* (MIS) programs generally prepare students to work with IT to manage business information assets, *Computer Information Systems* (CIS) programs educate students in the development, operation, and maintenance of computer-based IS, and *Information Technology* (IT), as a more recent addition, emphasizes hardware, technology integration and deployment, and interoperability.

Applications Development

Twenty-seven (11.2%) programs have tracks in *Applications Development*, a more traditional and established area. Accordingly, track names in this category are more standard as some general IS concepts such as problem solving, design, programming, and development are frequently used. For the same reason, precise IT job titles such as "Developer" and "Programmer Analyst" are also being used as the track name.

In this category, students develop broad knowledge in systems design, computer programming, database management, and project management. In terms of programming skills, students are usually required to take one or two programming languages and/or specialize in a variety of development environments, such as interactive or event-driven programming.

Networking/Telecommunications

Networking and Telecommunications (27 or 11.2%) represents the infrastructure perspective of IT including technical and management skills necessary to develop and manage computer and telecommunications networks. As another more established IS subfield, track names in this category can be combinations of the word network(ing) or telecommunications and common keywords such as "administration," "analysis," "design," "development," "engineering," "security," and "management".

Because of its emphasis on infrastructure components, courses often are offered in conjunction with other disciplines such as Communications, Computer Science, and Electrical Engineering programs. Review of course offerings also reveals that Networking and Telecommunications tracks are not necessarily different.

Web Development

This specialization (21 tracks or 8.7% of the total) arose during the explosion of the Internet computing in the 1990s. *Web Development* tracks provide the educational foundation and skills to design, develop, and implement Web-based applications.

Tracks with "Presence" and "Design" in their name focus on the client-side development of websites, while those without generally emphasize on server-side, database-driven Web applications development or both. In a few cases, Web applications also include e-commerce applications. In one particular track called "Web and Mobile Development," mobile applications development is part of one course offering. To differentiate, one track uses "i-Business" applications instead of "Web applications".

Students in this track category generally take courses in the subjects of Web design, Web programming, database management, and multimedia. Deeper tracks cover Web server operations, website administration, and Web standards and Protocols. Since modern Web development largely utilizes packaged development environments such as ASP.net, PHP, and JSP, the use of computer languages is also required in the course offerings. The addition of these languages can be expected to result in an overlapping skill set required by the Application Development track.

Business Intelligence

Thirteen tracks (5.4%) are categorized in the area of Business Intelligence. In coping with the explosive growth of digital data stored in computer databases, this track focuses on the leveraging of the information and knowledge assets to develop more competitive strategies and make better decisions. The two most common track names are Business Intelligence and Business Analytics, with four programs each. Because of their quantitative and analytic orientation, the majority of these tracks are hosted by departments with multiple disciplines in business including management science, operations management, decision sciences, and accounting.

Students in this category are required to take courses in subjects such as statistical analysis, database management, database applications, business modeling, data mining, decision support, and a few others. Common tools used in this regard include SPSS, SAS, Excel, and Microsoft Project.

Systems/Business Analysis

Business/Systems Analysis is another long established career specialization (13 or 5.4% of tracks). Traditionally, systems analysts use their knowledge and skills to solve information problems. Business Analysts work directly with management and users to analyze, specify, design and implement business applications. The Systems Analysis tracks typically use a combination of System(s) and Application with Analysis or Analyst in the track name.

Students in this track take courses in the areas of information planning, information engineering, database management, data modeling, IT Architecture, software quality control, systems security, and/or project management. To enrich the students' business analysis skills, some tracks require courses in other business domains such as decision support, cost accounting, or simulation.

E-business/E-commerce

Eleven (4.6%) tracks are in the *E-business/E-commerce* category. Tracks in this category tend to be similar: Electronic Business, Electronic Commerce, and Internet Commerce. While two tracks focus precisely on the marketing side of the e-business/e-commerce, several others allow students to take elective courses from the marketing department. In an interdisciplinary approach, one track called "Electronic Business Marketing" creates an electronic business marketing program that combines a well designed course set from both the marketing and the business information systems department.

Since E-commerce systems are frequently either Internet-based or Web-based, course offerings in these tracks emphasize e-commerce, but differ little from the Web Development tracks. Thus, students in one emphasis may take courses in the other.

Specialized Information System Studies

There are 11 (4.1%) tracks in the *Specialized information Systems/Studies* category that represent a variety of specific information systems or studies that individually lack the numbers to constitute a separate category. These tracks represent specializations in such areas as decision support, end-user computing, IT leadership, e-government, and project management.

One track named *Information Architecture* is in the special area of designing and implementing information systems that support and enable business strategies and operations. The track addresses topics covering concepts such as usability, information design, component-based design, and enterprise systems.

Data/Information Management

Data/Information Management (10 or 4.1%) concentrates on the organization, storage, retrieval, and employment of business data and information. Tracks in this category have names that emphasize design, development, administration, management of data and information. Course offerings address the spectrum of data concepts such as data structures, data warehousing, data communications, database design, database administration, and database management. On the information side, courses in the track cover information networking, information technology, information problem solving, and information systems planning and policy.

Two special tracks in this category expand the traditional concept of data. In one special track called "Data Media and Design," computer graphics is considered as another major element of data largely developed in the digital media. In another track called "Information and Knowledge Management," information and knowledge are viewed as an integral unit in the production of today's digital products, digital service, and social media.

Career Tracks vs. Industry Job Market

How meaningful are career tracks to future employment? To answer this question, this study mapped the eleven career tracks categories to the top areas for hiring entry-level IT workers as described in a recent, longitudinal study by Aasheim, Shropshire, Li, and Kadlec (2012). Appendix A-1 shows the results of the comparison.

The Aasheim et al. study (2012) analyzed 282 responses from IT managers to determine planned hiring needs for entry-level IT workers during the coming year. The results were grouped into hiring areas with the top 12 categories and their planned hiring rates as shown.

Not all tracks mapped to top hiring areas. Since only the top 12 entry-level IT hiring areas are listed, it is not surprising that some tracks, which are by definition specialized, do not all map to these high demand occupations. Tracks that represent regional employment and/or local faculty interests, for instance, may serve important regional needs but would not necessarily map to top hiring trends.

Of the track categories identified in this study, two categories, *IS Disciplines* and *Specialized Information System Studies*, describe tracks which do not appear targeted at a top hiring occupation. Tracks in the IS Disciplines category represent more traditional subdisciplines (IS, MIS, IT) within the field and generally exist to distinguish the program's other more specialized tracks. Specialized Studies represents such areas as decision support, end-user computing, IT leadership, e-government, and project management.

It should also come as no surprise that the IT Help Desk hiring area is without a career track category. This follows since a college degree is typically not a requirement for entry-level work in this area. The Bureau of Labor Statistics (2013) indicates "Some college, no degree" as the minimum level of education for work in this career track.

All nine of the remaining track categories map to top hiring areas. Some tracks can be seen to have a direct match with a single hiring area (e.g., business intelligence) while others tracks, with different titles (web development vs. e-business), appear to target the same hiring area of Web Design & Development.
Networking/Telecommunications tracks appears well designed to support a high demand for jobs in the area of telecommunications with a planned hiring rate of 34.5%. Applications Development and Business Functional Applications tracks appear well placed with jobs in programming/software engineering showing an expected hiring rate of 33.5%. Data/Information Management tracks directly support the hiring area for database workers with a planned hiring rate of 29.9%. Information Assurance, Security and Forensics tracks support hiring for workers in the area of information security with a hiring rate of 29.4%. Systems/Business Analysis tracks support the need for hiring workers in the area of systems analysis & design with a hiring rate of 25.3%. Business Intelligence tracks should find their students looking forward to employment in the business intelligence area with a hiring rate of 23.2%. Finally, both the Web Development and E-Commerce tracks appear well suited to support employment in the area of web design & development with a planned hiring rate of 22.2%.

What is surprising is the apparent discrepancy between two top hiring areas and the lack of career tracks to support them. The Aasheim study indicates that the rapid growth of cloud computing and its heavy use of online storage and virtualization have created a strong hiring demand for graduates to support these services. In spite of this growth, it appears not enough is being done to support graduates with skills in the areas of Storage (22.7%) and Virtualization (21.7%).

5. CONCLUSIONS AND RECOMMENDATIONS

This study performed a descriptive analysis of 401 undergraduate IS program in the United States (in business and management within the United States,) yielding a snapshot of track design at 82 programs with 241 career tracks. General conclusions are listed in the following subsections, followed by recommendations for future study.

Programs and Number of Tracks

Only 82 (20%) of the 401 undergraduate programs examined in this study offered career tracks in their curriculum designs. The most common offering was two career tracks (47.2%), probably because this design still offers students a choice while a larger numbers of tracks would require greater academic resources and foster a more complex curriculum design. Only one program offered as many as nine tracks (1.2%). Based on recent entry-level IT hiring data, tracks do appear well matched to place graduates in high demand occupations in the field. Of the top twelve hiring areas identified, career tracks appear targeted at placing graduates in nine of these areas. Several top hiring areas do not appear to have matching career tracks and these areas deserve closer examination by IS faculty.

Track Naming

As might be expected, track names often reflect the names of established subfields within the IS discipline. Names such as Application Development or Systems Analysis & Design are found among the 241 career tracks offered. It is also common to find track names, which described possible careers paths such as Systems Analyst. More often than not, track names are a blend of an IS subfield such as Networking and one or more generic keywords such as Management.

Of particular interest is the wide range of variation in the career track names being used. The vast majority of track names are unique to the school or program offering it. Even in a traditional IS subdiscipline such as Application Development, 14 of the 18 track names, or 78%, are used only once. The category of specialized studies contains 10 career track offerings and all are unique to their institutions. In total, 145 of the 170 career tracks identified in this study, or 85%, have unique names.

Apparently faculty either do not review track names from other programs or prefer to distinguish their school by using names that invoke meanings that are so specialized to their reputations, values, and expertise that duplication is unlikely. Taken together, the wealth of career track names should make a clear statement regarding the preparedness of the graduates for their future employment.

Track Categories

A careful review of the relevant data revealed that the 241 career tracks under study can be grouped into 11 career track categories. Of these 11 categories, only five represent the more traditional or standard areas of study within the field. These five are Application Development, Data/Information Management, IS Disciplines (IS, MIS, IT), Networking/Telecommunications, and Systems/Business Analysis. The remaining career tracks are a reflection on the dynamic nature of the field and demonstrate how faculty are working to maintain and update these specialized areas as the field changes. New and rapidly evolving areas of study such as Information Assurance, Security and Forensics and Web Development speak well of the ongoing innovation to curricula being done by faculty across the country.

Recommendations for Future Research

One area of future research would be to determine if IS graduates who pursue a career track have better employment prospects than those who do not. More empirical data is need to understand the comparative prospects of the 80 percent of the programs not offering career tracks at all. Career tracks require coordination and oversight. Possible differences in this regard may lie in the size of the programs in terms of both students and faculty, AACSB accreditation status, demands on faculty time for research, and part-time vs. full-time faculty composition. One of the limitations of this paper is that even though it can be expected that business schools use their websites as the primary media for communication, the website might, in fact, not reflect current course offerings.

More research is needed on the occupations and career paths of IS graduates who pursue a specialization track. The approach used in this study was to map career tracks to top hiring areas and these results look promising. Capturing actual hiring data and comparing these results with graduates' areas of specialization could help programs determine the effectiveness of their career tracks. Many campuses have a career center responsible for monitoring the placement of graduates and this would a good place to start with data collection.

This study did not examine the qualification of the career track in terms of the depth and breadth of coverage provided. In this regard, what does it take to be called a legitimate track? An area of future research should compare career track structures to determine which structures IS faculty prefer.

6. REFERENCES

Aasheim, C., Shropshire, J., Li, L., & Kadlec, C. (2012). Knowledge and Skill Requirements for Entry-Level IT Workers: A Longitudinal Study. *Journal of Information Systems Education*, 23(2), 193-204.

Boyle, T.A. (2007). Technical-Oriented Enterprise Resource Planning (ERP) Body of Knowledge for Information Systems Programs: Content and Implementation. *Journal of Education for Business*, 82(5), 267-275.

Bureau of Labor Statistics (2013). *Occupational Outlook Handbook*. Retrieved June 27, 2013 from http://www.bls.gov/ooh/computer-and-information-technology.

Downey, J. P., McMurtrey, M. E., & Zeltmann, S. M. (2008). Mapping the MIS curriculum based on critical skills of new graduates: an empirical examination of IT professionals. *Journal of Information Systems Education*, (19(3), 351-63.

Ehie, I. C. (2002). Developing a Management Information Systems (MIS) Curriculum: Perspectives from MIS Practitioners. *Journal of Education for Business*, 77(3), 151-158.

Foltz, C.B., & Renwick, J.S. (2011). Information Systems Security and Computer Crime in the IS Curriculum: A Detailed Examination. *Journal of Education for Business*, 86(2), 119-125.

Gorgone, J.T., Davis, G.B., Valacich, J.S., Topi, H., Feinstein, D.L., & Longenecker, H.E. (2002). IS 2002 – Model Curriculum and

Guidelines for Undergraduate Degree Programs in Information Systems. *Communications of the Association for Information Systems*, 11(1), 1-63.

Hawk, S. (2005). Specializing in Telecommunications: Networking Curricula of IS Programs in the United States. *Journal of Information Technology Education*, 4, 373-388.

Hwang, D., & Soe, L. (2010). An Analysis of Career Tracks in the Design of IS Curricula in the US. *Information Systems Education Journal*, 8(13).

Jones, M. R. (1997). It All Depends What You Mean by Discipline," in *Information Systems: An Emerging Discipline?* Mingers, J. and Stowell, F. (eds.), McGraw-Hill, London.

Khan, S. N. (2011). Strengthening The Curriculum Of Information Systems Program. *Review of Business Information Systems*, 15(3), 23-34.

Kim, I., & Kuljis, J. (2010). Applying Content Analysis to Web-based Content. *Journal of Computing and Information Technology*, 18(4), 369-375.

Lee, D.M.S., Trauth, E.M., & Farwell, D. (1995). Critical Skills and Knowledge Requirements of the IS Profession: A Joint Academic/Industry Investigation. *MIS Quarterly*, 19(3), 313-340.

Lenox, T.L., Woratschek, C.B., & Davis, G.A. (2008). Exploring Declining CS/IS/IT Enrollments. *Information Systems Education Journal*, 6(44), 1-11.

Lightfoot, J. M. (1999). Fads vs. Fundamentals: The Dilemma for Information Systems Curriculum Design. *Journal of Education for Business*, 75(1), 43-50.

Noll, Cheryl L., & Wilkins, M. (2002). Critical Skills of IS Professionals: A Model for Curriculum Development. *Journal of Information Technology Education*, 143-154.

Owen, W. (2003). Focus Tracks: Specializing in IT Education. *Proceedings of the 4th Conference on Information Technology Curriculum*, 135-138.

Slazinski, E.D. (2005). Observations on Implementing Specializations within an IT Program. *Encyclopedia of Information Science and Technology*, 2161-2167.

Soe, L., & Hwang, D. (2007). Career Track Design in IS Curriculum: A Case Study. *Information Systems Education Journal*, 5(29).

Stefanidis, A., Fitzgerald, G., & Counsell, S. (2013). IS Curriculum Career Tracks: A UK Study. *Education+Training*, 55(3), 220-233.

Tesch, D., Elaine C., & Gerald F. B. (2003). Evaluating IS Curriculum Issues through an Ongoing Alumni Assessment Mechanism. *Journal of Computer Information Systems*, 44(2), 40-48.

Topi, H., Valacich, J.S., Wright, R.T., Kaiser, K., Nunamaker, J.F., Sipior, J.C., & De Vreede, G.J. (2010). IS 2010: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems. *Communications of the Association for Information Systems*, 26(1), 359-428.

Appendix

Table A-1: Comparison of Career Track Categories with Aasheim's Areas for Hiring Entry-level IT Workers

Aasheim Entry-Level IT Hiring Area	Hiring* Rate	Track Category in this Study
IT Help Desk	45.9%	
Networking	34.5%	Networking/Telecommunications
Programming/Software Engineering	33.5%	Applications Development Business Functional Applications
Database	29.9%	Data/Information Management
Security	29.4%	Information Assurance, Security and Forensics
Systems Analysis & Design	25.3%	Systems/Business Analysis
Business Intelligence	23.2%	Business Intelligence
Web Design & Development	22.2%	Web Development
Web Design & Development	22.2%	E-business/E-commerce
Storage	22.7%	
Virtualization	21.7%	
Enterprise Resource Planning Systems	20.1%	Business Functional Applications (ERP)
Disaster Recovery	17.5%	Information Assurance, Security and Forensics (Computer Security)
		IS Disciplines (IS, MIS, IT)
		Specialized Information System Studies

* Hiring rate measured respondents (n=194) intention to hire entry-level IT workers within a given area during the following year. More than one area could be selected so percentages total greater than 100% as shown.

Table A-2: Track Names within Categories

Business Functional Applications	**41**
Accounting	**7**
Accounting	2
Accounting & Information Systems	5
ERP	**9**
Enterprise Information Systems	
Enterprise Resource Planning	1
Enterprise Resource Planning Systems	1
Enterprise System	4
Enterprise Systems (ERP) Technology Management	1
Enterprise Systems and Enterprise Resource Planning	1
Finance	**3**
Finance	1
Financial Management Systems1	1
Financial Systems	1
GIS	**3**
Geographic Information Systems	3
Healthcare	**4**
Health Informatics and Information Management	1
Health Information Systems	2
Healthcare Information Systems	1
Marketing	**2**
Marketing & Information Systems	2
Office Admin	**3**
Administrative management	1
Microsoft Office Specialist	1
Office Information Systems	1
Operations	**7**
Logistics Information Systems	1
Operations and Supply Chain Management	1
Retail Management and Technology	1
Supply Chain and Operations	1
Supply Chain Information Systems	1
Supply Chain Management	1
Supply Chain Management Systems	1
Others	**3**
Industrial Computer Application	1
Managerial Applications	1
Organizational Information Systems	1
Information Assurance	**35**
Audit	**5**
Audit	1
Information Systems Auditing	1
Information Systems Auditing and Control	1
IT audit & Control	1
IT Auditing	1
Computer Security	**27**
Computer Information Systems and Security	1
Computer Security	2
Cyber Security	1
CyberSecurity	1
Enterprise Security	1
Homeland Security	1
Information Assurance	5
Information Assurance and Computer Security	1
Information Security	6
Information Security and Architecture	1
Information Security and Assurance	1
Information Security Management	1
Information Systems Security	1
Infrastructure Assurance	1
Insurance Security & Assurance	1
IT Risk Consultant	1
Security	1
Forensics	**3**
Computer Forensics	2
Digital Forensics	1
IS Disciplines	**33**
Business Information Technology	1
Computer Information Systems	5
Generic CIT	1
Information Systems	10
Information Technology	5
Information Technology Management	1
Information Systems	1
IS Management	1
Management & Information Systems	1
Management Information Systems	6

Application Development	**27**
Application Development	6
Business Application Development	1
Computer Programming	1
Developer	1
Development	1
Information Resource Specialist	1
Information Systems Development & Implementation	1
IT Applications Development	1
Problem Solving & Programming Techniques	1
Programmer/Analyst	2
Programming	1
Software and Web Application Development	1
Software Design and Development	1
Software Development	2
Software Engineering and Database Design	1
Systems Analysis, Design, Implementation and Management Knowledge	1
Systems Design/Development	1
Systems Development	3

Networking /Telecommunications	**27**
Networking	**24**
Data communications, networking and distributed processing	1
Information and Communications Technology	1
IT Infrastructure Operations and Management	1
Network Administration	2
Network Administration and Management	1
Network and Enterprise Management	1
Network Design and Administration	1
Network Development and Management	1
Network Engineering	1
Network Management	2
Network Security Analysis	1
Network Technology Specialist	1
Networking	5
Networking & Information Security Knowledge	1
Networking and Security Emphasis	1
Networking Systems	1
Networks and Cybersecurity	1
System Administration	1
Telecommunications	**3**
Telecommunications & Information Management	1
Telecommunications and Computer Networks	1
Telecommunications and Networked Systems	1

Web Development	**21**
Enterprise Web Development	1
i-business application development & management	1
Internet technologies	1
Web	1
Web and database administration and management	1
Web and Mobile Development	1
Web Application Development for Business	1
Web Applications Developer	1
Web Based Applications	1
Web Design	1
Web Development	5
Web Presence Management	1
Web Technologies	1
Web/System Administration	1
Web-Based Systems	1
Website Design	1
Website Development	1

Business Intelligence	**13**
Business / Data Analytics	
Business Analytics (4)	
Business Analytics Knowledge	
Business Intelligence (4)	
Business Intelligence Analyst	
Business Intelligence and Analytics	
Data Mining	

Systems/Business Analysis	**13**
Analysis	**1**
Analyst	1
Business Analysis	**5**
Business Analysis	4
Business Systems Analyst	1
Systems Analysis	**7**
Information Systems Analysis and Design	3
System Design Emphasis	1
Systems Analysis and Design	1
Systems Analyst	2

E-Business/E-Commerce	**11**
e-Business	1
E-Business and E-Commerce	1
E-business and Multimedia	1
E-Business Management	1
E-Commerce	2
E-Commerce Marketing	1
Electronic Business Marketing	1
Electronic Commerce	1
Electronic Commerce Systems	1
Internet Commerce	1

Data/Information Management	**10**
Data / Technical Analyst	1
Data Analytics	1
Data Base Management Systems	1
Data Management	1
Data Media and Design	1
Database Administration	1
Database Design and Development	1
Database Management	1
Information and Knowledge Management	1
Information Architecture	1

Specialized IS Studies	**10**
Database and Decision Support	1
Decision Management	1
Decision Support Systems	1
E-Government	1
End User Training	1
End-User Computing Systems	1
Global IT leadership & management	1
Project Lifecycle	1
Project Management	1
Solutions Architecture	1

Working with Real Companies, Making a Real Impact: Student Perspectives on the Google Online Marketing Challenge

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Abstract

The Google Online Marketing Challenge is a global student competition in which teams are given $250 to develop and run an online advertising campaign for a business or non-profit organization over a three-week period. Despite the fact that 50,000 students have competed in the Challenge since its inception in 2008, relatively little is known about the students' experience in the Challenge. To address this shortcoming, this paper provides an overview of how the Challenge was implemented in an undergraduate Computer Information Systems class and then answers the following research questions: What do students like about the Challenge? What do students learn in the Challenge? How can the students' experience in the Challenge be improved? This research addresses these questions using quantitative and qualitative responses to a student survey. Results suggest that students enjoy working on a real project, seeing cause and effect in action, and gaining marketable skills. The key learning outcome of the Challenge is being able to explain core concepts in online marketing (such as click-through rate, landing page experience, and return on investment). Students like having the choice between finding a client on their own or being assigned a client by the professor. Also, according to the students, a four-member team is the ideal size for the Challenge. Furthermore, students would like to work on additional case studies relating to online marketing. Lastly, students recommend pre-selecting clients based on their willingness to use Google Analytics, as this would significantly improve students' ability to optimize campaign performance.

Keywords: Google Online Marketing Challenge, student perceptions, experiential learning, search engine marketing

1. INTRODUCTION

"Working with real companies was rewarding as we were having a real impact on the company with our marketing efforts." – Student

In its fifth year, the Google Online Marketing Challenge (the Challenge) has attracted over 50,000 students from almost 100 countries (Google, 2013b). Every spring semester, Google gives higher education student teams $250 to develop and run an online advertising campaign for a business or non-profit organization over a three week period. As part of the Challenge, students prepare and submit two reports to Google: a pre-campaign report, which describes the planned campaign, and a post-campaign report, which describes the results and lessons learned. After the pre-campaign report has been received and approved by Google, teams receive a credit of $250 in their respective AdWords accounts. They then have three weeks to launch and run their campaigns, after which they write up their results and lessons learned in a post-campaign report. Based on the pre- and post-campaign reports, Google determines the global winner as well as the winners for the various geographic regions. This is usually completed by the end of July.

The Challenge is an example of experiential learning (Kolb, 1984). First, the Challenge immerses students in search engine marketing and the process of developing a campaign for a client. Second, as students discuss and prepare the pre-campaign reports, they reflect on and observe their experiences from many perspectives. Third, throughout the Challenge, students are tasked with continuously applying and refining their knowledge by optimizing the campaigns over a three week period. Lastly, as part of the post-campaign report, they are tasked with creating a logically sound theory of what happened and why. These four steps are the fundamental building blocks of the experiential learning model.

Surprisingly, little is known about students' preferences with regards to the Challenge. Most research on the pedagogy behind the Challenge emerged as a result of the first Challenge in 2008. Most of these papers did not include an empirical component that addressed students' attitudes towards the Challenge (e.g. Flaherty & Jansen, 2009; Rosso et al., 2009). Others only addressed certain aspects, such as student learning outcomes (e.g. Treiblmaier et al., 2009; Neal et al., 2009), or did not include students' feedback regarding potential for improvement (e.g. Murphy et al. 2009). This work aims to close this gap in the literature. Specifically, to address the research questions:

- What did students like about the Challenge?
- What did students learn in the Challenge?
- How could the students' experience in the Challenge have been improved?

The remainder of this paper is structured as follows. First, how the Challenge was implemented as part of an undergraduate Computer Information Systems class is explained. Followed by, a review of prior pedagogical research on the Challenge. Finally, the methodology of a student survey and the presentation of results are explained.

3. LITERATURE REVIEW

The Google Online Marketing Challenge has been used in a range of courses from Internet Marketing (Lavin, 2010) to graduate MBA MIS courses (Rosso, 2009). Flaherty and Jansen's (2009) paper provides an in-depth description of the Challenge and its various components.

The Challenge is suited for both undergraduate and graduate students in classes such as advertising, consumer behavior, e-commerce, integrated marketing, marketing strategy and online marketing. Lavin (2010) supervised 29 teams from 3 different Internet Marketing classes, one online graduate course, and two undergraduate courses - one on-ground and one online. Student evaluations from all classes were high, and, fell in the "Outstanding" range of scores.

A number of papers have been written about the 2009 Google Challenge and have summarized statistics provided by the Google Online Marketing Challenge Research Center. (Treiblmaier et al., 2009; Flaherty & Jansen, 2009; Neale et al., 2009). Flaherty and Jansen (2009) wrote that all three constituents provided positive feedback. Ninety-four percent of professors and 92 percent of students reported being pleased with the experience. Eighty-nine percent of the businesses would recommend participating in the Challenge to their colleagues.

Treiblmaier et al. (2009) stated that the survey showed favorable results in terms of student learning. Students improved their ability to

- Select keywords for a marketing campaign;
- Discuss online marketing;
- Gain insights related to working with clients;
- Explain online marketing terms;
- Appreciate the difficulties of developing an outstanding online marketing campaign.

Neale and colleagues (2009) stated that 87% of the responding students agreed that the Challenge engaged them better than other teaching tools such as cases and simulations. Ninety-five percent of the instructors thought the ability to spend real money contributed positively to the learning experience, and 96% would run the Challenge in a future class.

4. METHODOLOGY

The Challenge was implemented as part of 'CIS 270: E-Business Systems,' which was an elective undergraduate Computer Information Systems (CIS) course taught in the School of Business that was also open to non-CIS majors. The class had a total enrollment of 31 students. The professor who taught the class had limited prior experience with Google AdWords. Thus, about 4-6 weeks prior to the semester, the professor consulted a number of free online resources by Google and other companies. In addition, the professor signed up for an AdWords account and spent about $10 on ads for a personal website. Links to these resources are listed in Table 1 below.

Google AdWords Help https://support.google.com/adwords/
Google Certification Program Learning Center https://support.google.com/adwords/certification/
Google Digital Marketing Course http://www.google.com/onlinechallenge/dmc/
Learn with Google http://www.google.com/ads/learn/
Pre- & Post-Campaign Reports from past Challenges http://www.google.com/onlinechallenge/past/index.html
Redfly Marketing Google AdWords Tutorials http://www.redflymarketing.com/adwords-tutorials/
SearchEngineLand PPC Academy http://searchengineland.com/ppc-academy-wrap-up-guidebook-58725

Table 1: Selected Online Resources

In preparing for the class, Google's official learning objectives for the Challenge (Google, 2013c) were reviewed. The learning objectives are stated as:
"At the end of the Google Online Marketing Challenge, students should be able to:

- Discuss online marketing and media planning;
- Collaborate effectively in a professional group setting;
- Explain the following concepts: click-through rate, landing page experience, campaign optimization, and return on investment (ROI);
- Discuss the benefits of targeting advertising to a select audience;
- Illustrate how technical and cultural factors affect the success of an online advertising campaign;
- Explain how to incorporate social media into a company's marketing plan."

The course was built around the Challenge, and these learning objectives were adopted for the course. To provide students with additional background regarding online marketing, a supplemental textbook, available online under a Creative Commons Attribution License (Stokes, 2011), was required. The course began with a broad discussion of online marketing and focused on specific aspects of search engine marketing. The weekly outline, which was used to guide the class lectures, is presented in Table 2.

Week	***Topic***
1	Overview of the Challenge
2	E-Business & Online Marketing
3	Search Engine Marketing
4	Keywords & Ad Groups
6	Ad Copy & Metrics
7	Bids & Budgets
8	(No classes: Spring Break)
9	Campaign Week 1: Performance Monitoring
10	Campaign Week 2: Experiments
11	Campaign Week 3: Optimization
12	Results Analysis & Presentation
13	*Special Topics*
14	*Special Topics*
15	Student Presentations
16	Final Exam

Table 2: Weekly Course Schedule

The pre-campaign report was due at the end of week 7. This placed the deadline right before Spring Break, which allowed a little extra time for Google to review the reports and transfer the credit into students' AdWords accounts. Students ran their three-week campaigns right after returning from Spring Break. In weeks 13 and 14, the class discussed various aspects of online marketing, such as website usability and mobile apps. A guest speaker from the marketing department discussed how online marketing tied in with other marketing activities of an organization. The post-campaign report was due at the end of week 15, before the final exam period.

In terms of grading, heavy emphasis was placed on the pre-campaign and post-campaign reports, each contributing 30% of the final grade (60% total). Google provided information on how the pre-campaign and post-campaign reports were graded (Google, 2013d) and these grading rubrics were adopted by the professor. Brief 25 question, multiple-choice midterm and final exams each counted for 15% of the final grade (30% total). The remaining 10% was equally split between peer evaluation of teamwork (5%) and in-class participation (5%).

In order to increase students' buy-in and sense of ownership over the project, students were asked to form teams and find clients for the Challenge on their own. Given that the class was open to non-CIS majors, it was stipulated that each team must have at least one CIS major among them – thus ensuring roughly equal amounts of technical knowledge across teams. The students were provided information from Google, outlining the Challenge, as well as tips on types of businesses to focus on and how best to approach them (Google, 2013a). Although the Challenge could be used with non-profit organizations, the class focused on working with for-profit businesses. The students reported no issues forming teams and finding suitable businesses to work with. The final list of clients included three companies in the restaurant/food services industry, a beauty salon, a florist, and a movie review website. The Challenge could have included a social media campaign (utilizing Google+). However, it was not, in order to keep complexity of the project at a minimal level.

At the end of the semester, a student survey consisting of 19 multiple-choice and two open-ended questions was distributed (Appendix A). The students were encouraged to complete the survey and 29 usable responses, representing a response rate of 93.5% were collected.

5. RESULTS

Of the 29 respondents, 12 (41.4%) were female and 18 (62.1%) were Computer Information Systems (CIS) majors. The vast majority (83.3%) of CIS majors in the class were male, representing an uneven distribution of gender by major ($X^2(1) = 11.948$, $p = .001$). Moreover, the majority (55.2%) of students in the class were juniors. The distribution of students by year is shown in Figure 1.
The distribution of gender by year is roughly equal ($X^2(3) = .898$, $p = .826$) and so is the distribution of CIS majors by year ($X^2(3) = 1.745$, $p = .627$).

The students formed five teams of five students and one team of six students. Given that the professor instructed students to have at least one CIS major per team, there were no significant differences between the teams with regards to the number of CIS majors ($X^2(5) = 8.612$, $p = .126$). There were, however, significant differences between teams with regards to gender, as two teams consisted of male students only ($X^2(5) = 11.823$, $p = .037$).

Lastly, the distribution of students by year was roughly even across teams ($X^2(15) = 21.673$, $p = .117$). Only one student had used Google AdWords before starting the class, which meant there were no differences with regards to prior experience between teams.

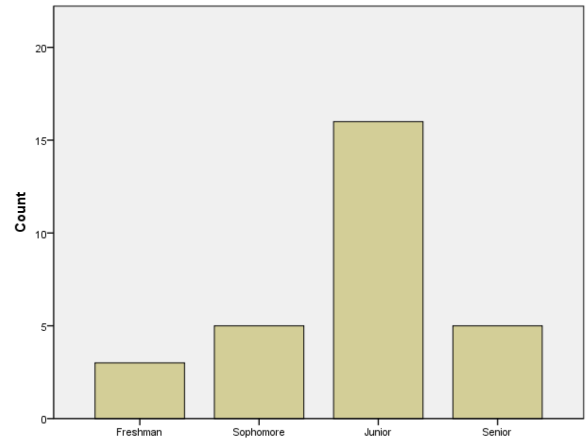

Figure 1: Distribution of students by year

What do students like about the Challenge?
Before delving into the particulars of what students liked about the challenge, understanding students' overall satisfaction with the Challenge was desired. Thus, they were asked to indicate their agreement with the statement "I enjoyed participating in the Challenge" on a scale from 1 – strongly disagree to 5 – strongly agree. Results indicated that all but one student enjoyed participating in the challenge (responding "agree" or "strongly agree"). The detailed results are shown in Figure 2.

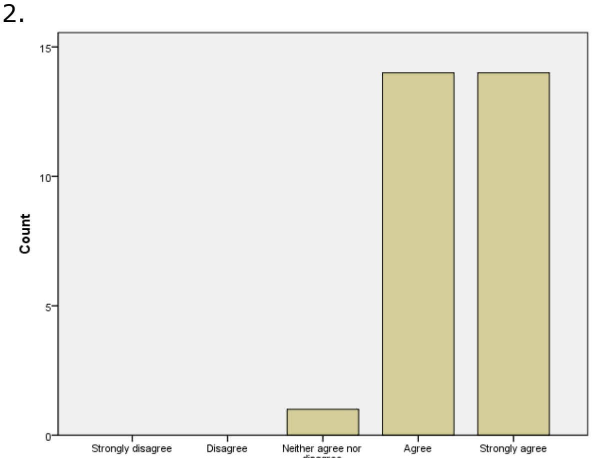

Figure 2: I enjoyed participating in the Challenge.

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Surprisingly, CIS majors were likely to enjoy participating in the challenge more (*M* = 4.67, *SD* = .485) than non-CIS majors (*M* = 4.09, *SD* = .539, *t*(27) = 2.974, *p* = .006). It was possible that the technical nature of search engine marketing was overall more attractive to CIS majors than to non-CIS majors.

Furthermore, an understanding of prior excitement about the Challenge was researched. To capture their sentiment, they were asked to indicate their agreement with the statement "I was enthusiastic about participating in the Challenge" on a scale from 1 – strongly disagree to 5 – strongly agree. Similar to the enjoyment question, all but two students were enthusiastic about participating in the Challenge (responded "agree" or "strongly disagree"). The detailed results are shown in Figure 3 below.

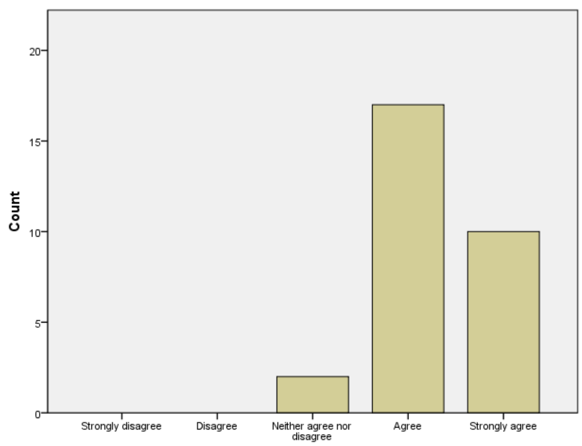

Figure 3: I was enthusiastic about participating in the Challenge.

Given these findings, it is not surprising that initial enthusiasm is strongly correlated with enjoyment (*r*(27) = .466, *p* = .011). Thus, the more students were enthusiastic about participating in the challenge, the more they ended up enjoying it. However, given that both measures were taken at the same time (i.e. at the end of the semester), it is possible that enjoyment affected students' perceived initial enthusiasm retroactively.

Next, of interest was what students liked most about participating in the Challenge. It was believed that students might feel more engaged in the Challenge than in other teaching tools (such as simulations or case studies). This was driven by the fact that the Challenge provided a hands-on, real world learning experience that was unique and difficult to replicate using other classroom-based instructional methods. To test this assumption, students were asked to indicate their agreement with the statement "compared to other teaching tools (such as simulations or case studies), I was more deeply engaged with the Challenge" on a scale from 1 – strongly disagree to 5 – strongly agree. All students agreed by responding either "agree" or "strongly agree." The distribution between the two answers can be seen in Figure 4 below.

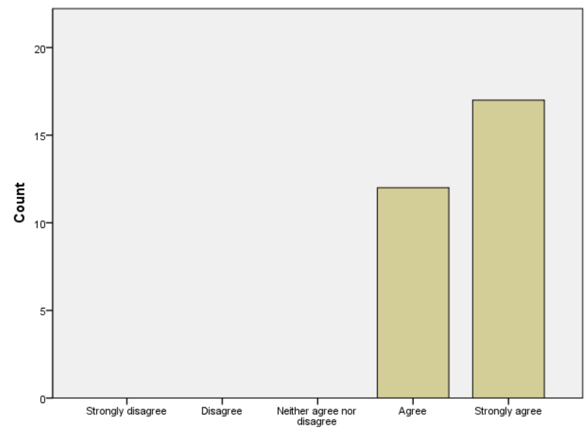

Figure 4: Compared to other teaching tools (such as simulations or case studies), I was more deeply engaged with the Challenge.

Clearly, students enjoyed the Challenge. However, to understand additional drivers of preferences for the Challenge, students were asked to respond in an open-ended format to the question of "what did you like most about participating in the Challenge?" All but one student responded to this question. After a thorough reading of the responses, the following three benefit-themes emerged: (1) working on a real project, (2) seeing cause and effect in action, (3) gaining marketable skills. The following sections briefly summarize each of the identified benefits.

Working on a real project

Several students highlighted the benefits of working on a real project, with real money, and making a difference for a real client. As one student stated, *"I like that it was a real thing. That we were spending real money."* Similarly, another student noted *"I liked working directly with the client and actually advertising for a company as opposed to the theoretical work we usually do in class."* Furthermore, students pointed to the real world impact of their work, as noted by *"working with real companies was* *rewarding as we were having a real impact on the company with our marketing efforts."*

Seeing cause and effect in action

Students liked the fact that Google AdWords allows them to experiment with different keywords, ads, and bid amounts, and see their effects within a matter of hours. As one student noted, *"making changes and seeing how they worked was cool."* Similarly, another student stated that he liked *"understanding how different techniques effected [sic!] our results."* Another student noted enjoying *"the freedom to decide how to do our campaigns and experiment."* Lastly, students mentioned feeling rewarded by their success as noted by a student: *"it was exciting to see the growth of the campaigns."*

Gaining marketable skills

Some students indicated that they liked gaining practical skills that are of importance to employers in the marketplace. For example, one student stated: *"How it is actually relevant to society today, companies are interested in people who know how to do things like AdWords."* Similarly, a student stated: *"I can apply the knowledge learned in future projects and in the work force."* Lastly, one student pointed directly to how she would use the skills in her future career: *"to learn new marketing methods I can use in my future career as a Public Relations professional."*

What do students learn in the Challenge?

Next the extent to which students felt that the Challenge achieved its stated learning objectives was explored. Given that the Challenge required students to work outside of the classroom (for example by regularly checking performance and making adjustments to their campaigns), students were asked how much time, on average, they spent working on the Challenge outside of class. As shown by the results in Figure 5, the vast majority (82.8%) spent 1-5 hours per week working on the Challenge. Some (17.2%) reported working an additional 5-10 hours per week on the Challenge.

Interestingly, male students were more likely to report more hours per week (M = 2.29, SD = .470, where 2 = 1-5 hours, 3 = 5-10 hours, etc.) than female students (M = 2.00, SD = 0, $t(27)$ = -2.158, p = .040).

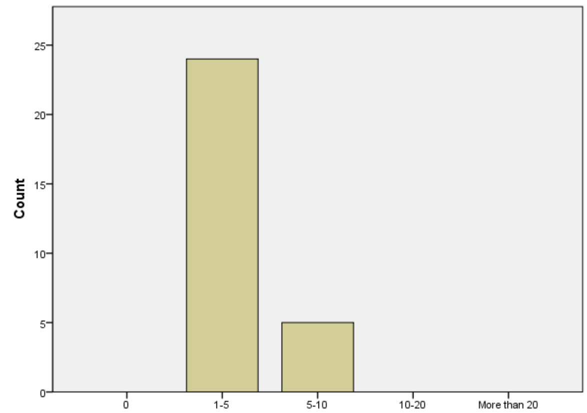

Figure 5: I spent about ___ hours per week working on the Challenge outside of class.

Next, students were asked to indicate their agreement with each of the six official learning objectives (Google, 2013). The results are summarized in Figure 6.

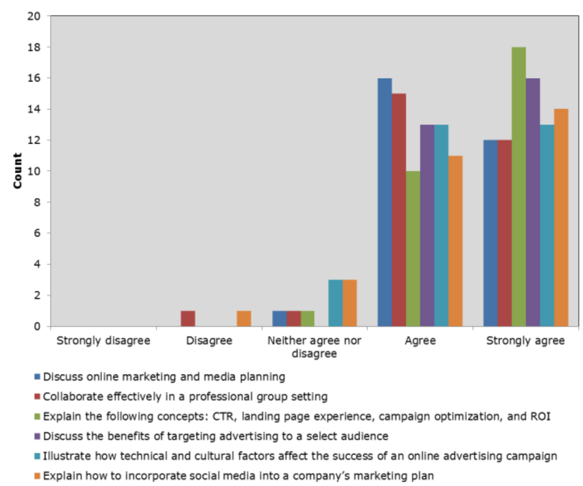

Figure 6: Participating in the Challenge improved my ability to ___.

Overall, the vast majority of students felt that the Challenge fulfilled each of the six learning objectives. However, the most students (62.1%) indicated strong agreement with the statement that the Challenge improved their ability to explain core concepts relating to online marketing, such as click-through rate (CTR), landing page experience, campaign optimization, and return-on-investment (ROI). The only two learning objectives that received a "disagree" response were "collaborate effectively in a professional group setting" and "explain how to incorporate social media into a company's marketing plan." Disagreement with the former statement could be explained by a student

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having had a negative experience with regards to collaboration in his or her group. Given that social media marketing was not specifically worked on in the class, it was surprising that not more students disagreed with the latter statement. However, social media marketing was discussed in class and students may have assumed that class discussions were part of the Challenge.

Given the above findings, it is not surprising that students' perceived improvement in the six learning objectives exhibit high degrees of inter-correlation (see Appendix B). However, the learning objective "explain how to incorporate social media into a company's marketing plan" is not significantly correlated with any of the other five learning objectives (all $r(27) > .290$, $p > .126$). Again, this is possibly due to the fact that the social media marketing Challenge was not included.

Interestingly, students' enthusiasm about participating in the Challenge was positively correlated with each of the six learning objectives (all $r(27) > .410$, $p < .040$). Thus, the more students' were enthusiastic about participating in the Challenge, the more they felt that the Challenge helped them improve on the learning objectives. This finding is surprising given that students' enjoyment participating in the Challenge was not correlated with any of the learning objectives (all $r(27) < .349$, $p > .064$). Therefore, the data suggested that students' enthusiasm was more important than enjoyment when it came to achieving learning objectives in the Challenge. Further research is needed to clarify the issue of enthusiasm being a self-reported, retroactive measure.

Also, students' seniority was positively correlated with both the extent to which they felt that participating in the Challenge improved their ability to collaborate effectively in a professional group setting ($r(27) = .400$, $p = .032$) as well as their ability to discuss online marketing and media planning ($r(27) = .464$, $p = .011$). Thus, it appears that more senior students felt that the Challenge helped them improve these abilities to a greater extent than more junior students. Also surprisingly, CIS majors were more likely to feel that participating in the Challenge improved their ability to illustrate how technical and cultural factors affect the success of an online advertising campaign ($M = 4.61$, $SD = .502$) than non-CIS majors ($M = 3.91$, $SD = .701$, $t(27) = 3.145$, $p = .004$). Given that CIS majors are more likely to have an interest in the technical factors underpinning the Challenge, it is possible that the Challenge was more effective in improving this skill for CIS majors than for non-CIS majors.

Importantly, the amount of time students spent working on the Challenge outside of class was positively correlated with students who felt that participating in the Challenge improved their ability to discuss the benefits of targeting advertising to a select audience ($r(27) = .411$, $p = .027$) as well as their ability to illustrate how technical and cultural factors affect the success of an online advertising campaign ($r(27) = .455$, $p = .013$). Thus, increasing amounts of work on the Challenge outside of class paid off in terms of increased learning outcomes.

Given that reflective observation is critical to the experiential learning model (Kolb, 1984), what extent students felt that their critical reflection, which was part of the post-campaign report, was useful to their learning was explored. The vast majority (82.8%) of students indicated that the "Learning Component" of the post-campaign report was useful for their learning. The distribution of responses is shown in Figure 7 below.

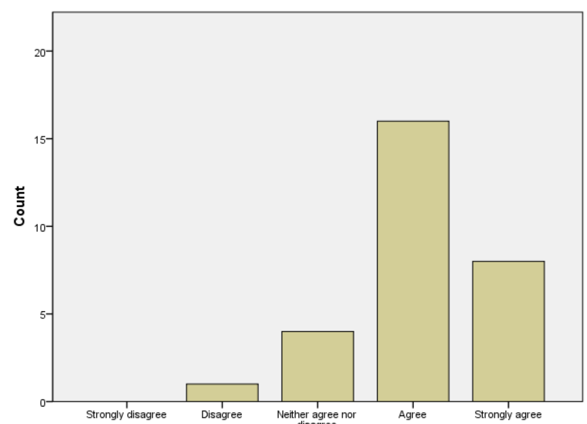

Figure 7: The critical reflection which is part of the post-campaign report (i.e. the "Learning Component") was useful for my learning.

Interestingly, the more students felt that the critical reflection was useful for their learning, the more they felt that participating in the Challenge improved their ability to collaborate effectively in a professional group setting ($r(27) = .425$, $p = .022$). This finding can be explained by the fact that the "Learning Component" focuses predominantly on aspects of collaboration (i.e. group dynamics and client dynamics), thus furthering students' learning in this realm.

How can the students' experience in the Challenge be improved?
One of the goals of the survey was to determine if the client selection processes could have been improved. Students were asked if they preferred finding a client on their own (which they had to in this class) or if they would have preferred being assigned a client to work with. As shown in Figure 8, the students were divided on this question. Although 44.8% percent indicate that they would prefer being assigned a client to work with, 27.5% would prefer finding a client on their own.

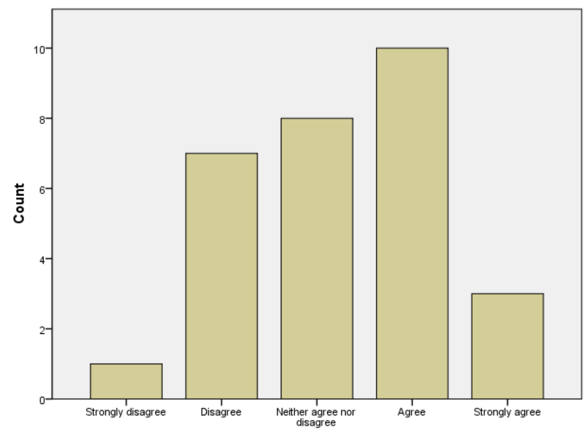

Figure 8: I would prefer being assigned a client to work with rather than finding a client on my own.

This suggests that, rather than making the decision to assign clients or have students find clients on their own, professors should consider offering both options to the students. This way, students who prefer finding a client on their own can do so, while students who want to be assigned a client can be catered to as well.

Furthermore, the survey questioned students' preferences with regards to ideal team size. Google specifies a minimum (3) and maximum (6) team size. The survey asked the students to indicate their preference outside of these boundaries. Although 80.6% of students in the class were members of five-student teams and 19.4% were in a six-student team, 48.3% would prefer a four-student team while 41.4% would prefer a five-student team. The distribution of responses is shown in Figure 9.

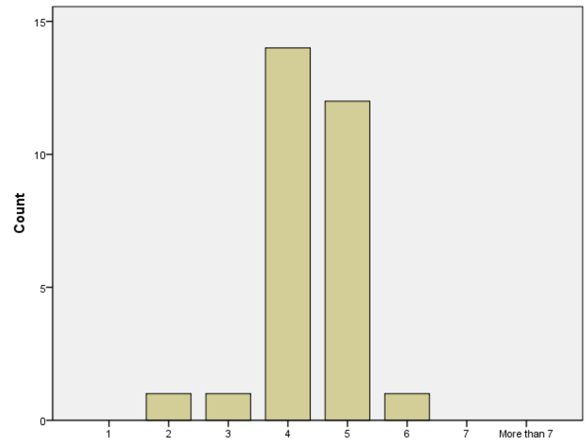

Figure 9: What would be the ideal team size for the Challenge?

Also, it should be noted that team size preference was not correlated with any other question on this survey. Thus, professors should aim to form teams consisting of four students, with the option of creating a five-student team, if necessary.

The survey also asked students how the Challenge could have been improved. Students were asked to give open-ended feedback to this question. Several themes were identified for improvement after an in-depth reading of the students' responses. A lot of students mentioned that their experience could have been improved by being part of a smaller team, which was consistent with findings regarding optimal team sizes above. Moreover, several students specifically stated preferring to be assigned a client to work with, which is also reflected by quantitative analysis above. However, in addition to these two points, the following two themes were identified for improvement: (1) provide additional case studies, (2) require Google Analytics. The following sections will discuss each theme.

Provide additional case studies
Several students mentioned that their experience could have been improved, had they been given additional materials in the form of case studies or conceptual papers. As one student noted, *"maybe go in depth with terminology with other case studies in class […] to support the learning of what was being taught in class."* Similarly, another student pointed to her need for additional theoretical background: *"The challenge was a great learning tool, but I would have liked to see an increased focus on e-marketing theory."* Similarly, another student

noted that he would have preferred to conduct additional research prior to the challenge to familiarize himself with the specific terminology of Google AdWords. Thus, specific case studies dealing with search engine marketing, or online marketing in general, could have been helpful to the students.

Require clients to use Google Analytics

Several students were frustrated with the fact that their client did not want to use Google Analytics, or any other form of web analytics. Google Analytics tracks website visitors, including those coming through ads on Google, and would allow students to better understand and optimize the customer conversion process. For example, one student stated: *"Use of Google Analytics […] could have improved our team's experience."* Similarly, another student noted: *"I really wish we could have used Google Analytics."* In fact, one student even suggested that students should only be allowed to work with clients that use Google Analytics: *"I think it would have been beneficial if we had to choose companies that did employ Google Analytics."* Since most clients outsourced web development to a third party, they were reluctant to pay their service provider for the integration of Google Analytics. Therefore, maybe it would be a good idea to require clients to use Google Analytics, if they want to participate in the Challenge.

6. CONCLUSIONS AND LIMITATIONS

This paper provides an overview of how the Challenge was implemented in an undergraduate Computer Information Systems class. Specifically, this research focused on understanding (1) what students like about the Challenge, (2) what students learn in the Challenge, and (3) how can the students' experience in the Challenge be improved.

Based on a survey among students, it was found that students enjoyed working on a real project, seeing cause and effect in action, and gaining marketable skills as a result of the Challenge.

The key learning outcome of the Challenge was for the students to be able to explain core concepts in online marketing (such as click-through rate, landing page experience, and ROI). The students agreed that the Challenge improved their ability to explain core concepts relating to online marketing, such as click-through rate (CTR), landing page experience, campaign optimization, and return-on-investment (ROI). The only two learning objectives that received a "disagree" response were "collaborate effectively in a professional group setting" and "explaining how to incorporate social media into a company's marketing plan". The latter was not covered in detail in the Challenge.

When asked how the challenge could be improved, students suggested working in teams of four and working on additional case studies relating to online marketing. Lastly, students emphasized the need to pre-select clients based on their willingness to use Google Analytics, as this would significantly improve students' ability to optimize campaign performance.

The study was limited in scope to just one classroom with a small sample size of just 29. The data collected was primarily descriptive in nature. Future work should be done to see if the challenge increased their knowledge of core concepts as compared to a course that did not utilize the Challenge.

7. REFERENCES

Flaherty, T., & Jansen, B. (2009). Insights on the Google Online Marketing Challenge and Its Successful Classroom Implementation. *MERLOT Journal of Online Learning and Teaching*, 5(2), 446 – 457.

Google (2013a). Selecting a Business or Non-Profit Organization. Retrieved 5/22/2013 from http://www.google.com/onlinechallenge/discover/select-business.html

Google (2013b). Welcome to the 2013 Google Online Marketing Challenge. Retrieved 5/22/2013 from http://www.google.com/onlinechallenge/index.html

Google (2013c). What can students learn by competing in the Challenge? Retrieved 5/22/2013 from http://www.google.com/onlinechallenge/discover/faqs.html

Google (2013d). Written reports. Retrieved 5/22/2013 from http://www.google.com/onlinechallenge/discover/campaign-reports.html

Kolb, D (1984). *Experiential Learning as the Science of Learning and Development*. Englewood Cliffs, NJ: Prentice Hall.

Lavin, M. (2010) The Google Online Marketing Challenge: An Opportunity to Assess Experiential Learning. *ABD Journal, 2, 1-11.*

Murphy, J., Hudson, K., Hunter, L., & Neale, L. (2009). The Google Online Marketing Challenge: Hands on teaching and learning. *Journal of Hospitality & Tourism Education*, 21(1), 44-47.

Neale, L., Treiblmaier, H., Henderson, V., Hunter, L., Hudson, K., & Murphy, J. (2009). The Google Online Marketing Challenge and research opportunities. *Journal of Marketing Education*, 31(1), 76-85.

Treiblmaier, H., Neale, L., & Murphy, J. (2009). Action Learning of Online Marketing via a Global Contest. *Central Asia Business Journal*, 2, 47-50.

Rosso, M., McClelland, M., Jansen, B., & Fleming, S. (2009). Using Google AdWords in the MBA MIS Course. *Journal of Information Systems Education*, 20(1), 41 – 49.

Stokes, R. (2011). *E-Marketing: The Essential Guide to Digital Marketing*. 4th Edition. Quirk Education: Cape Town, South Africa. Retrieved 5/22/2013 from http://www.quirk.biz/ emarketingtextbook/

Editor’s Note:

This paper was selected for inclusion in the journal as a ISECON 2013 Meritorious Paper. The acceptance rate is typically 15% for this category of paper based on blind reviews from six or more peers including three or more former best papers authors who did not submit a paper in 2013.

Appendix A: Survey Items

Question	***Answer choices***
1. Our client was helpful and accessible when needed.	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
2. Our client was interested in our work and the Challenge.	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
3. Compared to other teaching tools (such as simulations or case studies), I was more deeply engaged with the Challenge.	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
4. I enjoyed participating in the Challenge.	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
5. I was enthusiastic about participating in the Challenge.	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
6. I would prefer being assigned a client to work with rather than finding a client on my own.	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
7. Participating in the Challenge improved my ability to collaborate effectively in a professional group setting.	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
8. Participating in the Challenge improved my ability to discuss online marketing and media planning.	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
9. Participating in the Challenge improved my ability to discuss the benefits of targeting advertising to a select audience.	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
10. Participating in the Challenge improved my ability to explain how to incorporate social media into a company's marketing plan.	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
11. Participating in the Challenge improved my ability to explain the following concepts: clickthrough rate, landing page experience, campaign optimization, and return on investment (ROI).	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
12. Participating in the Challenge improved my ability to illustrate how technical and cultural factors affect the success of an online advertising campaign.	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
13. The critical reflection which is part of the post-campaign report (i.e. the "Learning Component") was useful for my learning.	(1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree)
14. I had used Google AdWords before starting this class.	(1 = True, 2 = False)
15. I spent about __________ hours per week working on the Challenge outside of class (for example doing related research, checking performance, updating the account, etc.).	(1 = 0, 2 = 1-5, 3 = 5-10, 4 = 10-20, 5 = More than 20)
16. What would be the ideal team size for the Challenge?	(1 = 1, 2 = 2, 3 = 3, 4 = 4, 5 = 5, 6 = 6, 7 = 7, 8 = More than 7)
17. I'm a __________.	(1 = Freshman, 2 = Sophomore, 3 = Junior, 4 = Senior)
18. I'm a CIS major.	(1 = True, 2 = False)
19. My gender is __________.	(1 = Female, 2 = Male)
20. What did you like most about participating in the Challenge?	(Open-ended)
21. How could your experience in the Challenge have been improved?	(Open-ended)

Appendix B: Correlations among Learning Objectives

	1	2	3	4	5	6
1. Collaborate effectively in a professional group setting.	--					
2. Discuss online marketing and media planning	.410*	--				
3. Discuss the benefits of targeting advertising to a select audience	.598**	.620***	--			
4. Explain how to incorporate social media into a company's marketing plan	.199	.125	.178	--		
5. Explain the following concepts: clickthrough rate, landing page experience, campaign optimization, and return on investment (ROI);	.240	.622***	.450*	.290	--	
6. Illustrate how technical and cultural factors affect the success of an online advertising campaign	.442*	.590**	.578**	.192	.670***	--

* $p < .05$, ** $p < .01$, *** $p < .001$

The Influence of Typeface on Students' Perceptions of Online Instructors

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Abstract

At its base, advertising is the process of using visual images and words to attract and convince consumers that a certain product has certain attributes. The same effect exists in electronic communication, strongly so in online courses where most if not all interaction between instructor and student is in writing. Arguably, if consumers make certain assumptions about a product based on the typeface used on a package, then online students are poised to do the same when they read emails from an online instructor. This pilot study looked at the specific medium of e-mail and how an e-mail's recipient (student) might transfer his or her perceptions of attributes of three typefaces to attributes of the sender (instructor) of the email. One was a commonly used typeface, and the other two were selected for their dramatic differences from the common typeface. The findings revealed that the participants' opinions of the sender were highly influenced by the typeface used. In the arena of online education, attention should be given to typeface selection in instructors' emails to students.

Keywords: Typeface, Online Education, Email, Communication, Font, Teacher-student Interaction

1. INTRODUCTION

Consider the act of reading body language. One watches and listens, giving meaning to both the words spoken and the movements that accompany them. Now consider email. One can only absorb what is on the page. There is no opportunity for body language; there is only the appearance of the text to accompany the meaning of the words.

Written communication represents not only our spoken language but also the emotions and intentions, or the tone, of the message. While written words are images that we sometimes dismiss, preferring to focus on the message's content, they hold degrees of meaning going beyond a word's denotation or connotation. Reducing reading to simply looking at words on a page simplifies and ultimately limits the message. Readers "design multiple interconnections" between what they see and what they read (Lemke, 2009, p. 300), meaning that the image of the words and how they function on a page, or the visual rhetoric, increases in importance when one communicates with an unseen other, as is usually the case in online education.

In the typical online post-secondary classroom setting, the instructor and student communicate electronically, and with the exception of the use of audio or video when available, all of this communication is written. This electronically-mediated setting shifts the student's communication experience to the visual, forcing him or her to comprehend not only the literal message but also construe meaning from the visual rhetoric of the text itself. As a result, online students "get to know" their professors through the visual image of the electronic text before them.

2. TYPEFACE

Typeface, or font, not only conveys the words intended but also carries a message of its own (Henderson, Geise, & Cote, 2004). Studies consistently show that the visual aspect of a word influences the way that the receiver processes it. As early as 1923, Poffenberger and Franken determined that fonts have an "atmosphere," or an air, of the following qualities: "cheapness, dignity, femininity, antiquity, nature, and elegance" (p. 314) and concluded that the sender of a message was best served if he or she matched the typeface to the readers' expectations of the product. For example, one would advertise luxury items using an elegant calligraphic typeface, while for durable goods would use a no-nonsense, simple font. A typeface's "atmosphere" refers specifically to the "capacity of a typestyle to connote meaning over and above… [what] is linguistically conveyed by words" (Lewis & Walker, 1989, p. 243). In short, visual aesthetics influence a receiver's comprehension and judgment of the message (Bloch, Brunel, & Arnold, 2003; Lewis & Walker, 1989).
Given that individuals perceive consistent meanings to typographical features (Brumberger, 2003a; Poffenberger & Franken, 1923), any incongruence between the words' appearance and meaning will affect the reader's ability to process the meaning of the message. Readers consistently employ prior experience with visual cues of words, e.g. boldface, color, size, and typeface or font, to determine the message's full meaning and emphasis of the message (Kostelnick, 1989). Poor visual images can influence students to interpret an online instructor's message differently than the instructor intended, ultimately impacting communication within the course and attitudes about the instructor. Effective communication between participants is vital for effective performance in any online culture (Clark & Gibb, 2006).

Typeface Personas

Because typefaces are "credited with creating first impressions," Shaikh, Chaparro, and Fox sought to determine whether online fonts have consistently ascribed personas such as *stable, mature, formal, elegant, youthful,* and *casual* when testing perceptions about them (2006, p. 1). They noted that typefaces with both serifs and an even baseline, such as Times New Roman and Georgia, connote stability and formality. According to Bernard, Mills, Peterson, and Storrer's 2001 study, these fonts are typically found in business documents with Times New Roman being one of the most popular. Fonts without an even baseline, such as Comics Sans and Kristen ITC, are called scripts and tend to be considered casual and youthful. Additionally, according to Henderson et al. (2004), natural script typefaces that resemble handwriting are re-assuring to the reader (e.g. Bradley Hand ITC and Freestyle Script).

In 2003, Brumberger conducted two studies on whether typeface and text had distinct personalities in readers' eyes. She determined that people "consistently ascribe particular personality attributes" to both typeface and texts (2003a, p. 213). Brumberger's study revealed that readers recognize whether a typeface is appropriate for a certain situation as well as that some typefaces are considered "all-purpose," which she theorized may be because they are seen regularly enough to have become "generic" (2003b, p. 227).

Mackiewicz's (2005) analysis of fifteen typefaces' letterforms found that typefaces consistently regarded as *professional* contained similar elements, such as straight-edged ending strokes balanced by teardrop lobes (which soften the sharper edges), horizontal crossbars on *e*'s, serifs, and letters resting on an even baseline. She also noted that typefaces with imperfections are typically perceived as *friendly*. These "imperfections" consist of broken construction, such as when the loops of the *g* or a bowl on the *a,* are not completely closed. Typeface imperfections also include rounded ending strokes, slanted crossbars on the *e*'s, and an uneven baseline where letterforms either dip below or sit above (Mackiewicz, 2005).

3. ONLINE LEARNING

As noted, the receiver constructs meaning when presented with written electronic communication. How this meaning is constructed influences the success or the failure of that particular communication (Geisler et al., 2001). The level of trust that the receiver has in the sender affects how successful the communication is (Smith, 2008), and that trust is influenced by structure (Dirks & Ferrin, 2001). Structure, in this situation, is defined not only as the formal guidelines within which one operates, but also is the sense of knowing what to expect from interactions.

The instructor's communications are vital in developing that interpersonal structure because his or her behavior greatly determines the student's perception of the course and instructor and influences academic success. The role of the online instructor is little different from an instructor in a face-to-face classroom in that there are expectations regarding content delivery and classroom control, though the online classroom places more responsibility on the student and expects a higher level of self-direction and motivation. As found by Finn, Schrodt, Witt, et al. in 2009, a strong relationship exists between students' perceptions of an instructor and student learning. Part of this perception comes from "immediacy behaviors," or communication between the instructor and the student that reduces both the social and psychological distance between them (Menzel & Carroll, 1999, p. 32). Online instructors who engage in immediacy behaviors (e.g. asking the students about the course, providing personalized examples, and revealing a sense of humor) have a higher level of student academic success (Arbaugh, 2001).

4. METHODOLOGY

This study sought to learn whether the typeface in an e-mail influences the receiver's perception of the sender in cases where there is a lack of body language and prior interpersonal, face-to-face interaction. An online survey, consisting of one e-mail presented in three typefaces and a forced-choice scale with nine pairs of adjectives for rating each typeface was administered to post-secondary students to first rate each typeface and then rate the sender of the e-mail in each typeface. We sought to explore whether an e-mail's typeface persona would be attributed to the sender. The study was IRB approved.

Participants

The pilot study convenience sample was drawn from three post-secondary schools in which instructor colleagues teach that offer both online and on-ground classes. One was a two-year career college with an average enrollment of 575. The other two schools were four-year private universities, one with about 4,000 students, the other with nearly 5,000 students. All three institutions are in the same city in the Mid-Atlantic.

The sample consisted of 22 females and 30 males (N=52) between the ages of 18 and 48. Ten participants (19%) were students in accredited allied health programs at the career college. Forty-two participants (81%) were students in the four-year universities, primarily in core curriculum courses. Twenty-five different majors were reported by the participants.

Instrument

A web-based survey was designed to gather the participants' perceptions about three typefaces (typeface persona) in an email and their perceptions of the sender using the three typefaces (sender persona) in an email. The survey was based on the research instruments of Brumberger (2003a, 2003b), Lewis and Walker (1989), Poffenberger and Franken (1923), and Shaikh et al. (2006), all of whom conducted studies to understand the reactions that typefaces elicit. The three typefaces were Times New Roman, Impact, and Kristen ITC:

1) Times New Roman, according to Bernard et al., (2001), is a typeface that suggests a businesslike tone and is neither elegant nor youthful; it lacks a personality. Because of its visual harmony or directness, this font is often used by respected companies and in business documents (Brumberger, 2003a, Henderson et al., 2004; Shaikh et al., 2006). Its effect on immediacy may be neutral.

2) Typically considered masculine because of its thick lines, **Impact** typeface is engaging and is considered a "modern" typeface (Henderson et al., 2004). It is considered easy to read and is often found on posters or in headlines (*Impact Typeface*, 2007). Because of its heavy tone, it may impede immediacy.

3) Kristen ITC is characterized by an uneven baseline and san serif design. Both Bernard et al. (2001) and Shaikh et al. (2006) noted that Kristen ITC is a friendly font best used to convey happiness,

creativity, and a casual tone. It is often used for children's documents. Because of its friendly tone, it may create more immediacy.

The typefaces that we selected were chosen for their commonality a well as the distinctive differences in their design. Other than the ubiquitous Times New Roman, the other two were selected because of their opposing styles to each other, a lightweight script and a heavy block, to demonstrate the effect of many similar fonts with stark differences from Times New Roman. The electronic survey was presented on a split-screen with the e-mail message on the left and the survey questions on the right so that the participants could answer the questions while looking at the typeface. After a few demographic questions, the participants viewed a neutral, general welcome message from a fictitious online instructor in three different fonts. The first was in Times New Roman, the second in Impact, and the third in Kristen ITC. The instructor's name, Dr. Smith, was generic and gender-neutral. The only difference between the e-mails was the typeface itself; perceptions derived from the name of the instructor, gender, or content of the message were minimized.

A four-point semantic differential scale containing nine paired attributes was used to quantify the participants' perceptions of the typefaces and the sender. One adjective of a contrasting pair (*youthful*) appeared on the left side of a list and the other (*mature*) on the right side. In between the adjectives were numerals 1, 2, 3, and 4. Participants selected a numeral on the scale indicating their perception of, first, the typeface and then second, of the sender. The four points were used to force a choice and prevent the selection of "neutral." The list of adjectives used in the scale came from the studies of Shaikh et al. (2006), Brumberger (2003b), and Lewis and Walker (1989). The paired attributes were: Polite — Rude, Mature — Youthful, Formal — Casual, Consistent — Inconsistent, Supportive — Unsupportive, Professional — Unprofessional, Attractive — Unattractive, Assertive — Passive, Masculine — Feminine. The instrument also allowed for write-in attributes through open-ended spaces for participants to add perceptions for each typeface and each sender's use of the three typefaces.

Data Collection

Participants were recruited through personal visits to college classrooms of instructor colleagues where one of the authors, M.L., explained the study and invited students to participate. M.L. read a brief introduction to the study then passed around a sign-up sheet to collect volunteers' e-mail addresses by which to send the survey link. The 149 volunteers received the link within 48 hours. Reminder emails with the link were sent twice over two weeks. Fifty-two ultimately completed the 10-15 minute survey.

Data Analysis

We decided to collapse the four-point scale to two points because the choice of attributes was either toward one or the other, and the sample size did not allow for finer distinctions in the analysis. There were six data points: Times New Roman typeface persona, Times New Roman sender persona, Impact typeface persona, Impact sender persona, and Kristen ITC typeface persona and Kristen ITC sender persona. Frequencies for each of the nine attributes were obtained. Attributes from the open-ended options were collected and grouped by theme, first negative or positive, and then by similarity to the nine attributes in the instrument. The relationship between each of the typeface personas and the sender personas was analyzed by comparing the frequencies for each of the three typefaces' nine attributes with the sender's nine attributes on each typeface. Written-in adjectives were used to confirm or disconfirm the quantitative results.

5. RESULTS

Times New Roman Typeface

For Times New Roman, the typeface was judged *polite* and *consistent* by at least three-quarters of participants, and *attractive, professional, supportive, youthful, casual, passive*, and *feminine* by more than half. Senders using Times New Roman were more highly regarded than was the typeface alone. Perceptions of the sender who used Times New Roman were unequivocal on all attributes, with *consistent*, *professional*, *formal*, *polite*, and *mature* all receiving at least 90% of the scores. *Supportive, attractive*, and *assertive* were attributes of senders by at least three-quarters of participants. Perceptions of the typeface and the sender were most well matched on *politeness*. Contradictory perceptions of attributes of the typeface and of the sender were found on four items, with the typeface receiving more than 50% of the scores on *youthfulness, casualness, passivity*, and *femininity* while the sender was overwhelmingly assessed as being the opposite: *mature, formal, assertive*, and *masculine*. Table 1 shows the highest rated adjective of each pair in descending order on the Times New Roman typeface persona compared with the sender persona using it.

Characteristic	Typeface (N=52)	Sender (N=52)
Polite	90	94
Consistent	75	98
Supportive	65	85
Mature	40	90
Formal	40	96
Professional	58	96
Attractive	56	81
Assertive	44	77
Masculine	38	67

Table 1: *Frequencies Comparing Typeface Persona and Sender Persona for* Times New Roman*, in Descending Order, as Percentage of Total Sample*

In addition to the nine pairs of adjectives for the font and the sender using the font, participants who completed the open-ended portion typed in adjectives that supported the results of the quantitative section of the survey. For Times New Roman, 127 adjectives were provided; 85% conveyed a positive or professional assessment, such as *approachable, fair, friendly, normal, polite,* and *traditional*. Only 15% of the adjectives carried a negative judgment: *boring, busy, sharp,* and *weak.*

The written-in adjectives to describe the sender were very similar to those for the typeface. Of the 99 adjectives describing the sender, 84% were positive or professional, e.g. *business-like, classy, conservative, formal, honest, intelligent, neat, simple,* and *white collar.* Only 16% were negative, and they were predominantly focused on behavior, such as *brownnoser, compliant, distant, rule driven,* and *workaholic.*

Impact Typeface

For **Impact**, most participants assessed the Impact typeface as *assertive*, *masculine,* and *consistent*. Half judged Impact as *rude* and *unsupportive*. The typeface persona was attributed to the sender using it on six of the nine attributes meaning the typeface persona and sender persona were similarly perceived. Senders using Impact were judged much less *polite*, somewhat less *assertive*, and slightly less *supportive* than was the typeface alone, but more *mature*, and slightly more *formal*, *professional*, and *attractive.* The perception of the typeface and the sender matched most closely on *masculine* and *consistent*. Table 2 shows the highest rated adjective of each pair on the Impact typeface persona, in descending order, compared with the persona of the sender using it.

Characteristic	Typeface (N=52)	Sender (N=52)
Assertive	83	73
Masculine	77	75
Consistent	67	69
Supportive	48	42
Polite	48	30
Mature	42	62
Formal	40	46
Professional	33	38
Attractive	31	35

Table 2: *Frequencies Comparing Typeface Persona and Sender Persona for* Impact*, in Descending Order, as Percentage of Total Sample*

The written-in terms participants added again supported the quantitative results. Participant-provided adjectives for the typeface Impact were 48% negative and primarily described the appearance of the typeface itself, e.g. *blob, cluttered, dark, hard to read,* and *thick*.

Participant-provided adjectives describing the sender were also higher in negativity (53%). Like those provided for Times New Roman, the adjectives provided for Impact focused on the behavior of the sender, such as *arrogant, bossy, cold, egotistical, grumpy, mean, selfish, short-tempered,* and *unapproachable.*

Kristen ITC Typeface

Participants viewed both the typeface and the sender as polite and attractive. The typeface persona of Kristen ITC was perceived as supportive and consistent, but the sender who used it was judged less so. The sender using Kristen ITC was perceived considerably differently than the typeface on all the attributes other than attractive, but in the same order. The sender was perceived as youthful, feminine, casual, polite, passive, attractive, and unprofessional more dramatically than was the typeface itself. Table 3 shows the highest rated adjective of each pair, in descending order, on the Kristen ITC typeface persona compared with the sender persona using it.

Characteristic	Typeface (N=52)	Sender (N=52)
Polite	81	87
Attractive	79	81
Supportive	73	64
Consistent	73	50
Professional	46	19
Assertive	45	15
Formal	42	11
Mature	38	4
Masculine	21	6

Table 3: *Frequencies Comparing Typeface Persona and Sender Persona for Kristen ITC, in Descending Order, as Percentage of Total Sample*

For Kristen ITC, the written-in adjectives varied. There were 121 adjectives provided to describe the typeface. Participants described Kristen ITC as *childish, girly,* and *welcoming.* The sender was described by 99 participants' adjectives as *childish, girly, carefree,* and *glamorous.* The typeface and sender were also described in unattractive terms. For the typeface, 27% of the adjectives were negative: *distracting, messy, sloppy, unattractive,* and *unlegible* [sic]. For the sender, 21% were negative, e.g. *ditsy, dumb, meek, timid,* and *unassertive*.

6. DISCUSSION

Supporting McLuhan's decree that the medium is the message, the role of typeface in electronic communication goes beyond visually displaying the sender's words (1964). Typeface not only conveys the literal meaning of a message but also the personality of the sender, which means that the receiver of the message reads the physical appearance of the words as well as the words themselves.

The online student, relying solely on the electronic words sent by the instructor, construes meaning in the typeface as well as in the words used and attributes certain personality traits to the sender based on the style of the typeface. The instances where the perception of the typeface and sender did not match on Times New Roman may be because it is so common and, to some participants, has lost visual meaning and is simply a generic font, appropriate for all purposes and carrying little weight in terms of influencing perception (Baumberger, 2003b). Participants judged senders as more professional for using a common business-like font, transferring the typeface's persona more fully to the sender. However, for differences in perception between typeface and sender for Kristen ITC, the transference of typeface person to the sender resulted in a less favorable perception of the instructor as a professional, even though participants tended to perceive the typeface persona rather favorably.

Overall, the results relating to students' perceptions about Times New Roman support previous research regarding the typeface's persona as traditional, non-threatening, and accessible to readers (Henderson et al., 2004; Mackiewicz, 1990; Bernard et al., 2001) This typeface works well as a default typeface for online communication as it allows the receivers to read the message and experience little negative distraction by the typeface (e.g. being difficult to read due to design qualities or suggesting a tone that contradicts the message itself). Times New Roman can aid in influencing the receiver as it lacks an aggressive or too-playful appearance. In essence, the fact that its design does not create a large amount of visual noise means that it allows the receiver to focus on the message (Bitzer, 1968). With 73% of the participant-provided adjectives describing the sender as professional, this typeface can influence the receiver to accept the message for what it is and not for what it appears to be.

With its bolder lines, Impact literally and figuratively takes up more space on the page, forcing the reader to pay more attention to the design. Its fixed pitch, or the spacing between the letters, makes the letters appear more cramped together. The participant-provided adjectives attested to the effect of this typeface's design in instructor-student communication, as 74% of the adjectives focused on the negative aspect of the typeface's appearance and 70% focused on the negative or unprofessional personality of the sender. The Impact typeface, then, creates too much visual noise for the message, changing a neutral message from a professor into one with an underlying harsh tone. As with Times New Roman, the results for perceptions relating to the Impact typeface support previous research. This typeface, according to the participant-provided adjectives, is inappropriate for general communications because it comes across as abrasive, rude, and demanding. The strongest theme within the participant-provided adjectives was negative in tone, thus senders who need to develop a professional and/or positive working relationship, as instructors do to create a successful learning environment, should avoid this typeface. However, in situations where the message is brief and important, e.g. *Please submit your final papers today!*, or when the message is a headline, e.g. *Take a Study Break at the Café*, this typeface is appropriate due to its attention-getting design as well as the fact that the information is brief and does not visually overwhelm the page.

Unlike the other two typefaces in our study, Kristen ITC possesses a very specific visual connotation to femininity and youthfulness. Combining its rounded design with its historical use in communications aimed at children, Kristen ITC has evolved to represent the opposite of Impact's harsh tone and Times New Roman's professionalism. This typeface does not present itself in a threatening or forceful manner, which can influence its being perceived as more polite and attractive. As with Impact, the participants had opinions regarding the appropriateness of this typeface for instructors. Participants rated Kristen ITC as too casual and unprofessional for it to have the same accessibility and the same neutrality as Times New Roman. Like the Impact typeface, the appearance of this playful typeface can overpower the sender's intended message. Two of the major themes within the participant-provided adjectives, for both sender and receiver, were childishness and playfulness, therefore, senders who need to convey an air of authority or send an important message should avoid this typeface.

Limitations

Validity issues revolve around the participant pool, specifically its size and its demographic make-up. The sample size was small, out of 149, only 52 ultimately completed the survey. Some students started the survey, but failed to complete it. This may be due to the length of the survey, though the time required tocomplete it was roughly 10-15 minutes. Some participants completed the survey but, with each progressive screen, provided fewer adjectives in the qualitative section, which may be because participants were eager to finish and/or lost interest. There is the possibility that the length of the email letter, though only eleven sentences long, was perceived as being too long. Another possible limitation is the fact that the sample letter contained instructions so the words' meanings may have influenced the participants' perception of the sender. Finally, not providing a neutral option on the semantic differential scale forced the participants to choose between the adjectives. This pilot study has led to the design of a new study to overcome these limitations.

7. CONCLUSION

Online students who have a positive sense of their instructors are more likely to do well academically and have a higher level of satisfaction with their courses (Arbaugh, 2000). This study offer evidence of one way in which instructors' electronic communications can influence positive student perception of the instructor and the course, especially in early interactions. On-line instructors should be aware of the effect of choice of typeface when communicating with their students. Our study encourages the design of basic communication guidelines which have been found conducive to decreasing miscommunication in virtual settings (Remidez, Stam, & Laffey, 2007; Hsu & Chou, 2009; Clark & Gibb, 2006). Using these results as a guide for typeface will prove useful for those in academia who want to ensure that the visual rhetoric of their message does not distort the meaning of the message.

8. REFERENCES

Arbaugh, J. (2000). Virtual classroom characteristics and student satisfaction with internet-based MBA courses. *Journal of Management Education, 24* (32), 32-54.

Arbaugh, J. (2001). How instructor immediacy behaviors affect student satisfaction and learning in web-based content. *Business Communication Quarterly, 64* (4), 42-54.

Bernard, M., Mills, M., Peterson, M., & Storrer, K. (2001). A comparison of popular online fonts: Which is best and when? *Usability News, 3* (2).

Bitzer, L. (1968). The rhetorical situtation. *Philosophy and Rhetoric, 1*, pp. 1-14.

Bloch, P. H., Brunel, F. F., & Arnold, T. J. (2003). Individual differences in the centrality of visual product aesthetics: Concept and measurement. *Journal of Consumer Research, 29*, 551-565.

Brumberger, E. R. (2003a). The rhetoric of typography: The persona of typeface and text. *Technical Communication, 50* (2), 206-223.

Brumberger, E. R. (2003b). The rhetoric of typography: The awareness and impact of typeface appropriateness. *Technical Communication, 50* (2), 224-231.

Clark, A. M. (2003). A preliminary investigation of student perceptions of online education. *Information Systems Education Journal, 1* (36), 1-9.

Clark, D. N., & Gibb, J. (2006). Virtual team learning: An introductory study team exercise. *Journal of Management Education, 30*, 764-787.

Dirks, K., & Ferrin, D. (2001). The role of trust in organizational settings. *Organizational Science, 12* (4), 450-467.

Finn, A., Schrodt, P., Witt, P. E., Jernberg, K., & Larson, L. (2009). A meta-analytical review of teacher credibility and its associations with teacher behaviors and student outcomes. *Communication Education, 58* (4), 516-537.

Geisler, C., Bazerman, C., Doheny-Farina, S., Gurak, L., Haas, C., Johnson-Eilola, J., et al. (2001). IText: Future directions for research on the relationship between information technology and writing. *Journal of Business and Technical Communication, 15* (3), 269-308.

Henderson, P. W., Giese, J. L., & Cote, J. A. (2004). Impression management using typeface design. *Journal of Marketing, 68*, 60-72.

Heo, M. (2009). Design considerations for today's online learners: A study of personalized, relationship-based social awarenes information. *International Journal of E-Learning, 8* (3), 293-311.

Hsu, J.-L., & Chou, H.-W. (2008). The effects of communicative genres on intra-group conflict in virtual student teams. *International Journal of Distance Education, 7* (1), 1-22.

Kostelnick, C. (1988). A systematic approach to visual language in business communication. *The Journal of Business Communication, 25* (3), 29-48.

Lemke, J. L. (2002). Visual communication. *Travels in hypermodality, 1* (3), 299-325.

Lewis, C., & Walker, P. (1989). Typographic influences on reading. *British Journal of Psychology, 80*, 241-257.

Mackiewicz, J. (2005). How to use five letterforms to gauge a typeface's personality: A research-driven method. *Journal of Technical Writing and Communication, 35* (3), 291-315.

Menzel, K. E., & L.J., C. (1999). The impact of gender and immediacy of willingness to talk and perceived learning. *Communication Education, 48* (1), 21-40.

McLuhan, M. (1962). *The Gutenberg galaxy.* Toronto: Signet Books.

Poffenberger, A., & Franken, R. (1923). A study of the appropriateness of type faces. *Journal of Applied Psychology, 7*, 312-329.

Remidez, H., Stam, A., & Leffey, J. M. (2007). Web-based template driven communication support systems: Using shadownet workspace to suport trust development in virtual teams. *International Journal of e-Collaboration, 3* (1), 65-83.

Shaikh, A. D., Chaparro, B. S., & Fox, D. (2006). Perception of fonts: Perceived personality traits and uses. *Usability News, 8* (1).

Smith, W.S. (2008). *Decoding generational difference: Fact, fiction… or should we all just get back to work?* Deloitte Development, LLC.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18* (6), 643-662

Communicating the Value of Program-Level Accreditation for Information Systems in a College of Business

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Abstract

Undergraduate programs in Information Systems are challenged to offer a curriculum that is both rigorous and relevant. Specialized college-level accreditation, such as AACSB, and program-level accreditation, such as ABET, offer an opportunity to signal quality in academics while also remaining relevant to local stakeholders and constituents. Computing programs in schools with AACSB accreditation may face challenges in maintaining relevance to meet local stakeholder needs when a technically oriented computing program exists alongside other less technically-inclined programs in business. The challenge is to balance the technical needs of the program with the mission-driven needs of the college of business. This paper makes the case that program-level accreditation can be used to complement college-level accreditation while carefully managing the needs of a technical program in business computing. This paper discusses the culture and characteristics of ABET and AACSB drawing from recent experiences in attaining initial accreditation from both ABET and AACSB. Data regarding each accreditation is examined to ruminate on why more Information Systems programs are not accredited, or seeking accreditation, now that it has been over 10 years since Information Systems programs have been accredited by ABET's Computing Accreditation Commission. Several threats, challenges, imperatives, and opportunities in seeking both accreditations are discussed. Particular attention is afforded to lessons learned from seeking and earning both accreditations simultaneously. This paper holds the position that the benefits of both accreditations outweigh the limitations. However, IS programs seeking ABET accreditation in light of AACSB accreditation must be prepared to communicate the value of program-level accreditation.

Keywords: ABET, AACSB, Accreditation, Assessment, Continuous Improvement

1. INTRODUCTION

Accreditation of academic institutions and programs remains a viable approach to signal and ensure educational quality and adherence to widely accepted standards. Accreditation has become an almost existential imperative at the institution level in the United States should institutions wish to have access to various forms of Federal funding (SACS, 2012). Beyond institutional-level accreditation, information systems (IS) programs have options for specialized accreditation which signals compliance with standards that ensure that operations, faculty, programs, and curriculum are of a sufficient quality to achieve the college's mission. At the college level, AACSB represents a specialized accreditation that meets these needs. ABET's Computing Accreditation Commission (CAC) offers program-level accreditation for several computing disciplines, which allows a collegiate program to certify that they have met certain standards that are specific and relevant for computing. These standards are often viewed as those necessary to produce graduates ready to enter the discipline in a professional capacity.

Most specialized accreditations, both at the college and program levels, provide students with greater opportunities for employment, better access to graduate education, and greater mobility in their careers (AACSB, 2013a). Accreditation provides standards and processes to ensure continuous improvement of curriculum, evaluation, assurance and of learning, and faculty qualifications.

This paper proceeds as follows. First, we compare and contrast two specialized accreditations: AACSB at the college level and ABET at the program level. We make the case that both program-level and college-level accreditation are mutually beneficial. We relate the importance and relevance of these two specialized accreditations to the needs of a small regional Computer Information Systems (CIS) undergraduate program. Moreover, we discuss these issues as they relate to our recent experiences in the simultaneous pursuit of both accreditations. We offer insight concerning the challenges in obtaining both accreditations and reflect on the degree to which program-level accreditation must be sold to administrators in the face of the higher-order AACSB accreditation.

We also discuss the culture and history of both AACSB and ABET accreditation standards and processes. We next present a profile regarding the characteristics of AACSB-accredited schools, ABET-accredited programs in computing and information systems, and an overview of ABET-accredited programs in IS as they relate to AACSB accreditation. Next, we present the case that, when an information system program is located within a college of business, both ABET and AACSB accreditations are beneficial. We also conclude with lessons and insights learned during the course of our own experiences.

We continue with an examination of the characteristics of college- and program-level accreditations in terms of desired outcomes as they pertain to students, faculty, parents, employers, and other constituents. We do this by highlighting the demography of accreditation for both AACSB and ABET. We discuss why program-level accreditation is a complement to school-level accreditation in that it can help to specify and meet the needs of a technically-focused program in IS. We conclude by discussing how program-level accreditation answers a growing imperative for accountability to ensure learning outcomes and continuous improvement; an imperative for both AACSB and ABET (Beard, Schwieger, and Surendran, 2008; Culver and Warfvinge, 2013; Kelley, Tong, and Choi, 2010; Pringle and Michel, 2007).

2. "CULTURAL" CHARACTERISTICS OF AACSB AND ABET ACCREDITATION

It is reasonable to contrast specialized college-level accreditation standards, such as those provided by AACSB, as being culturally distinct from accreditation standards aimed at specific programs, such as CAC's standards for IS programs. Going back to 1932, ABET's history has been rooted in engineering and concerns related to professional development in the discipline (Prados, 2007). Over the years, ABET has emerged as being a recognized accreditor of college and university programs in applied science, computing, engineering, and technology.

AACSB, originally The Association to Advance Collegiate Schools of Business, was founded in 1916 and was primarily engaged in the accreditation of North American business (AACSB, 2013b). AACSB accreditation is more school and mission-oriented and encourages a tailored approach aimed at meeting mission and goals for a given school. This focus on a flexible and custom approach is sensible in that a curriculum and program blend may be developed that works for its unique circumstances. However, the circumstances of programs within the college may differ. Some programs must also remain flexible in their curriculum to serve the needs of their profession(s) and needs of local industry. Serving these needs and satisfying these constraints may be challenging when college-level accreditation requirements take precedent.

Given the differing levels of analysis and different aims, AACSB and ABET offer both contrast and complement when program-level needs are considered. The objectives- and stakeholder-orientation of ABET serves as a model for how the unique characteristics of a program can be preserved in the case of both accreditations.

Characterizing the AACSB Accreditation Process

The AACSB accreditation process is largely mission-driven in that accreditation standards flow from an initial set called the *Strategic Management and Innovation Standards* (AACSB, 2013). AACSB characterizes it's mission-driven proclivity thusly: "*'Strategic Management' is based on the principle that a quality business school has a clear mission, acts on that mission, translates that mission into expected outcomes, and develops strategies for achieving those outcomes. It addresses three critical and related components: mission and strategy; scholarship and intellectual contributions; and financial strategies*" (AACSB, 2013). These initial standards (AACSB standards 1 – 3) provide an overarching tone for the balance of AACSB's business accreditation standards.

AACSB also provides standards (AACSB standards 4 – 7) for students, faculty, and staff in regards to how these constituents help to serve and realize a college's mission. There are also standards (AACSB standards 8 – 12) that address learning and teaching. Note that AACSB's assurance of learning (AOL) approach to quality assurance is not prescriptive such that the specific needs of disciplines and programs are addressed. For instance, in the case of curriculum management, the college is given quite a bit of leeway: "*A curriculum maps out how the school facilitates achievement of program learning goals. It is defined by content (theories, concepts, skills, etc.), pedagogies (teaching methods, delivery modes), and structures (how the content is organized and sequenced to create a systematic, integrated program of teaching and learning). A curriculum is also influenced by the mission, values, and culture of the school*" (AACSB, 2013).

The management of college-level curriculum is also described as entailing: "*…processes and organization for development, design, and implementation of each degree program's structure, organization, content, assessment of outcomes, pedagogy, etc. Curricula management captures input from key business school stakeholders and is influenced by assurance of learning results, new developments in business practices and issues, revision of mission and strategy that relate to new areas of instruction, etc.*" (AASCB, 2013). It is worth noting that AACSB does mention "key business school stakeholders," however, the process for identifying these stakeholders, and ensuring that their needs are met, is not explicit.

A final set of standards (AACSB standards 13 – 15) address the degree to which the program remains relevant by providing both faculty and students with opportunities for academic study and professional engagement. AACSB clearly desires that these endeavors intertwine.

In general, the AACSB culture focuses on the needs of the college in terms of how a college of business mission describes the college's goals and purpose. Thus, while the aggregate learning needs and goals of the college as a whole are discussed, the acute needs of any one program are not specifically addressed. In the college of business, the more technical disciplines, such as accounting, finance, operations management, decision-support management, and information systems, may have additional needs that are not entirely met by the strictures of college-level accreditation. Certainly it is difficult for the learning goals and assurances of learning to acutely describe the needs of an intermediate programming class as such courses are not college-wide in nature.

AACSB is designed to accredit colleges of business that are deemed to fulfill their mission with processes that ensure assessment and continuous improvement. This process operates against a strategic plan to guide a five-year continuous improvement process. Schools that successfully pursue this process may renew their accreditation.

Characterizing the ABET Program Accreditation Process

The ABET accreditation process also relies on peer review and self-evaluation. However, given the applied nature of most programs accredited by ABET, there is an emphasis on Program Educational Objectives (PEOs) which are heavily oriented towards specific competencies which must be possessed by graduates, and observable and confirmable by industry constituents, in a period of one to five years after graduation. This outcomes-oriented approach that pervades the ABET assessment culture much as mission-orientation does for AACSB.

The ABET accreditation process moves back into the instructional realm by specifying both general and discipline-specific Student Outcomes (SOs) which must be mapped to a program's curriculum. An accredited program must show compliance with processes that lead to continuous improvement. This process threads from student performance in the classroom, up through the program-level SOs, and beyond to observations on PEO achievement. There is an emphasis on grounding student performance in the tangible artifacts and skills concomitant with applied disciplines.

ABET's CAC provides general and program-specific criteria as standards for accreditation. These criteria focus on students, PEOs, SOs, processes for continuous improvement, curriculum, faculty qualifications and activities, educational facilities, and institutional support. Programs meet these criteria by putting into place, maintaining, and reviewing processes for the management of PEOs, SOs, assessment, and evaluation (ABET, 2013b).

ABET specifies a range of assessment activities which, as is the case with AACSB, sit at the heart of accreditation actions. ABET mentions both an "Assessment" and a "Continuous Improvement" cycle of activities that intertwine, inform, and provide feedback between them. Programs that remain in good standing are subject to review and renewal of accreditation every six years.

3. AACSB-ACCREDITED COLLEGES AND ABET-ACCREDITED PROGRAMS

Another means of understanding the contrast and characteristics between AACSB and ABET accreditation is to review basic data about schools and programs accredited. Our review of this data raises curiosity as to why there are so few ABET-accredited programs in IS. We also wonder how AACSB accreditation meets the acute needs of its technical programs. While others, such as Larson and Harrison (2012), have extensively examined the characteristics of ABET-accredited programs in the USA, our aim is to compare and contrast ABET-accreditation of IS programs as they are situated in AACSB-accredited schools.

AACSB Accreditation Statistics

As of mid 2013, there are 683 schools or institutions holding AACSB accreditation (AACSB, 2013c). Of these institutions, 501 are located in the United States, which constitutes 73% of the world-wide total. In this regard, it is reasonable to assume that the United States system of higher education has significant impact on attitudes towards accreditation.

The high number of accredited programs in North America belies the origins of AACSB and suggests growth opportunities internationally (see Figure 1 below).

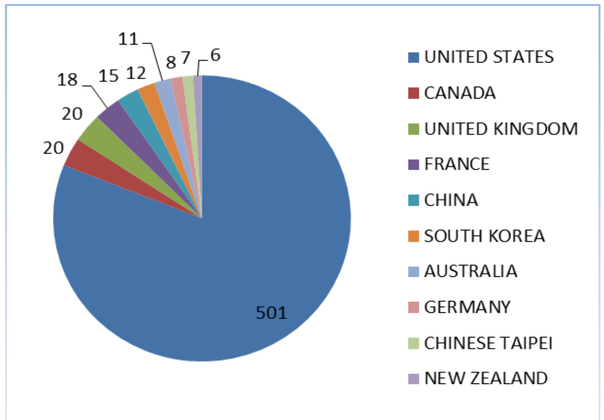

Figure 1. Large number of AACSB-accredited programs in North America

ABET Accreditation Statistics

As of mid 2013, ABET has over 3,100 accredited programs in engineering and technology-related disciplines (ABET, 2013b). These programs are accounted for in 587 institutions of higher education in 24 countries (see Table 3 in appendix) (ABET, 2013b). Thus, many schools have multiple ABET-accredited programs. For some colleges of engineering and technology, the sum portfolio of accredited programs constitutes, more or less, a college-level accreditation. ABET accreditation remains quite important for professional certification and licensure in many engineering and technology related fields.

ABET-accredited programs are governed by four accreditation commissions: Applied Science Accreditation Commissions; Computing Accreditation Commission; Engineering

Accreditation Commission; Engineering Technology Accreditation Commission. Table 4 (in appendix) shows the various criteria for programs covered under each commission. A closer examination of Table 4 also reveals that a majority of these criteria are specific to engineering and engineering technology fields. Figure 2 provides a clearer view of the overwhelming influence and presence of engineering in ABET accreditation.

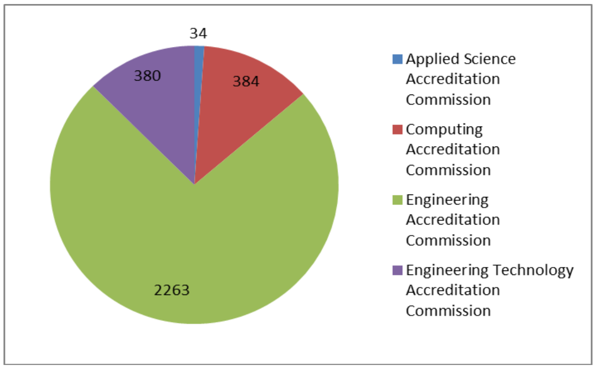

Figure 2. Number of Programs by ABET Accrediting Commission

ABET-Accredited Programs by Computing Discipline

Shackleford et al. (2006) provide useful definitions and descriptions for the major computing disciplines: Computer Engineering, Computer Science, Information Systems, Information Technology, and Software Engineering. The CAC provides accreditation criteria for each of these programs. Given the relative age of the computing disciplines, most of the ABET-accredited programs are in Computer Science. There are fewer (293 vs. 52) ABET-CAC accredited programs in IS (ABET, 2013a). Figure 3 shows the distribution of the five major computing disciplines within the ABET accreditation commissions.

Shackleford et al. (2006) also aptly characterize the disciplines along a continuum spanning from hardware and software (Computer Engineering and Computer Science) to organizational integration (Information Systems and Information Technology), and those that bridge the two (Software Engineering and Information Systems).

As we ponder the problem space of computing (Shackleford et al., 2006), we can understand that, while ABET provides criteria for many engineering, technology, and computing undergraduate programs, ABET is a culture concerned with the applied aspects of its disciplines (see Figure 10 in the appendix).

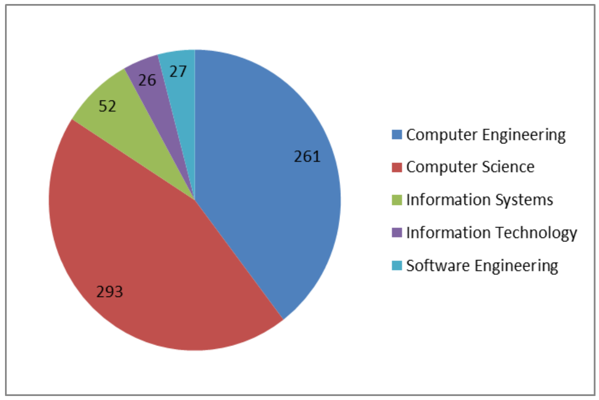

Figure 3. Distribution of Computing Programs Accredited by ABET's Computing Accreditation Commission

ABET-Accredited Statistics Related to AACSB Accredited Colleges

We also reviewed the number of ABET-accredited programs in AACSB-accredited schools as of mid 2013.

Although there are 47 ABET programs accredited under the "Information Systems" criteria, these programs are known by 15 distinct names. Table 5 shows the distribution of program names. This confusion in the nomenclature of the IS discipline remains problematic.

Another point of interest is the degree to which ABET-accredited programs conforming to CAC's IS criteria are located within the college of business. This is a matter of concern given that the criteria for IS programs require an additional Student Outcome specific to IS: "*(j) An understanding of processes that support the delivery and management of information systems within a specific application environment*" (ABET, 2013b). Generally, the college of business curriculum, particularly as guided by AACSB accreditation processes, readily supplies the "specific application environment" necessary for the fulfillment of this Student Outcome. Furthermore, the CAC specifies "*…One-half year of course work that must include varied topics that provide background in an environment in which the information systems will be applied professionally*" (ABET, 2013b). These 15-credit hours are easily met by the core curriculum provided by most AACSB-accredited schools.

Whereas many programs accredited by the CAC have been accredited for close to 30 years, most of the IS programs have been accredited for 10 years or less (ABET, 2013b). Figure 13 (in appendix) shows how many programs under CAC accreditation were accredited from the earliest days of ABET up through the 1980s, 1990s, 2000s, and into present times.

Also of interest would be the accrual of new accreditations under the CAC's IS program criteria. Figure 4 shows initial accreditation for programs in three phases: Early (2000-2003) – 13 new programs; Middle (2004-2009) – 28 new programs; Recent (2010-2013) – 7 new programs. The majority of IS programs have received initial accreditation in the Early and Middle periods (Figure 4).

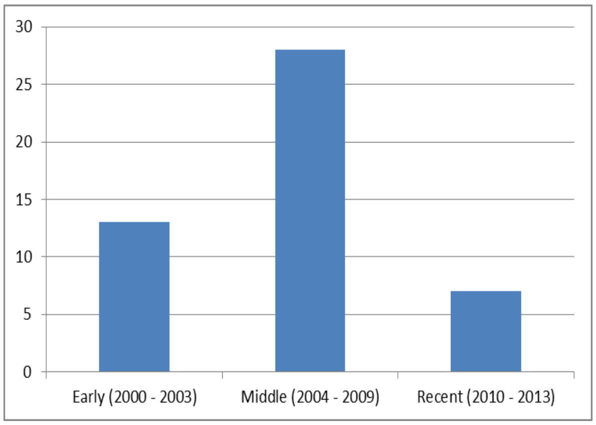

Figure 4. Periods of newly-accredited IS programs

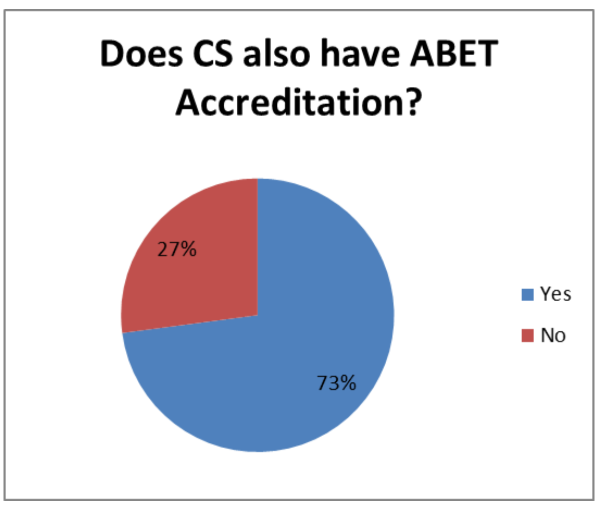

Figure 5. Percentage of Institutions Where CS is also Accredited

Another interest in ABET-accredited IS programs has to do with these programs' relationship to other entities. How many ABET-accredited programs in IS have ABET-accredited programs in CS at the same school (Figure 5)? How many ABET-accredited programs are located within the college of business (Figure 6)?

How many of ABET-accredited programs, regardless of whether they are located in the college of business, have AACSB-accredited colleges of business on campus (Figure 7)?

Figure 5 shows that in a majority of institutions, the Computer Science program is also ABET-accredited.

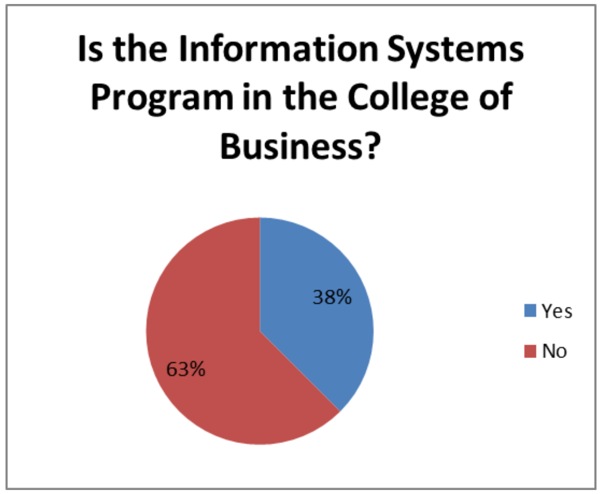

Figure 6. Percentage of ABET-Accredited Programs located in the College of Business

Figure 6 (above) shows that nearly two out of three ABET-accredited programs in IS are NOT in the college of business. This is an interesting fact that is somewhat counter intuitive.

Given the history of IS, and the general focus of research in IS, it is can be assumed that most programs are located in the college of business. However the data show that a minority of ABET-accredited programs in IS are found in a college of business.

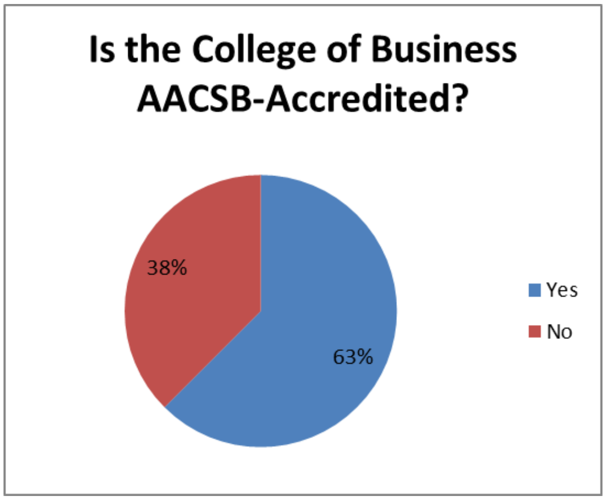

Figure 7. Percentage of ABET-Accredited Programs where the College of Business is AACSB-Accredited

Figure 7 (above) shows that an equal majority of the institutions with ABET-accredited IS programs also have an AACSB-accredited business school. It is likely that these programs fulfill IS-specific criteria curricular needs in cooperation with the AACSB-accredited school of business on their campus.

Table 1 rounds out this analysis by showing that institutions with an ABET-accredited IS program NOT located in the college of business, but where that college of business is AACSB-accredited, are in the majority. In Table 1 below, the total of all percentages in all cells adds up to 100%.

	AACSB	**Not AACSB**
In Biz	21%	17%
Not Biz	42%	21%

Table 1. Distribution of ABET-accredited programs: Presence in College of Business and AACSB-accreditation for College of Business

Relevance to AITP-EDSIG

Another important issue is whether the topic of ABET program accreditation, as it relates to AACSB accreditation, is of any concern to the AITP's Special Interest Group for Information Systems Educators (EDSIG). We offer two quick and non-scientific proxies to gauge this. First, we recorded the institutional affiliation of all authors listed in the 2012 proceedings of the Information Systems Education Conference in New Orleans. There were 199 unique authors/presenters of refereed papers, abstracts, workshops, panels, presentations, and posters. These authors represented 88 institutions of higher education and a handful of organizations or companies. For the purposes of our demonstration, we'll just focus on the 88 institutions of higher education. Ten of these institutions (13%) have an ABET-accredited IS program on campus (see Figure 8).

We can also examine how many of the authors/presenters at ISECON 2012 are from institutions with an AACSB-accredited school/college of business. This presents an interesting figure where the number of AACSB-accredited institutions is 37 (42%), which is nearly triple the number of ABET-accredited programs (see Figure 9 below).

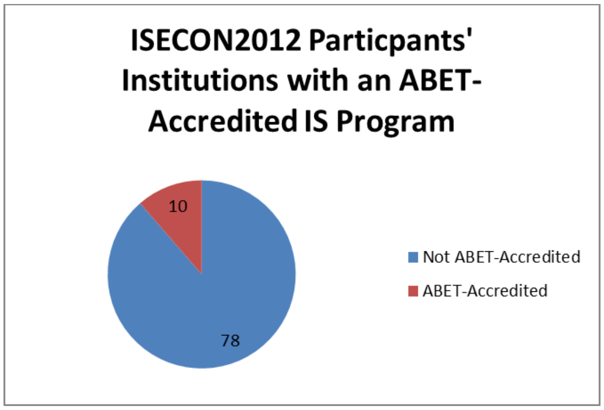

Figure 8. ISECON 2012 Institutions with an ABET-Accredited IS Program

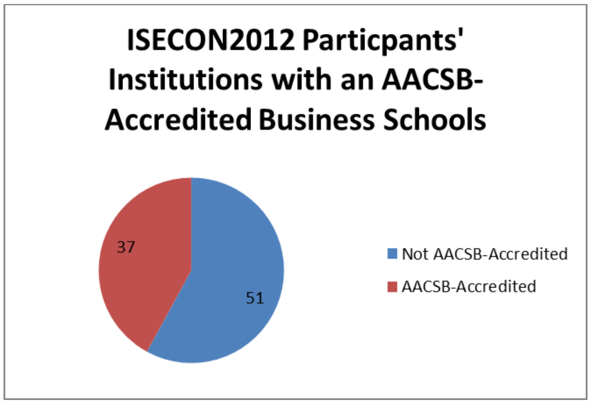

Figure 9. ISECON 2012 Institutions with an AACSB-Accredited Business School

The implication here is that there is potential opportunity for more of these programs where the business school is AACSB-accredited to explore program-level accreditation. Certainly ABET's IS-specific criteria call for collaboration with the business school.

Another "thumbnail" proxy for gauging interest in program-level accreditation (such as ABET) would be the number of peer-reviewed papers or abstracts submitted and published in the ISECON proceedings. A quick title search and subject search reveals few papers each year on the topic from 2006 to 2012 (see Table 2 below). Data were obtained using the ISECON proceedings website's search feature (http://proc.isecon.org/).

Year	**ABET in Title**	**ABET in Keyword**	**Number of Papers in Proceedings**
2012	1	1	66
2011	2	1	74
2010	0	2	103
2009	3	4	99
2008	0	1	97
2007	2	0	129
2006	1	0	126

Table 2. ABET-related research activity in ISECON Proceedings 2006-2012

Opportunity

We believe the data concerning ABET-accredited programs in IS reveal opportunities for non-ABET-accredited IS programs. This assertion raises certain questions: Why are colleges of business with IS programs not pursuing (or not planning to pursue) AACSB accreditation? Of the IS programs in AACSB-accredited colleges of business, why are these programs not pursuing ABET accreditation? We address the structures which may lead to answers to these questions in the next section.

4. THE NEED FOR PROGRAM-LEVEL ACCREDITATION

While specialized accreditations, such as AACSB and ABET, may be signals of quality and strength of compliance, it is the means by which these privileges are earned that is compelling. It is through systematic assessment of programs, curriculum, and faculty. Such processes lead to quantifiable and verifiable continuous improvement. Thus, at each level, AACSB and ABET offer concrete and actionable guidance. However, the importance of assessment and continuous improvement are not conveyed or operationalized similarly at each level.

AACSB provides a means of demonstrating, through assurances of learning, that the curriculum, implemented across disciplines and programs, leads to student learning that is consistent with the goals and mission of the college. On the other hand, ABET is particularly effective at providing an assessment and continuous improvement process which supports the needs of local stakeholders.

An ABET-accredited IS program benefits from AACSB in that the program-specific aim of ensuring that IS skills and knowledge is enhanced by their application in business. Thus, the business core, and in particular, a business capstone course, provide context for focusing the IS program and its curriculum. In this regard, the imperative for accreditation is somewhat higher for the IS program is it needs accreditation guidance for standards particular to its technical nature and accreditation guidance for its application area.

Our experience with seeking program-level accreditation in parallel to college-level accreditation has revealed three principle concerns: need, relevance, and imperative.

Program-Level Need

The IS discipline spans a unique set of concerns. Whereas organizational issues relevant to IS are somewhat grounded in management, marketing, industrial psychology and sociology, the IS discipline is also very technical and applied (Shackleford et al., 2006). There are changes and trends in areas related to application technology, software methods, and systems architectures which IS programs must respond to. Thus, while our assessment efforts must be used to improve our curriculum, our curriculum, as it responds to trends, presents a moving target. This makes it difficult to develop data for longitudinal assessment comparison. For IS programs, this increases the importance of program objectives.

Given the volatile nature of the technology component of the IS discipline, an objectives- and stakeholder-orientated accreditation process allows a program to grow and adapt in phases. The ABET accreditation process for IS programs provides Program Educational Objectives (PEOs) and Student Outcomes (SOs). PEOs are similar to mission-oriented objectives in AACSB in that programs can tailor these objectives to both industry trends and local needs. The ABET process ensures regular review of PEOs according to the assessment and continuous improvement process which incorporates student performance on SOs and stakeholder input. A strength of the ABET process is the degree to which PEOs are emphasized and dictate the subsequent structure of SOs, Course Learning Outcomes (CLOs), efficacy of mission, etc. Thus, PEOs ensure/enforce synchronization with stakeholders, students, mission, and employers as the program must map from PEOs to these other things.

It is important to note that the mere act of assessment does not guarantee any program-level improvements. Entire areas of assessment literature highlight the criticality of developing good assessment instruments with respect to quality and reliability. Moreover, the systematic use of assessment outputs for continuous improvement must also be monitored and managed carefully. That is, the presence of an assessment process alone in insufficient to ensure that meaningful continuous improvement will transpire.

IS programs need a program-level accreditation process as the standards, guidance, and process make it prudent to shape PEOs about stakeholder input and needs. This allows an IS program to use SOs, which are typically prescriptive from ABET's criteria, to "anchor" the program's core curriculum. For instance, in our own program, core courses are used to measure SOs and ensure ABET compliance. We then use electives explore new topics and ensure currency and relevancy. During the course of an 18-month rotation with these electives, we identify the usable and useful aspects covered and incorporate those into our core curriculum. This approach provides a solution for a rather profound problem for IS programs: how do we reconcile between the application area of business, the need for core traditions in computing education and training, and respond to new and emergent trends in computing?

A program-level accreditation process, such as ABET's, has provided our program with a model to define our core curriculum, via our SOs, around the central concern of IS development – which is an arguably appropriate approach for a Computer Information Systems program. At the same time, we heed an imperative to remain grounded in business. In either case, ABET's SOs also can be designed with the flexibility to define a program as being more managerial of more technical. In our case, our program's mapping of SOs to our curriculum is evenly distributed about our core curriculum with some leaning towards information systems development topics.

Relevance

ABET accreditation of our program has also provided an additional means of ensuring relevance in our program. The PEO-focus of the ABET accreditation criteria is well-suited to meet expectations, needs, outcomes, imperatives from legislation, parents, employers, consumers, industry – and to validate those outcomes. Ultimately, program accreditation assists a program to remain relevant by allowing for constant assessment and improvement. However, ABET's general computing criteria, and criteria specific to information systems, grounds our program in the fundamentals of the discipline. When coupled with an elective strategy that accommodates new technologies and trends, our IS program is equipped to prepare graduates to meet industry needs. It seems that this marks the ultimate goal to establish relevancy – the professional placement of graduates who meet the objectives of the program. In our case, we have little doubt that our ability to prepare students for successful professional placement is among our highest imperatives for the relevance of our program (Fischer, 2013).

Imperative

What seems missing, above all else, for program-level accreditation of IS programs is professional imperative. As many ABET-accredited IS programs exist outside of the college of business (often in engineering schools, technology schools, or a combination of business/engineering/technology schools), it would appear that these programs are governed by a culture that favors more technical concerns (Figure 11). Put another way, the imperative for program-level ABET accreditation has a tradition in colleges of technology and engineering, where professional certification and licensure relies on these accreditation. As the heritage of IS programs lies more with business and organizational needs, the strong imperative for ABET accreditation for IS programs in AACSB-accredited business schools is lacking.

As we have previously noted, a lack of imperative for program-level accreditation for computing programs in a college of business may be due to both a level-of-analysis mismatch between AACSB and ABET, and some degree of friction from a mismatch of cultures. Generally, a dean of an AACSB-accredited college has little imperative to seek and achieve program-level accreditation. There are exceptions, according to other professional needs (such as in Finance and Accounting), or according to the personal disposition of a dean, or according to other institutional proclivities. However, data on accredited programs provides evidence that AACSB-accredited schools of business are less likely to seek program-level certifications such as ABET.

5. OVERCOMING CHALLENGES AND OBSTACLES

The motivations for seeking a specialized accreditation at the school-level are completely different from those at the program level. In our experience, this is particularly so for schools with AACSB accreditation. In the ABET culture, particularly in light of licensure and professional certification, the imperative for program-level accreditation is higher. However, this is evidenced more so in the engineering side, rather than in the computing disciplines. The principle challenges we have observed, in the context of establishing need are: finding the imperative we mention above; overcoming cultural biases; the inherent identity crisis of the computing disciplines (in particular IS); and garnering top administrative support.

Overcoming Bias

Communicating the value of program-level accreditation by appeal to need, relevance, and imperative is not an entirely prescriptive approach. There have been challenges in our initial accreditation process that revealed fundamental biases in how the information systems discipline is perceived and the political/power position of IS programs in the college of business. Whereas in our case administrators have been very supportive, the clash of cultures between business and engineering and technology provides "headwinds" from both our business identity and from prevailing ABET culture of engineering. On the business side, there were times we felt as though AACSB had little consideration for IS as a discipline. For instance, the *2011-12 AACSB Business School Questionnaire (BSQ)* asks accredited schools about undergraduate programs in Economics, International Business, Management, and Marketing, but not Information Systems. Furthermore, while Figure 13 shows that the popularity in ABET accreditation in computing peaked in the first decade of the 21st century, there were clearly more Computer Science programs over time. Perhaps in this case ABET's engineering bias shows here as there is little evidence that accreditation have been actively marketed towards information systems programs.

Identity Crisis

Given that programs which are currently accredited (and are thus classifiable) under the CAC's information systems criteria are known by 15 different names, it seems that information systems, as a discipline, continues to suffer identity crisis. Whereas Figure 10 demonstrates how a computing discipline can be understood along a dimension ranging from theory to practice, and operating from an organizational down to hardware and architectural level, it is clear that characterizing a computing discipline is somewhat fraught. However, among all of the computing programs accredited by the CAC, programs classifiable as information systems have the widest variation in program name (see Table 5 and Table 6). While the "Computer Information Systems" nomenclature is almost as widely in use as "Information Systems," it is likely some attempt to reinforce and reestablish the technical component of the discipline is needed to minimize confusion for prospective students and employers of students.

A close examination of the CAC's criteria for computing programs in general, and information systems programs in particular, demonstrates that core computing topics remain paramount. In this regard, ABET has remained consistent in characterizing of the core topics in computing:

- Coverage of the fundamentals of a modern programming language
- Data management
- Networking and data communications

- Systems analysis and design
- The role of Information Systems in organizations

On the other hand, guidance from other professional organizations (AIS, AITP, ACM) has been less consistent and variations have been the subject of controversy (Longenecker, Feinstein, and Clark, 2013). Thus, while we may suggest that this "identity crisis," possibly rooted in where IS scholars/educators/employers believe IS functions along a continuum from technology to business/organizational needs, we also hold that program-level accreditation for information systems provides a reasonable means of managing this crisis.

Antecedents and Challenges: Lessons Learned

Among the stated aims of this paper is to both share our conviction that ABET accreditation provides a meaningful complement to AACSB accreditation and share our experiences in seeking these accreditations. We now share some of these observations.

It may not come as a surprise that support from administration was a key factor. To obtain top management support remains vital received wisdom from our own literature (Markus, 1983). Equally important, however, is the support and "buy in" from program faculty. In our experience, aside from a very low minority of terminally obstinate individuals that may be found in any environment, a significant and credible majority of program faculty must completely participate for a program-level certification to work in a sustainable manner. This is so as success requires complete and reliable engagement in the entire process: planning, collecting, assessing, and evaluating program assessment data for continuous improvement. Given the various "headwinds" we describe in this paper, program faculty must not only be tenacious, but must also seek the cooperation of non-program faculty. This was often only possible due to support from administration. There are also considerable initial and ongoing costs associated with ABET accreditation. Administration must be willing to incur costs for both college-level and program-level accreditation. There are considerable start-up costs over and above what will be required to maintain standards of accreditation. It is important to mention that these costs go beyond money and extend into commitment of time and other resources.

In retrospect, particularly given a significant degree of overlap in own pursuit of both AACSB and ABET accreditation, our principle challenges where:

- Resource availability
- Administrative support
- Culture clash – AACSB/Business vs. ABET/Engineering
- Curriculum guidance – Following AIS/AITP/ACM guidance vs. modeling on ABET

While we feel ABET provides a good system for shaping curriculum, solutions to the other challenges were achieved due to good administrative support and tenacious efforts on the part of faculty. Of all the challenges we faced, the "culture clash" was at times the most difficult. This may stem entirely from undertaking the ABET effort with some overlap while the AACSB effort was underway. Both processes constituted multi-year campaigns with a significant amount of self-study and self-assessment required before a comprehensive assessment process is adopted.

5. CONCLUSION

Our own experiences illustrate that program-level accreditation addresses the need for an IS program to provide value to program stakeholders. This is accomplished using a core program curriculum to remain grounded in the fundamentals of computing while utilizing electives to address local needs and to explore new and emerging trends. This approach allows our program concrete targets to aim for in hopes of remaining relevant and creates some imperative for program-level accreditation. Our most vital means of establishing this imperative has been the understanding and support of top administration. As our institution provides a strategic goal that each unit seek the highest accreditations possible, our program has been able to secure ABET accreditation for our CIS program by way of institutional imperative.

Truth to Power

The hurdle of infusing ABET accreditation as a strategy to meet program/stakeholder needs, while also satisfying college-level AACSB accreditation, is perhaps the most profound. This process can be characterized as an exercise in speaking "truth to power" (Wildavsky, 1979). In a college of business, regardless of the stature, health, and efficacy of the IS program, the concerns of any program will not take precedent over those of the college; particularly not when AACSB accreditation is at stake.

Moreover, it is important to consider which "view" of the business school is dominant. This is significant as AACSB, being mission-oriented, enables matters pertinent to the role of programs and curricula to flow from the tenor of the college mission. If the college of business is seen as a "trade school," in keeping with the earliest roots set in the Harvard Business School (Binks, Skarkey, and Mahon, 2006), then the technical nature of the IS program may be accommodated. However, the search for more serious grounding in positivist science from the 1950s and 1960s still pervades the North American business school culture (again, shown as overwhelmingly dominant in AACSB). As such, programs where cognitive and behavioral science are influential (Management, Marketing, Economics) may view the practical needs of the IS program as secondary. Whereas the accounting and finance disciplines have professional certification and licensure as imperatives, IS typically does not.

However, the question remains: how can an IS program in an AACSB-accredited school speak the "truth" of the benefits of program-level certification to the "power" of AACSB-certification? The way forward may lie in demands for accountability - legislative, stakeholder driven, and administration-directed – for measurable outcomes from higher education. Fortunately, program-level accreditation such as ABET's CAC criteria for information systems, asks for assessment and continuous improvement at a granularity that may soon become requisite for AACSB. As it stands, newer 2003 standards for AACSB, which must be implemented from 2013 onwards, are a step in this direction.

Moving Forward

Solutions to the various impediments and "head winds" we have described here may not quickly arise or offer uniformly prescriptive actions. However, while we see clearly a symbiosis and synergy between AACSB and ABET accreditation, reconciling these cultures is challenging. A future direction for work in this area is to develop an explicit process model that better describes the interplay between college-level (AACSB) and program-level (ABET) accreditation. Each approach offers a level of analysis for assessment and continuous improvement which can be used to understand and improve the IS curriculum. We believe that this understanding can be achieved for other disciplines in the college of business as well. Among the greater value-added benefits for college-level AASCB processes in the addition of program-level ABET accreditation is how ABET accreditation uses program-level objectives to meet local stakeholder needs. It is likely that meeting these needs are the ultimate test of the success of both the college and the academic program.

6. REFERENCES

AACSB, (2013a). 2013 Business Accreditation Standards. AASCB International. http://www.aacsb.edu/accreditation/business/standards/2013/strategic-management-and-innovation/. Last accessed: 07/15/2013.

AACSB, (2013b). AACSB Accreditation Standards. AACSB International. http://www.aacsb.edu/accreditation/standards/. Last accessed: 07/15/2013.

AACSB, (2013c). Schools Accredited in Business, AACSB International. http://www.aacsb.edu/accreditation/AccreditedMembers.asp. Last accessed: 07/18/2013.

ABET, (2013a). Accredited Program Search. http://main.abet.org/aps/Accreditedprogramsearch.aspx. Last accessed: 07/19/2013.

ABET, (2013b). Criteria for Accrediting Applied Science Programs, 2013 – 2014. http://www.abet.org/uploadedFiles/Accreditation/Accreditation_Step_by_Step/Accreditation_Documents/Current/2013_-_2014/cac-criteria-2013-2014.pdf. Last accessed: 07/18/2013

Beard, D., Schwieger, D., & Surendran, K. (2008). Integrating soft skills assessment through university, college, and programmatic efforts at an AACSB Accredited Institution. Journal of Information Systems Education, 19(2), 229-240.

Binks, M., Starkey, K., & Mahon, C. L. (2006). Entrepreneurship education and the business school. Technology Analysis & Strategic Management, 18(1), 1-18.

Boyer, E. L. (1991). The scholarship of teaching from: Scholarship reconsidered: Priorities of the professoriate. College Teaching, 39(1), 11-13.

Culver, S. M., & Warfvinge, P. (2013). Assessment, accountability, and educational quality in the United States and Sweden. European Journal of Higher Education, 3(1), 10-23.

Fischer, K. (2013). A College Degree Sorts Job Applicants, but Employers Wish It Meant More. The Chronicle of Higher Education, March 4, 2013. http://chronicle.com/article/The-Employment-Mismatch/137625/. Last Accessed, 07/19/2013

Kelley, C., Tong, P., & Choi, B. J. (2010). A review of assessment of student learning programs at AACSB schools: A dean's perspective. Journal of Education for Business, 85(5), 299-306.

Larson, S. and Harrington, M.C.R. (2012), A Survey of ABET Accredited Information Systems Undergraduate Programs in the USA. 2012 Proceedings of the Information Systems Educators Conference, 29(1961), New Orleans Louisiana, USA. pp. 18.

Longenecker, B., Feinstein, D., Clark, J. D. (2013). Information Systems Curricula: A Fifty Year Journey. Information Systems Education Journal, 11(6) pp 71-95. http://isedj.org/2013-11/ ISSN: 1545-679X. (A preliminary version appears in The Proceedings of ISECON 2012)

Markus, M. L. (1983). Power, politics, and MIS implementation. Communications of the ACM, 26(6), 430-444.

Prados, J. W. (2007). A Proud Legacy of Quality Assurance in the Preparation of Technical Professionals: ABET 75th Anniversary Retrospective. ABET, Baltimore, pp.346.

Pringle, C., & Michel, M. (2007). Assessment practices in AACSB-accredited business schools. Journal of Education for Business, 82(4), 202-211.

Shackelford, R., McGettrick, A., Sloan, R., Topi, H., Davies, G., Kamali, R., ... & Lunt, B. (2006). Computing curricula 2005: The overview report. ACM SIGCSE Bulletin, 38(1), 456-457.

Southern Association of Colleges and Schools Commission on Colleges (SACS). (2012). The Principles of Accreditation: Foundations for Quality Enhancement. pp. 44

Wildavsky, A. B. (1979). Speaking truth to power. Transaction Books.

APPENDIX

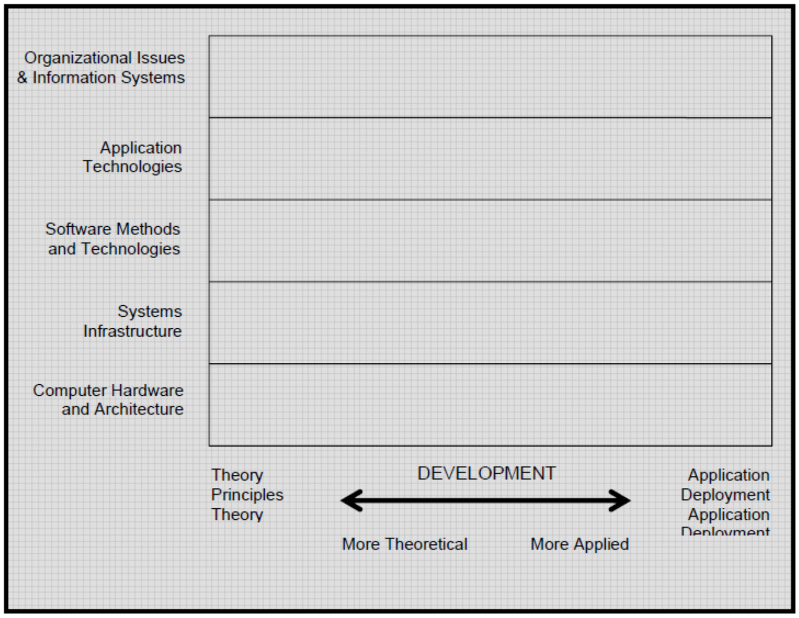

Figure 10. The Problem Space of Computing (Shackleford et al., 2006)

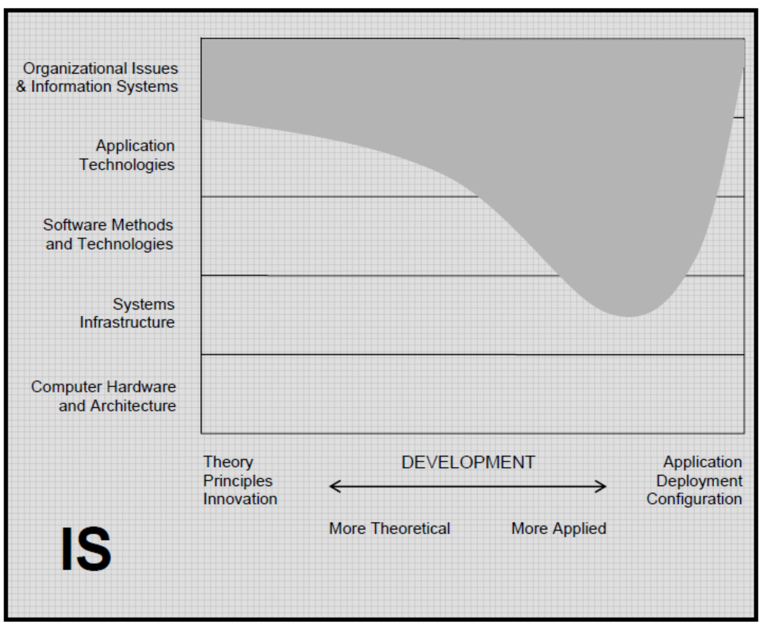

Figure 11. The Problem Space of Information Systems (Shackleford et al., 2006)

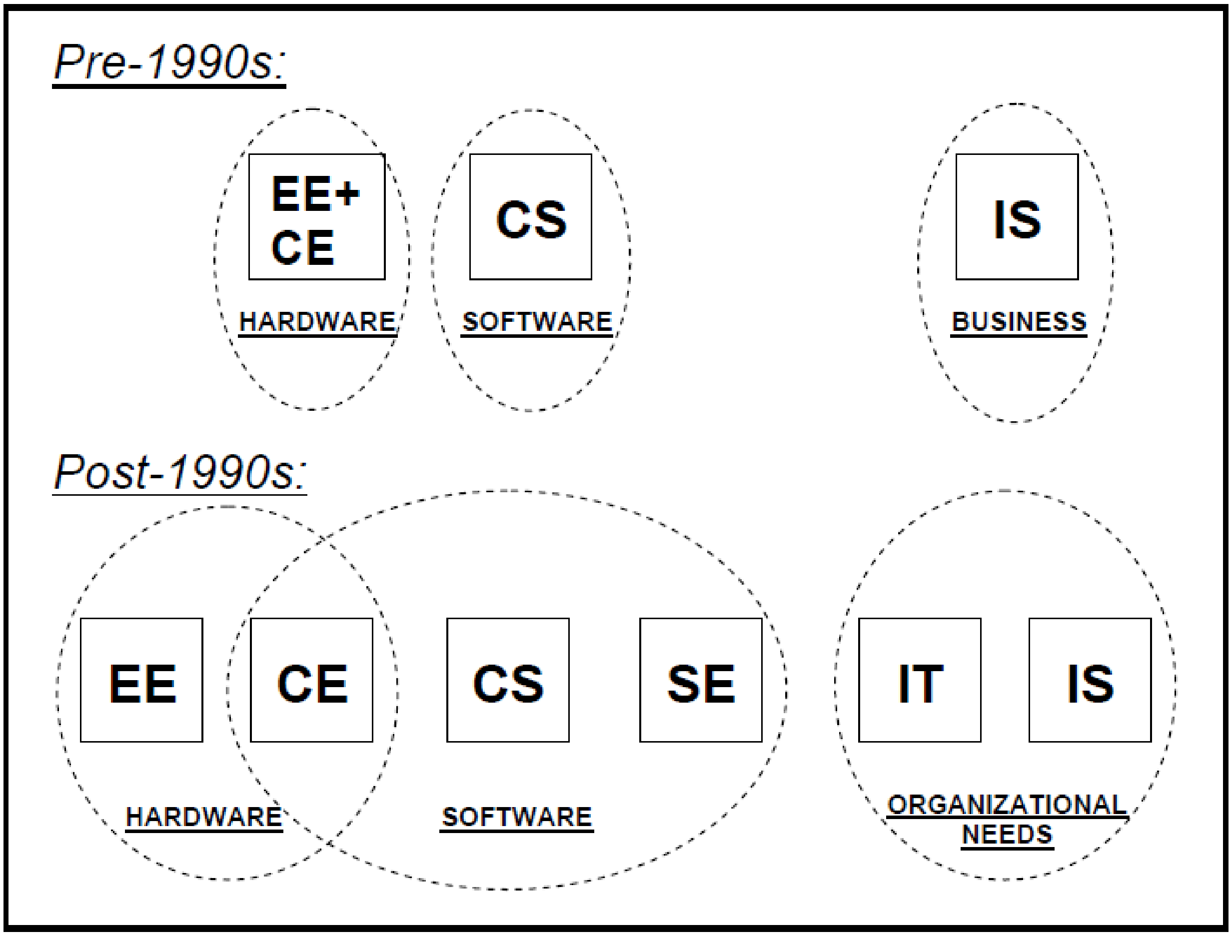

Figure 12. Continuum of Fundamental Concerns for Computing Programs (Shackleford et al., 2006)

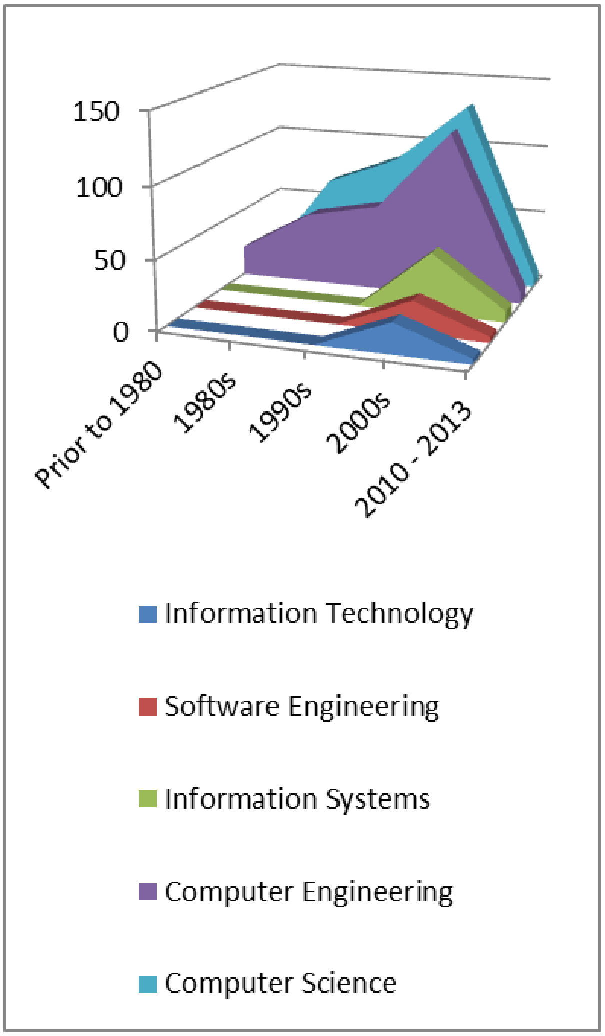

Figure 13. Trends in Newly-Accredited CAC Computing Programs Over Time, By Program

Country	Number of Schools	Percentage of Overall Schools
UNITED STATES	501	73%
CANADA	20	3%
UNITED KINGDOM	20	3%
FRANCE	18	3%
CHINA	15	2%
SOUTH KOREA	12	2%
AUSTRALIA	11	2%
GERMANY	8	1%
CHINESE TAIPEI	7	1%
NEW ZEALAND	6	1%
SPAIN	4	1%
NETHERLANDS	4	1%
MEXICO	4	1%
TURKEY	3	0%
SWITZERLAND	3	0%
SINGAPORE	3	0%
PERU	3	0%
BELGIUM	3	0%
THAILAND	2	0%
SOUTH AFRICA	2	0%

Table 3. Countries with the highest number of AACSB-Accredited Schools

ABET Commission	Criteria Covered Under Commission
Applied Science Accreditation Commission	Environmental, Health, and Safety Health Physics Industrial Hygiene Safety Surveying and Geomatics
Computing Accreditation Commission	Computer Engineering Computer Sciences Information Systems Information Technology Software Engineering
Engineering Accreditation Commission	Architectural Engineering Bioengineering and Biomedical Engineering Biological Engineering Ceramic Engineering Chemical Engineering Civil Engineering Construction Engineering Electrical and Electronics Engineering Engineering Management Engineering Mechanics Engineering, Engineering Physics & Engineering Science Engineering Environmental Engineering Geological Engineering Industrial Engineering Manufacturing Engineering Materials Engineering Mechanical Engineering Metallurgical Engineering Mining Engineering Naval Architecture and Marine Engineering Nuclear and Radiological Engineering Ocean Engineering Petroleum Engineering Surveying and Geomatics Engineering Systems Engineering Telecommunications Engineering Welding Engineering
Technology Accreditation Commission	Aeronautical Engineering Technology Automotive Engineering Technology Bioengineering and Biomedical Engineering Technology Chemical Engineering Technology Civil Engineering Technology Computer Engineering Technology Construction Engineering Technology Drafting and Design Electrical and Electronics Engineering Technology Electromechanical Engineering Technology Engineering Technology (General) Fire Protection Engineering Technology Industrial Engineering Technology

	Information Engineering Technology Instrumentation and Control Systems Engineering Technology Manufacturing Engineering Technology Mechanical Engineering Technology Naval Architecture and Marine Engineering Technology Nuclear and Radiological Engineering Technology Surveying and Geomatics Engineering Technology Telecommunications Engineering Technology Welding Engineering Technology

Table 4. ABET Accreditation Commissions and Respective Criteria

Program Name	Number of Programs Using this Name
Information Systems	19
Computer Information Systems	16
Management Information Systems	5
Computer Science - Information Systems Option	1
Computing and Information Sciences: Information Systems	1
Computing and Information Systems	1
Computing with concentration in Information Systems Science	1
Informatics	1
Informatics: Information Systems	1
Information Science	1
Information Science and Systems - Information Systems	1

Concentration	
Information Science and Systems - Web Development Concentration	1
Information Systems and Technology Management	1
Information Systems Engineering	1
Information Systems Management	1

Table 5. Variations in the Names of Programs Classifiable as "Information Systems" under the CAC Criteria

Criteria	**Number of Programs**	**Number Known by Criteria Name**	**%**
Computer Engineering	261	215	82%
Computer Science	293	283	97%
Information Systems	52	19	37%
Information Technology	26	18	69%
Software Engineering	27	26	96%

Table 6: Number and Percent of Programs Called by their CAC Criteria Name

Majoring in Information Systems: Reasons Why Students Select (or not) Information Systems as a Major

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Abstract

Filling the pipeline for information systems workers is critical in the information era. Projected growth rates for jobs requiring information systems expertise are significantly higher than the projected growth rates for other jobs. Why then do relatively few students choose to major in information systems? This paper reviews survey results from about two hundred freshmen business students at a medium sized western university. The survey asked these students to share their perceptions of jobs that do not require information systems skills, of skills employers look for in new employees, of reasons that peers major in information systems disciplines, and of reasons they do not. This research suggests further exploration of reasons students and professionals chose information systems as a field of study and work. It also suggests using a survey group other than general business majors.

Keywords: Information Systems, College Major, Career Selection

1. INTRODUCTION

Why students select the majors they do is an ongoing concern for university faculty and administration. It is also a national concern with the Obama administration announcing a new "One Decade, One Million more STEM Graduates" initiative in December of 2012 (Feder, 2012). The reasons for this initiative include BLS projections of double digit growth rates in STEM jobs over the next decade (see Table 1) as well as maintaining and increasing our national competitiveness in technology related industries (US Department of Labor, 2012; Feder, 2012). As it relates to the academy, Frauenheim (2004) illustrates that fewer majors translates into fewer graduate students which leads to fewer doctorates, which leads to fewer potential faculty. This phenomenon can occur in any major, including information systems majors.

The main concern is that the United States could lose its lead in STEM industries to countries such as China and India. For IS faculty, the concern is continuing IS programs and filling classrooms with IS students who will matriculate into the IS workforce.

The projected growth rate for all jobs, according to the BLS, is 14%, which gives a comparison for the statistics contained in Table 1 (US Department of Labor, 2012). Determining the factors that contribute to students not majoring in STEM disciplines (IS in particular) has been a thread in the literature for decades. The facets of this research thread will be illustrated in the literature review section.

Table 1
BLS statistics related to CIS disciplines

Position	Growth Rate	Employment Change 2010-2020
Database Admin.	31%	33,900
Info. Sec. Analyst, Web Developer	22%	65,700
Network Analyst	28%	96,600
Comp System Analyst	22%	120,400

(US Department of Labor, 2012)

2. LITERATURE REVIEW

Determining why students are not majoring in IS disciplines has primarily been accomplished with student surveys (Pollacia & Lomerson, 2006; Crampton, Walstrom, & Schamback, 2006; Walstrom, Schamback, Jones, & Crampton, 2008; Kuechler, McLeod, & Simkin, 2009; Downey, McGaughey, & Roach, 2011; Kumar & Kumar, 2013).

Pollacia and Lomerson (2006) reported factors such as too hard, too technical, and would not enjoy the work as reasons why students do not major in IS. Pollacia and Lomerson also reported that students are not receiving adequate or accurate information about IS careers during their high school years.

Crampton, et al. (2006) identified personal interest as the most important factor in major selection. Lower in the rankings came family, teachers, friends, and high school counselors. This survey also measured how informed students were about careers in business disciplines upon completion of high school. The bottom of this list includes computer science, information systems, and logistics/operations.

Walstrom, et al. (2008) verified that students are not aware or only marginally aware of careers in information systems upon completion of high school. This study also determined that factors most influencing IS as a major include personal interest, job prospects and salary while the least influencing factors include guidance counselors and advising centers. Kuechler, et al. (2009) determined that non-IS majors do not consider themselves to be good with computers and also do not know what information systems are and what IS workers do.

Downey, et al. (2011) identified aptitude and interest as positively correlated with selecting an IS related major. Further, the survey identified influences of parents, friends, family, and high school counselors as the lowest factor in selecting IS as a major. The study by Downey, McGaughey, and Roach (2009) indicates that students major in MIS due to interest in the subject, interest in computers, and high monetary reward. In contrast, the less important factors in deciding to major in MIS include influence of high school teachers and counselors, and influence of family and friends.

In addition to recruiting students into IS disciplines, recruiting female students has been of concern to researchers and educators (Croasdell, McLeod, & Simkin, 2011; Beyer, 2008). Croasdell et al. (2011) found that females major in IS due to core reasons such as personal interest, job outlook, and respect of job position. Contrary to many studies listed in this section, Croasdell et al. also found that the influence of family members positively impacts females as to IS major selection.

Beyer (2008) found that female MIS students were more likely to have had positive role models such as computer teachers in high school. This, once again, points at the secondary school structure in the United States as an area critical to influencing major selection of students in college.

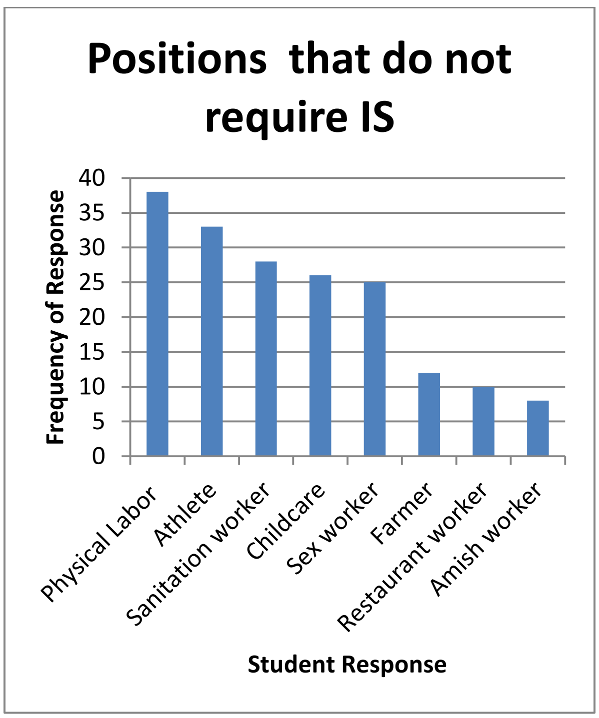
In a survey released by Microsoft (2011), STEM students decided on studying STEM disciplines in secondary school (78%) or before (21%). These students also reported that a class or a teacher sparking their interest in the subject was the top factor in deciding on a STEM major.

3. METHODOLOGY

A survey instrument was developed in the fall semester of 2012 and pilot tested in an introduction to business class. Refinements were made to the survey instrument based on the pilot study and the literature review (see Appendix A). The new survey instrument was then administered to multiple sections of the introduction to business class, in the spring semester of 2013, which is primarily composed of freshmen business students who have not settled on their major concentration in the business department. The survey is presented along with an introductory talk about the CIS major in an attempt to stimulate interest in the major. The survey contains two free response questions and four Likert Scale questions. Additionally, basic demographic information was collected for analysis. A total of 202 surveys were collected, six of which were removed due to missing information or incorrectly coded responses. This resulted in an *n* of 196 for this study, with 69 females and 127 males, with an average age of 21.3 years. The average age appears elevated due to the presence of 24 non-traditional students (25 years of age and older) in the classes (Choy, 2002). The survey respondents consisted of 76% freshmen, 18% sophomore, 5% junior, and 1% senior.

4. FINDINGS

Chart 1
Students' perceptions of jobs that will not require knowledge of computer information systems

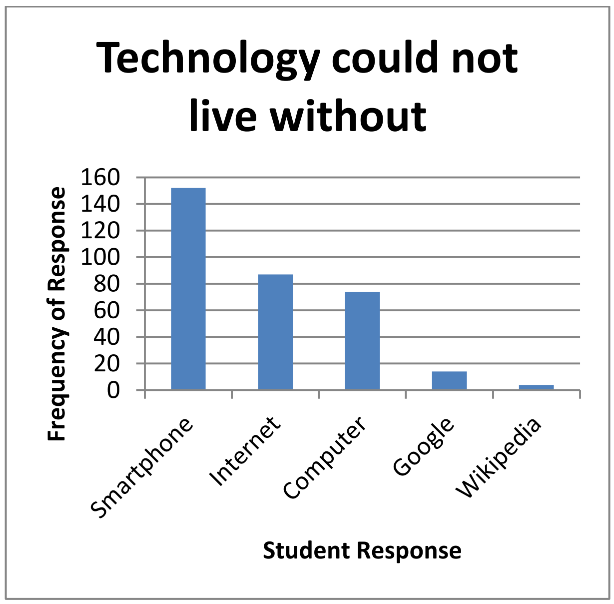


The first survey question asked the students to list a position in the business world that will not require any knowledge of computer information systems. This question was designed to stimulate conversation and to get the students thinking not of where information systems are, but where are they not. The results are summarized in the Pareto chart, Chart 1.

Many of these positions are not technology driven, but they still utilize technology. For example, restaurant workers use point of sale systems for ordering, and credit card systems for billing, and many of the other job classifications use technology for communications.

The second question queried the students as to which types of information technology they could not live without in their lives. Chart 2 illustrates their responses.

Chart 2
Technology business students cannot live without



The most frequent response is smartphone, which can be used as a computer and to access the other three technologies (Internet, Google, Wikipedia). Arguably, the smartphone is the one piece of technology that students cannot live without. This is confirmed by every keynote panel at the AITP's National Collegiate Conference, where one skill these technology professionals are looking for is mobile application experience.

Question 3 asks "Which computer skills do employers look for in new employees?" The responses are listed in Table 2, where 1 = not important and 5 = very important.

Table 2 illustrates that students perceive the Internet and the Microsoft Office Suite as the most in demand skills employers are looking for. Lower in importance are local area network skills, collaboration skills, and hardware skills. An ANOVA; $F(7,1559) = 38.91$, $p < 0.01$, confirms that hardware skills are rated significantly lower than the other skills.

Table 2
Computer skills employers look for in employees (student perception)

Skill	Average	Standard Deviation
Internet Skills	4.5	1.0
Word Processing	4.4	0.8
Spreadsheet	4.3	0.8
Presentation	4.2	0.9
Database	4.1	0.8
Local Area Network	4.1	1.0
Collaboration	3.9	1.0
Hardware	3.1	1.3

Question 4 asks the students to rate the reasons why their peers major in CIS. The results are in Table 3, where 1 = not important and 5 = very important.

Table 3
Why students major in CIS (student perception)

Reason	Average	Standard Deviation
Personal Interest	4.2	1.0
Probability of work	4.2	0.9
Salary	4.1	0.8
Prestige of profession	3.6	0.9
Performance in HS classes	3.5	1.1
Parental influence	2.4	1.1
Friend/teacher influence	2.4	1.1

Table 3 yields three groupings of reasons that are statistically different as tested using an ANOVA; $F(6, 1357) = 98.35$, $p < 0.01$. The primary drivers for students to major in IS are personal interest, employment prospects, and salary. Surprisingly, parental influence and friend/teacher influence seem to have little (perceived) impact on students' selection of a major. Both of these results agree with the studies by Crampton, et al. (2006) and Downey, et al. (2011). This survey and others rank teachers as having very little impact on students' selection of a STEM major, contradicting the results of the Microsoft (2011) survey. The difference could be attributed to sample groups. While this survey along with Crampton, et al. (2006) and Downey, et al. (2011) sampled general business students, the Microsoft survey sampled STEM majors.

Question 5 asks the students to rate the reasons their peers do not major in CIS. The results are in Table 4 where 1 = not important and 5 = very important.

Table 4
Why students do not major in CIS (student perception)

Reason	Average	Standard Deviation
Not their career choice	4.4	1.0
Not interesting, too hard, mathematics requirements	4.1	1.1
Career opportunities	3.0	1.2
Financial considerations	3.0	1.1
Image of IS worker	2.9	1.1
Parental influence	2.6	1.2
Friend/teacher influence	2.4	1.1

Table 4 also yielded three groupings of reasons why students do not major in IS. Again, an ANOVA was used to determine these differences. $F(6,1354) = 80.76$, $p < 0.01$. The most important factors for not majoring in IS appear to be personal interest and mathematics requirements. In a less important position are career opportunities, financial concerns, and the image of the IS worker. Confirming the results of the previous question (Table 3) parental influence and friend/teacher influence are rated as the least important reasons. These results agree with the study by Pollacia and Lomerson (2006).

The final question asked of the survey group is one of awareness of business careers. This question asks the students if they were informed about various careers while in high school. The results are presented in Table 5, where 1 = not informed and 5 = completely informed.

Table 5 yields two groupings, awareness of management, finance/economics, and marketing, careers and awareness of accounting and CIS careers. Students seem to be uninformed, in general, about all business careers according to the average ratings, but particularly uninformed about accounting and CIS careers. These results confirm those reported by Walstrom, et al. (2008) and reinforce the perception that students are uninformed about IS disciplines when completing high school.

Table 5
Students' knowledge of careers (self-reported)

Career	**Average**	**Standard Deviation**
Management	2.9	1.3
Finance/Economics	2.8	1.4
Marketing	2.7	1.3
Accounting	2.5	1.3
Computer Information Systems	2.3	1.3

Comparing responses by gender it is found that in four categories there are statistical differences in how males and females responded. These results are presented in Table 6, where 1 = not important and 5 = very important.

Table 6
Statistical differences between genders

Category	**Average Male**	**Female**	**t-test statistic**	**p-value**
Local area network skills	3.94	4.38	3.10	< 0.01
Hardware skills	2.92	3.48	2.87	< 0.01
Salary	4.00	4.29	2.30	< 0.05
Prestige of profession	3.51	3.75	1.73	< 0.10

In the categories where gender differences are statistically different, females consistently rated the job skill or reason for majoring in information systems higher than the males in the survey group. This could lead to the observation that females believe that more job skills will make a job seeker more employable and that females pursue salary and prestigious positions more than males.

5. CONCLUSIONS

Our study verifies what many other studies over the last decade have pointed out. Students major in IS fields due to personal interest, employment outlook, and salary levels. The employment outlook is positive and salary levels are good, so this leaves personal interest as the variable to study. Personal interest can be stimulated by parent and teacher contact, however, many studies show that students rate these contacts as low level factors on selecting a major. This result could be influenced by sample selection, so IS majors should be surveyed as to why they selected their major and conclusions about why students do not major in IS can be studied from the current sample.

This study and others (Pollacia & Lomerson, 2006; Walstrom, et al., 2008; Downey, McGaughey & Roach, 2009) suggest that university departments must increase their presence in area high schools in order to recruit interested students into IS disciplines. However, attacking this problem in high schools might be too late to stimulate interest in IS disciplines. Starting technology clubs in elementary or middle school could stimulate interest, as well as having technologically savvy teachers in the classroom. Both of these proposals require commitment from university IS departments and departmental personnel.

Stimulating personal interest in IS careers and the field in general is another approach to filling the IS pipeline with qualified workers. This research suggests further study on determining when personal interest is developed in IS careers and how to positively affect this interest. This proposed study could survey IS professionals and IS students to determine baseline personal interest variables which could indicate when and how to stimulate personal interest in the IS field.

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6. REFERENCES

Beyer, S. (2008). Gender differences and intra-gender differences among management information systems students. *Journal of Information Systems Education*, 19(3), p. 301-310.

Choy, S. (2002). Nontraditional undergraduates. National Center for Education Statistics. Retrieved from: https://nces.ed.gov/pubs2002/2002012.pdf

Croasdell, D., McLeod, A., & Simkin, M. (2011). Why don't more women major in information systems? *Information Technology and People*, 24(2), p. 158-183.

Crampton, W., Walstrom, K, & Schamback, T. (2006). Factors influencing major selection by college of business majors. Issues in Information Systems, VII(1), p. 226-230.

Downey, J., McGaughey, R., & Roach, D. (2009). MIS versus computer science: an empirical comparison of the influences on the students' choice of major. *Journal of Information Systems Education*, 20(3), p. 357-368.

Downey, J., McGaughey, R., & Roach, D. (2011). Attitudes and influences toward choosing a business major: The case of information systems. Journal of Information Technology Education, 10, p. 231-251.

Feder, M. (2012). One decade, one million more STEM graduates. Retrieved from: http://www.whitehouse.gov/blog/2012/12/18/one-decade-one-million-more-stem-graduates.

Frauenheim, E. (2004). Students saying no to computer science. Retrieved from: http://news.cnet.com/Students-saying-no-to-computer-science/2100-1022_3-5306096.html

Kuechler, W., McLeod, A., & Simkin, M. (2009). Filling the pipeline for IS professionals: What can IS faculty do? *Journal of Information Systems Education*, 18(1), p. 407-415.

Kumar, A. & Kumar, P. (2013). An examination of factors influencing students selection of business majors using TRA framework. *Decision Sciences*, 11(1), p. 77-105.

Microsoft. (2011). Microsoft releases national survey findings on how to inspire the next generation of doctors, scientists, software developers and engineers. Retrieved from: https://www.microsoft.com/en-us/news/press/2011/sep11/09-07MSSTEMSurveyPR.aspx

Pollacia, L. & Lomerson, W. (2006). Analysis of factors affecting declining CIS enrollment. *Issues in Information Systems*, VII(1), p. 220-225.

US Department of Labor. (2012). Occupational outlook handbook. Retrieved from: http://www.bls.gov/OOH/computer-and-inforrmation-technology/home.htm

Walstrom, K, Schamback, T., Jones, K., & Crampton, W. (2008). Why are students not majoring in information systems? Journal of Information Systems Education, 19(1), p. 43-54.

Editor's Note:

This paper was selected for inclusion in the journal as a ISECON 2013 Distinguished Paper. The acceptance rate is typically 7% for this category of paper based on blind reviews from six or more peers including three or more former best papers authors who did not submit a paper in 2013.

Appendix A

Computer Information Systems – A Degree for the 21st Century

1. List two positions in the business world that will not require any knowledge of computer information systems.

    a.

    b.

2. List two types of information technology that you could not live without in your personal life.

    a.

    b.

3. What kind of computer skills do you think that employers look for in new employees? Please rate each skill according to the scale: 1 = not important, 2, 3, 4, 5 = very important

	Presentation Skills (such as PowerPoint)
	Word Processing Skills (such as Word)
	Spreadsheet Skills (such as Excel)
	Database Skills (such as Access)
	Internet Skills (such as searching and information gathering)
	Local Area Network Skills (such as navigating the H:, K:, and F: drives)
	Collaboration Skills (such as Google Docs or Microsoft 365)
	Hardware Skills (such as replacing hard drives or network interface cards)
	Other Skills please list: ____

4. Why do you think students major in computer information systems? Please rate each reason according to the scale: 1 = not important, 2, 3, 4, 5 = very important

	Personal interest – technology is cool
	Probability of working in field after graduation
	Salary – starting and long-term
	Prestige of profession
	Parents influenced choice of major
	Friends or teachers influenced choice of major
	Performance in high school courses – technology studies are easy for them
	Other reasons: ____

5. Why do you think students do not major in computer information systems? Please rate each reason according to the scale: 1 = not important, 2, 3, 4, 5 = very important

	Not what they wanted to do for a career
	Career opportunities
	Financial considerations – salary, benefits
	Image of the information system worker
	Parents influenced choice of major
	Friends or teachers influenced choice of major
	Subject not interesting, subject matter too hard, mathematics requirements
	Other reasons: ____

6. Demographic questions. Please circle or fill in the blank.

Gender: □ Male □ Female **Year of birth:** 19______

Year in school: Freshman Sophomore Junior Senior

Major: ___________________________ **Minor:** __________________________

In high school I was informed about careers in:
Circle your response where: not informed = 1 2 3 4 5 = completely informed

Marketing	**1 2 3 4 5**
Management	**1 2 3 4 5**
Accounting	**1 2 3 4 5**
Finance/Economics	**1 2 3 4 5**
Computer Information Systems	**1 2 3 4 5**

Interdisciplinary Project Experiences: Collaboration between Majors and Non-Majors

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Abstract

Students in computer science and information technology should be engaged in solving real-world problems received from government and industry as well as those that expose them to various areas of application. In this paper, we discuss interdisciplinary project experiences between majors and non-majors that offered a creative and innovative opportunity for collaborative learning. Active-learning exercises allowed students to express their creativity and apply concepts learned from each discipline. Feedback from this effort resulted in the development of the Seven C's (Competencies) for collaborative learning that were ascertained for successful completion of an interdisciplinary project. We feel that these interdisciplinary and collaborative efforts increased student appreciation, enhanced team skills, and created a positive learning environment for the application of concepts.

Keywords: Collaborative Learning, Interdisciplinary Project, Team Skills, Technology, Music

1. MOTIVATION AND RELATED WORK

Collaborative learning is effective in academic development because it engages more students with the subject matter. By replacing the traditional lecture style delivery method with team-based learning, students in an introductory computer science course showed significant improvement in retention rates, enhanced programming skills and increased confidence in their ability to program (Lasserre & Szostak, 2011).

To enhance individuality and diversity, Falkner and Munro created a collaborative learning environment in an introductory computer science course where faculty worked with students to set goals and tasks, establish processes to solve an authentic problem, engage and motivate students to work together and focus on problem solving as the task for constructing collaborations to develop social support structures (Falkner & Munro, 2009). As a means to share discoveries, perspectives and technical skills, researchers have discovered a growing interest in computational thinking at the university level to support exploratory and innovative computing research. By utilizing computational thinking, students can focus explicitly on interdisciplinary collaboration, leverage computational methods, and work "collaboratively to design tools that will let team members express themselves directly in computational terms and explore their own computational questions" (Stone, 2008).

Within the environments of pair programming, problem solving and agile software development projects, McKinney and Denton noted that their students demonstrated "deeper learning, developing skills wanted by industry, having fun, higher retention, higher achievement, higher course success rates, higher interest, and higher sense of belonging" as benefits of collaborative learning (McKinney & Denton, 2006). The completion of an international collaborative project between students from two schools with varying backgrounds and cultures, provided an opportunity for building trust and solidarity while focusing on project management, distribution of efforts and communications (Laxer, Daniels, Cajander & Wollowski, 2009).

To enhance individual foundation principles and increase success in future team projects, Coleman and Lang recommend the teaching of communication skills, small group interaction and collaborative projects that meet the following project guidelines (Coleman & Lang, 2012):

- *Supervised assignments either assigned in class or in a laboratory give teams mutual accountability.*
- *Assignments that revolve around a single concept provide student teams with a shared understanding of their task.*
- *Pair-programming limits the complexity of the team mechanics and results in a collectively-produced product.*
- *Time is set aside for reflective discussion of team experiences, so that elements that drive team success are highlighted.*

Salgian developed a "Conducting Robots" project where students majoring in computer science, mechanical engineering, interactive multimedia and music designed and developed a robotic and graphical conducting system to direct an orchestra and provided an opportunity for students to focus on critical thinking, creative problem solving, and computational thinking skills (Salgian, Ault, Nakra, Wang & Stone, 2011). Glasser asserted that: being active while learning is better than being inactive. Most people learn only 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they see and hear, 70% of what they talk over with others, 80% of what they use and do in real life and 95% when they teach someone else (Glasser, 1998).

Interdisciplinary collaboration provides opportunities for innovation, problem solving and increased technical abilities. The motivation for this paper was to create a learning environment where majors and non-majors would need to collaborate for the successful completion of a project. In this paper, we discuss the interdisciplinary project definition with information about the Information Sciences and Technology (IST) majors and students enrolled in a Music Theory - General Education Arts course who participated in teams for the completion of the project. We share team process requirements, collaborative learning experiences and describe the Seven C's (Competencies) for collaborative learning that resulted from this effort. We conclude with student comments, feedback and reflection from a faculty perspective.

2. INTERDISCIPLINARY PROJECT

This collaborative learning experience was an interdisciplinary project between IST majors enrolled in a Distributed Computing course and students from various majors enrolled in a Music Theory course, as shown in Figure 1. Unlike other projects discussed in the literature that assessed projects assigned to students in specific majors, this project was unique in that it was completed by IST majors working with General Education students.

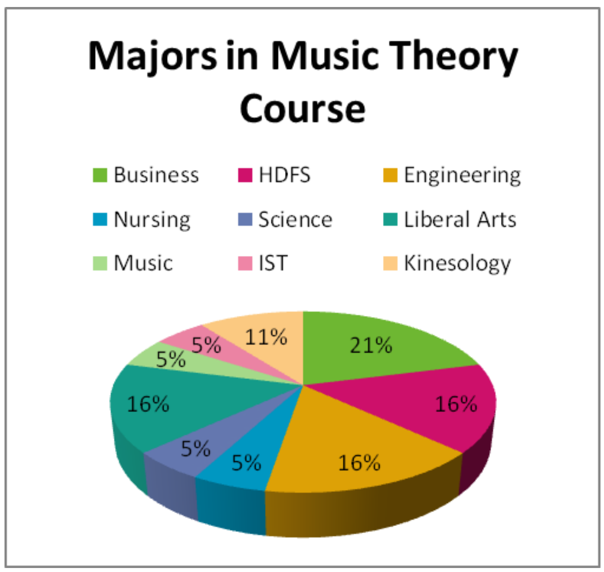


Figure 1. Majors in Music Theory Course

Project Definition
For our project, the Music students were tasked with creating digital musical scores and the IST students were tasked with writing Java applications for robot movements that when coalesced would complete a robot dance where the movements of robot couples were synchronized to the rhythm of the music (Smarkusky & Toman, 2013). The design and implementation of the choreography would be the bridge between discipline areas.

A goal of this project was to utilize the seven principles for good practice in undergraduate education as presented by Chickering and Gamson, shown in Table 1 (Chickering & Gamson, 1987).

Encourages contacts between students and faculty.
Develops reciprocity and cooperation among students.
Uses active learning techniques.
Gives prompt feedback.
Emphasizes time on task.
Communicates high expectations.
Respects diverse talents and ways of learning.

Table 1. Seven Principles for Undergraduate Education

The project was planned well in advance with courses being offered on the same days, same time slots, and in proximity to each other on campus for the spring semester. Both the IST and Music courses were taught in computer labs for the completion of individual and joint efforts. The syllabi for each course contained the dates on which students would be working on individual assignments and meeting with students from other disciplines for completion of the project. The faculty members teaching each course were present during all individual and joint meetings to assist students when needed. Additional office hours and lab times were scheduled during the project to allow students ample time to meet with team members and work on the project.

Faculty asked students in their specific courses to challenge the students in the other discipline. We wanted students from each discipline to be well-prepared for the project, so both faculty members utilized active-learning exercises to expose students to the respective music theory, animation and programming components that together would provide the foundation for this project.

Technologies
For the music component of the project, we elected to utilize Sibelius (Sibelius, 2012), a sophisticated music notation software for composers and arrangers that can be utilized by beginners and students with a small learning curve. Its user interface is task-oriented and allows users to have the ability to create and edit a musical score. For the creation of the robot dance, IST students utilized the LEGO® MINDSTORMS® NXT (The Lego Group, 2012) with leJOS NXJ (leJOS Team, 2007), since it utilizes the high-level Java programming language, supports object-oriented programming, and provides students with an opportunity to use open source software. Applications can be developed using the NetBeans (www.netbeans.org) or Eclipse (www.eclipse.org) Integrated Development Environment (IDE) with available plugins for both environments. Students used the respective software applications to realize a design in music or choreography and implement a solution. Iterative development coupled with various forms of visual and audio feedback enhanced the student learning experience.

Assessment
The grading criteria for the project was based on the correctness and completeness of technical requirements for each discipline, with each team dependent upon the choreography for success and integration of the final project. The digital music scores, created by the music students, needed to include correct staves, key signature, time signature, notes, rhythmic durations, slurs, expressive and tempo markings, dynamics, musical symbols, correct number of measures repeat signs, etc. The Music students were also required to incorporate additional instruments to the basic piano score included flute, clarinet, trumpet, saxophone, guitar, bass, and drum set.

Although the choreography was initially designed by the Music students, it was the responsibility of the IST student to ensure that the dance moves were creative, complicated and complex while remaining synchronized to specific timings and movements within the music. For the IST students, the grading criteria for the animation component of the project was based on the creativity and complexity of the choreography for two robots; synchronization of movements between two robots; synchronization (timing) of movements to the music file for both robots; overall appearance and quality of the choreographed dance for the two robots; and submission of project deliverables. These assessment criteria for the music and animation components were provided to the students to help identify the roles of each team member, provide a guideline for project success, and promote a positive learning experience for students in an interdisciplinary team.

Majors and Non-Majors

The project included eight students in the Distributed Computing course and nineteen students in the Music Theory course. All students enrolled in the Distributed Computing course were majoring in Information, Sciences and Technology and were required to complete this course to satisfy a requirement for the major. All of the students enrolled in the Music Theory course elected to enroll in this course to satisfy three credits of the General Education - Arts requirements. The fundamental guidelines for a General Education course at our university states that a course must “aid students in developing intellectual curiosity, strengthened ability to think, and a deeper sense of aesthetic appreciation” (Baccalaureate Degree Curriculum, 2012). In meeting these criteria, we wanted to excite students about the use of technology while being creative, and utilize active-learning exercises to aid in the retention of knowledge.

We selected students from each course and assigned interdisciplinary teams based on student performance from previous course assignments, complexity of assigned song, and perceived student expectations based on individual work ethics in the classroom. Each team consisted of one IST student and two or three Music Theory students. Faculty created teams and associated file-sharing space in A New Global Environment for Learning (ANGEL), our Course Management System. This shared space provide a repository for students to post and share their Sibelius files, WAV files, choreography design, and the Java source code files.

For this project, the IST students brought problem solving skills, technical knowledge and programming skills needed for the NXT Mindstorms, and soft skills from previous team projects. The Music students provided the creativity needed for the development of the choreography as well as the knowledge and creation of a musical score that includes tempo, notation, instrumentation, and style of the background music. Students from each discipline needed to utilize course concepts, knowledge, and develop combined team skills for successful completion of the project.

3. COLLABORATIVE EXPERIENCES

At the onset of the project, faculty held a joint meeting between classes to provide an overview of the music and animation requirements. Student teams and songs were assigned during this meeting with the remainder of class time used for initial team building, brainstorming of ideas, and selecting a theme for the choreography. This project included an element of creativity that allowed students from both disciplines to work together towards a common goal. By providing students with an opportunity for participatory learning and defining an assessment that included a set of learning objectives linked to grading criteria, we could level the playing field for different types of students (Carter, Bouvier, Cardell-Oliver, Hamilton, Kurkovsky, Markham, McClung, McDermott, Riedesel, Shi & White, 2011).

Similar to the experiences of students in an international collaborative project (Laxer et. al., 2009) and a conducting robots project (Salgian, et. al, 2011), our students were initially apprehensive about the project and how it would proceed because they were working with students from other disciplines. Before student teams were introduced, Music students were intimidated by the IST students whom they referred to as the “smart” students. After the initial team meeting, the confidence level of the Music students increased because they soon realized that the IST students didn’t have the required knowledge to create a digital musical score and also didn’t feel comfortable designing the choreographed dance. Similarly, the IST students realized that the Music students didn’t have any knowledge about software development or how to program the robots to implement the dance routine. The choreography and digital musical scores created by the Music students would stipulate the parameters of the robot dance that was to be implemented by the IST student. To enhance the choreography and synchronize the movements to the digital musical score, the Music and IST students would need to work together as a team and integrate concepts learned in both courses.

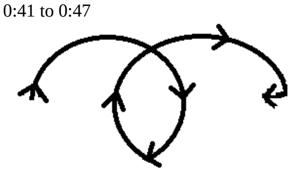
Progression

For the first three weeks of the project, the teams in the music course worked diligently to complete the digital musical scores that would be the background music for the robot dance and establish an initial design of the choreography that would be implemented by the IST students. While the Music students were implementing the musical score, the IST students were becoming familiar with the LeJOS platform, Bluetooth communication protocols, and the movement capabilities of the NXT robots. As part of their curriculum, our IST students had previous team experience and were familiar with competencies for team performance (Smith & Smarkusky, 2005). We encouraged the IST students to utilize these skills to mentor the Music students as most of these students were freshmen or sophomores and had little experience with team projects or the associated expectations for successful team performance.

During the final phase of the project, both Music and IST students further defined the dance routine to include forward and backward movements, right and left turns, box steps, spins and arcs. A snippet of choreography is shown in Figure 2. Together the IST and Music students observed the robot movements, listened to the music, and precisely documented the start/stop times for each movement as they followed the design of the choreography. Knowing that the timing of the movements was critical to the quality of the dance, the IST students worked on the project during class meetings and additional lab hours to realize the movements of the dance with the robot couples.

3) 0:33 to 0:40
- Spins clockwise/counterclockwise then [stops back to back 45 angle]

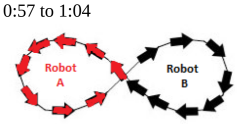
4) 0:41 to 0:47



5) 0:48 to 0:50
- Quickly comes forward together face to face

6) 0:51 to 0:56
- Backward arc moving away

7) 0:57 to 1:04



[Final position stands as 45 degree angle]

8) 1:05 to 1:12
- Backward Arc

Figure 2. Snippet of Choreography for Robot Dance

Team Building

By adapting the Tuckman model to represent that the skill level of a team will generally increase, and the enthusiasm of the team will fluctuate during life of the project, Largent and Lüer showed this model was an effective tool to teach teamwork and monitor team development (Largent & Lüer, 2010). As our interdisciplinary teams worked side-by-side on the completion of this project, we perceived the collaborative learning between interdisciplinary members. Students started using a common language to describe the dance steps, assigning tasks, setting deadlines, planning for future changes, and working together as a cohesive team.

Similar to the objectives for team skills defined by McKinney and Denton for introductory computer science students which included "communicate with students and faculty about course concepts and practices; cooperate with a team in an effort to solve problems and develop software; and demonstrate a strong work ethic by attending class and participating fully" (McKinney and Denton, 2006), students in our courses utilized these skills and others for the successful completion of the project. Teams were very excited about the outcome of the robot dance project and would often stay after class to work on their projects so that their dance would be better than other teams. During this process, the IST student appreciated the time and effort that the Music student had put into the digital musical score and the choreography, and the Music student appreciated the attention to detail and knowledge that was shown by the IST student for the implementation of the robot dance.

The Seven Competencies

Since our project was an effort between majors and non-majors, we conducted a survey to gather information from a student perspective to determine a ranking among team competencies with regard to the successful completion of our interdisciplinary team project. All 27 students (19 Music and 8 IST) completed the survey. The Seven C's (Competencies) for Collaborative Learning that resulted from this survey are shown in Table 2 of the Appendix. This table includes the Seven C's (Competencies) with associated description, number and percentage of students that identified each competency as having an impact on the success of the interdisciplinary project.

All students (100%) agreed that **Communication**, both written and verbal, was the most important competency. Students utilized various diagrams and written step by step descriptions for the definition of the choreography. **Commitment** ranked second (88.89%), with students needed to have a strong work ethic and dedication to the completion of the project. **Cooperation** (70.37%) and **Comprehension** (66.67%) ranked third and fourth, respectively. Being an interdisciplinary project, students needed to cooperate on the completion of the choreography and yet have respective knowledge in their own discipline for a quality integration of effort.

Requiring students to complete technical requirements for projects in each discipline, students from each course needed to be held accountable. Since students had an understanding of the time required to complete each task, students needed to take responsibility for their individual contributions. Students indicated the importance of a leadership role and motivating others to deliver an integrated quality product. Students relied on trust between team members for the successful completion of the project within the stated deadlines. These collaborations resulted in identification of **Contract** and **Command** at 59.26% and 55.56%, respectively. Due to the creative nature of this project, 51.85% of the students responded that **Creativity** was a critical factor in the successful completion of the robot dance project. At the end of the project, all students were proud of what they accomplished and satisfied with what they had learned.

4. FEEDBACK AND REFLECTION

The majority of the feedback that we received from students was positive. Students indicated that they enjoyed using robots as an area of application and working with other majors. Student feedback included phrases that included "fun and challenging", "being able to let loose", "fun interesting team dynamic", "well organized", "a fun experience where I got to experience everything I learned", "allowed you to be more creative and work with people you did not know", and "unique and interesting project". The only negative comments that students included were that they wished they had more class time to work together on the project and students from both disciplines requested that they would like to have more involvement, even if just at an introductory level, in the completion of tasks for the opposite discipline.

Additional feedback from the students was collected via the completion of a survey using a 5-point Liker Scale (where 1 = Strongly Disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, and 5 = Strongly Agree). The percentage of positive responses include all responses with Agree with Strongly Agree and indicated that 92.59% of the students thought this project was a creative learning experience, 88.89% of the students enjoyed working with students in other disciplines, 96.30% of the students felt that both Music and IST students worked together as a team to create a successful and complete project, and 88.89% of the students would recommend offering this project again to Music/IST students in the future.

Overall, this project was a success. Students felt that they were able to incorporate the content learned in both courses into the robot dance, to include the background music, choreography and the implementation of the movements using Java. We noted that students were encouraged and wanted to ensure that their final project was complete and of high quality, especially since their projects would be demonstrated to class members and invited members of the campus community.

Although we grouped teams together based on previous academic assessments, complexity of song and student expectations from previous exercises, we noticed that teams of average performers seemed to work better as a whole, were more creative, and seemed to have more fun with the project. We previously discussed student apprehension and varying team project experience among students. To address these concerns, we plan to incorporate several team building exercises during the initial joint meeting between classes to enhance team building and establish expectations for each member of the team based on the Seven Competencies that were identified in this paper. We hope these exercises will provide students with a common foundation for which majors and non-majors can enhance their knowledge of collaborative learning. We look forward to providing additional interdisciplinary, innovative and challenging learning opportunities for our students.

5. REFERENCES

Baccalaureate Degree Curriculum (2012). Section 1, http://senate.psu.edu/guide/sec1.html

Carter, J.,Bouvier, D., Cardell-Oliver, R., Hamilton, M., Kurkovsky, S., Markham, S., McClung, O.W., McDermott, R., Riedesel, C., Shi, J., & White, S. (2011). Motivating all our students?. In *Proceedings of the 16th annual conference reports on Innovation and technology in computer science education - working group reports* (ITiCSE-WGR '11), Liz Adams and Justin Joseph Jurgens (Eds.). ACM, New York, NY, USA, 1-18. DOI=10.1145/2078856.2078858 http://doi.acm.org/10.1145/2078856.2078858

Chickering, A. W., & Z. F. Gamson (1987, March). Seven Principles for Good Practices in Undergraduate Education. *The AAHE Bulletin*. Retrieved on June 1, 2013 from http://www.aahea.org/aahea/articles/sevenprinciples1987.htm

Coleman, B. & Lang, M. (2012). Collaboration across the curriculum: a disciplined approach to developing team skills. In *Proceedings of the 43rd ACM technical symposium on Computer Science Education* (SIGCSE '12). ACM, New York, NY, USA, 277-282. DOI=10.1145/2157136.2157220 http://doi.acm.org/10.1145/2157136.2157220

Falkner, K. & Munro, D.S. (2009). Easing the transition: a collaborative learning approach. In *Proceedings of the Eleventh Australasian Conference on Computing Education - Volume 95* (ACE '09), Margaret Hamilton and Tony Clear (Eds.), Vol. 95. Australian Computer Society, Inc., Darlinghurst, Australia, Australia, 65-74.

Glasser, W. (1998). *Choice Theory in the Classroom*, New York: Harper Collins, ISBN: 0-06-095287-3.

Largent, D.L. & Lüer, C. (2010). "You mean we have to work together!?!": a study of the formation and interaction of programming teams in a college course setting. In *Proceedings of the Sixth international workshop on computing education research* (ICER '10). ACM, New York, NY, USA, 41-50. DOI=10.1145/1839594.1839603 http://doi.acm.org/10.1145/1839594.1839603

Lasserre, P. & Szostak, C. (2011). Effects of team-based learning on a CS1 course. In *Proceedings of the 16th annual joint conference on Innovation and technology in computer science education* (ITiCSE '11). ACM, New York, NY, USA, 133-137. DOI=10.1145/1999747.1999787 http://doi.acm.org/10.1145/1999747.1999787

Laxer, C., Daniels, M., Cajander, Å., & Wollowski, M. (2009). Evolution of an international collaborative student project. In *Proceedings of the Eleventh Australasian Conference on Computing Education - Volume 95* (ACE '09), Margaret Hamilton and Tony Clear (Eds.), Vol. 95. Australian Computer Society, Inc., Darlinghurst, Australia, Australia, 111-118.

The LEGO Group. (2012). http://mindstorms.lego.com/en-us/whatisnxt/default.aspx

leJOS Team. (2007) http://lejos.sourceforge.net/

McKinney, D. & Denton, L.F. (2006). Developing collaborative skills early in the CS curriculum in a laboratory environment. In *Proceedings of the 37th SIGCSE technical symposium on Computer science education* (SIGCSE '06). ACM, New York, NY, USA, 138-142. DOI=10.1145/1121341.1121387 http://doi.acm.org/10.1145/1121341.1121387

Salgian, A., Ault, C., Nakra, T.M., Wang, Y., & Stone, M.K. (2011). Multidisciplinary computer science through conducting robots. In *Proceedings of the 42nd ACM technical symposium on Computer science education* (SIGCSE '11). ACM, New York, NY, USA, 219-224. DOI=10.1145/1953163.1953229 http://doi.acm.org/10.1145/1953163.1953229

Sibelius, (2012). www.avid.com/US/products/Sibelius7

Smarkusky, D.L., & Toman, S.A. (2013). An Interdisciplinary Learning Experience: The Creation of a Robot Dance, *Information Systems Education Journal*, 11(5), 55-62.

Smith, III, H.H. & Smarkusky, D.L. (2005). Competency matrices for peer assessment of individuals in team projects. In *Proceedings of the 6th conference on Information technology education* (SIGITE '05). ACM, New York, NY, USA, 155-162. DOI=10.1145/1095714.1095751 http://doi.acm.org/10.1145/1095714.1095751

Stone, M. (2008). Support collaboration by teaching fundamentals. In *Proceedings of the Third Workshop on Issues in Teaching Computational Linguistics* (TeachCL '08). Association for Computational Linguistics, Stroudsburg, PA, USA, 129-136.

APPENDIX

Team Competency	Description	# Students	Percent
Communcation	Students effectively used written or verbal communications to interact, ask questions, and convey information with faculty and students during all phases of the project.	27	100.00%
Commitment	Students were dedicated to completing the project and showed a strong work ethic via active participation during course and team meetings.	24	88.89%
Cooperation	Students worked together as a team to solve problems and implement solutions.	19	70.37%
Comprehension	Students shared and demonstrated their knowledge and understanding of related subject material and concepts.	18	66.67%
Contract	Students were prepared for team meetings, completed assigned tasks by specified deadlines, earned trust of team members, held accountable for actions, and performed in a professional manner.	16	59.26%
Command	Students demonstrated leadership qualities by keeping team members motivated and focused by creating a positive team environment while moving the project forward.	15	55.56%
Creativity	Students shared original and innovative ideas, various perspectives and possibilities, and solutions that were a result of "thinking outside of the box".	14	51.85%

Table 2. The Seven C's (Competencies) for Collaborative Learning in Interdisciplinary Projects

A Study of Information Systems Programs Accredited by ABET In Relation to IS 2010

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Abstract

This article examines the relationship between ABET CAC standards for undergraduate programs of information systems and IS 2010 curriculum specifications. We have reviewed current institution described course work that identifies course structures from accredited IS programs. The accredited programs all matched the expectations expressed in ABET CAC standards. However, we found that IS2010 failed to meet ABET CAC specifications. In order to attempt to resolve this obvious disconnect, we compared ABET CAC to IS industry standards and to IS 2010 specifications. It is our finding that ABET CAC compares well with industry expectations, whereas there is a disconnect in comparing IS 2010 and ABET/CAC and industry specifications.

1. Introduction and Background

ABET is the accrediting organization that accredits our discipline. It has in helping to improve IS programs. Specifically,

> *"Why Accreditation Matters*
> *Simply put, accreditation is value. Reaching into our public, private, and professional lives, accreditation is proof that a collegiate program has met certain standards necessary to produce graduates who are ready to enter their professions. Students who graduate from accredited programs have access to enhanced opportunities in employment; licensure, registration and certification; graduate education and global mobility.*
>
> *ABET is an integral part of each of these areas because we accredit over 3,100 applied science, computing, engineering, and engineering technology programs at more than 670 colleges and universities in 24 countries worldwide. Approximately 85,000 students graduate from ABET-accredited programs each year."* (ABET, 2013)

Academic societies in computing, ACM and IEEE-CS, have a relation to ABET by helping to provide leadership in developing criteria. These criteria form the basis for evaluating programs. ABET develops the accreditation process, manages an institution visitation and review process. It is comprised primarily of volunteers. Programs are not required to be accredited but do so do enhance their standing with potential students. ABET derives operating funds from the reviewed institutions and from the professional societies.

The curriculum specifications of any ABET model must be consistent with the served constituency, in this case, the IS industry. Scholars and industry participants take part in determining the needs of the constituency. These needs become encapsulated as student outcome and program objectives.

Since the curriculum IS 2010 (Topi, 2010) was published there has been significant interest in this curriculum's lack of technical subjects such as programming, data communications and networking, and database management compared with earlier models (Couger, 1997; Davis, 1997; Gorgone, 2003). To more precisely understand how the IS 2010 specifications differ with what many IS programs are currently covering we choose to look at a well-defined subset of programs in the United States that are accredited by the Computing Accreditation Commission (CAC) of ABET. Currently there are 37 such programs (http://main.abet.org/aps/Accreditedprogramsearch.aspx). The study was done by reviewing the catalogs for each program. There are 10 international programs. We choose not to look at these because difficulties reading their languages.

A review and analysis of course offerings from accredited schools (Larson, 2012) presented an excellent study of the nature of ABET/CAC programs of IS. They found heterogeneous behavior in courses offered both by title and composition. This is compatible behavior for accredited institutions since the goal of accreditation is to ensure that within broad guidelines, institutionally set objectives and provided measures of outcomes ensure quality standards.

2. METHODOLOGY

We extracted the list of ABET accredited information systems programs from the ABET website. For each program the catalog course listings were inspected to ascertain coverage of the seven IS 2010 courses. Using the same set of programs and relevant course data, the coverage of two of ABET/CAC criteria coverage of modern programming languages and data communications and networking was analyzed.
The next step was to analyze the data from Apigian and Gambill review of 240 business programs (2010) in with comparison with the set of accredited programs.

Finally, the ABET/CAC criteria were mapped to a competency classification categories converting the 100 point scale to a 4 point version (Longenecker, Feinstein and Babb, 2013). IS Industry skills demand, and IS 2010 outcomes were likewise mapped to the competency categories to enable ABET/CAC and IS 2010 satisfaction of expectations comparison.

3. COMPUTING ACCREDITATION COMMISSION CRITERIA

ABET criteria consist of nine separate criteria (http://www.abet.org/DisplayTemplates/DocsHandbook.aspx?id=3148). These are

1. Students
2. Program Educational Objectives
3. Student Outcomes
4. Continuous Improvement
5. Curriculum
6. Faculty
7. Facilities
8. Institutional Support
9. PROGRAM CRITERIA for Information Systems and Similarly Named Computing Programs

Of these nine criteria the only ones that effect a program's selection of courses are Student Outcomes, Curriculum and the Program Criteria for Information Systems. The relevant statements are found in Table 1.

Two specific criteria are 1--An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs, and 2--An ability to use current techniques, skills, and tools necessary for computing practice. ABET (2013b). Methods to attain these outcomes must be well documented and collected periodically to enable review and revision.

Student Outcomes	
	An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution
	An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
Curriculum	
	The technical and professional requirements must include at least one year of up-to-date coverage of fundamental and advanced topics in the computing discipline associated with the program.
Program Criteria for Information Systems	
	coverage of the fundamentals of a modern programming language, data management, networking and data communications, systems analysis and design

Table 1. Relevant ABET/CAC Criteria

IS 2010 provides a single programming course, however it is not specified as a required component of the degree. Also, the description of the course does not define it as an object oriented programming course. To attain adequate professional ability as required by the CAC standard would require multiple years of experience to achieve such a competency (Babb, Longenecker, Baugh, and Feinstein, 2013).

There is also some question about the coverage of fundamental and advanced topics since IS 2010 has a relatively flat prerequisite structure with IS 2010.1 the sole prerequisite for the next five courses.

IS 2010.1 Foundations of Information Systems
↓
IS 2010.2 Data and Information Management
IS 2010.3 Enterprise Architecture
IS 2010.4 IS Project Management
IS 2010.5 IT Infrastructure
IS 2010.6 Systems Analysis and Design

There is limited curriculum coverage in IS 2010 for networking and operating systems. Likewise, there is no capstone course that is designed to extend development of higher level skills.

4. CAC ACCREDITED PROGRAMS COVERAGE OF IS 2010.

Table 3 shows the coverage of IS 2010 courses. Data was available for 35 of the 37 programs accredited by CAC/ABET.

Based on Table 3 coverage by CAC/ABET programs is good for Data Information and Management and Systems Analysis & Design with 34 and 30 programs respectively offering these topics.

Foundations of Information Systems and IS Project Management are in the middle of the coverage with 21 and 18 programs covering this material.

Enterprise architecture and IT infrastructure is only offered by 10 and 11 programs respectively.

Similar to Larsen et al (2012) we note that there may be some level of inaccuracy due to inconsistency with the naming of courses.

However it is obvious from Table 3 and the discussion that the coverage of IS 2010 courses by the ABET accredited IS programs is spotty at best. **In fact there is only a 55 percent coverage of the IS 2010 courses by the IS programs accredited by ABET/CAC**.

5. CAC ACCREDITED PROGRAMS COMPARED TO A TECHNOLOGY SUITE OF TOPICS

Table 1 exhibited the characteristics that are required for IS programs to be accredited by ABET/CAC. Table 2 (see Appendix) compares these CAC accredited programs with these characteristics.

The data from Table 2 demonstrates the **almost complete coverage of these topics by the accredited IS programs. In fact there is 86 percent coverage of the topics**. The few programs that do not cover the topics must have them covered in some other location. This is not surprising since, in order to be accredited a program must cover these topics.

6. COMPARISON WITH BUSINESS IS PROGRAMS

IS 2010, the current information systems curriculum model, was developed with a core to be utilized with several electives. According to

Apigian and Gambill who reviewed 240 business programs by studying catalog copy considerable support was found for programming. This is somewhat surprising as IS 2010 has dropped any programming requirement from the model curriculum. Also, they noted that programs required somewhere between 4 and 16 courses with an average of 9 courses. The sample of these 240 courses is not dissimilar with the CAC accredited programs. (See Table 3 below:)

	Percent of Programs Attaining Requirement	
Required Courses	**ABET Programs**	**240 Business Schools**
Programming, Applications Development	97	99
Data And Information Management	97	99
Systems Analysis & Design	86	85
Data Communications and Networking	89	54
Intro to Information Systems	60	76
Project Management	51	54
Other courses not shown		

Table 3. Comparison of ABET and Business IS Programs in Completing Requirements
Note: Column 2 is from the current study showing percentage of ABET accredited programs matching the required course criterion; the numbers of column 2 are similar to those reported by Larsen (2012), while Column 3 data is taken from Apigian and Gambill 2010.

7. ABET/CAC STUDENT OUTCOMES AND CURRICULUM COMPARED WITH IS INDUSTRY EXPECTATIONS AND IS 2010 OUTCOMES

Table 5 (see Appendix) shows data collected from ABET, surveys of IS industry and government expectations and IS 2010 outcomes statements from required courses. Competency categories and Survey data were utilized from Longenecker, Feinstein and Babb (2013). IS 2010 course outcome statements were mapped to the competency categories as well—skill levels were interpreted based on the statements IS 2010 skill level chart.
ABET student outcome and curriculum statements mapped easily and completely to the competency categories. Likewise Colvin's data (2008) surveying graduates 3-5 years post graduation, the data of Aasheim, et al 2012 surveying IS industry professionals, and the Department of Labor expert statements regarding related STEM cell opportunities mapped well to the competency categories. The average of these surveys produces what we labeled as an "Average Industry Demand". That demand was compared with the IS 2010 curriculum outcome statements. Several significant gaps were detected in Personal and Interpersonal Skills, and in Programming whereas other areas were well suited by the IS 2010 curriculum specifications.

8. CONCLUSION

The IS 2010, the ABET/CAC criteria and IS accredited programs along with several published surveys were analyzed to ascertain differences between the accredited programs and IS 2010.

It was not surprising that we found almost complete coverage of the criteria specified material by the accredited IS programs. When we compared the same IS accredited programs the sample of 240 business schools, we found great similarity except for the CAC Criteria requirement of data communications and networking. The ABET accredited programs coverage was 35% higher than the selected business programs.

There are two significant observations relative to the ABET/CAC accredited IS programs and IS 2010. The first is that the there is only a 55 percent coverage of the IS 2010 courses by the ABET/CAC programs. On the other hand the same programs have an 86 percent coverage of the ABET/CAC criteria topics. This indicates there is a significant disconnect between IS 2010 and the ABET/CAC IS accredited programs. The indication is that for these programs, some modification of IS 2010 is warranted.

IS 2010 attention to personal and interpersonal skills probably relates to a decision to not include the topics as formal outcome specifications.

The decision of the IS 2010 authors to leave out programming while including enterprise computing topics represents the view that the new topics are important, and that leaving out programming enables flexibility for exploration by universities. We feel that industry demand for programming is strong and that most programs in recognition of this fact are teaching programming in support of the careers of their students.

9.0 REFERENCES

Aasheim, C., Shropshire, J., Li, L., Kadlec, C. (2012). Knowledge and Skill Requirements for Entry-Level IT Workers: A Longitudinal Study, *Journal of Information Systems Education. Summer 2012, Vol. 23 Issue 2,* p193-204

ABET (2013b). ABET CAC-Criteria-2013-2014.pdf p5), http://abet.org/accreditation-criteria-policies/ retrieved May 31, 2013

ABET (2013). "Why Accreditation", http://www.ABET.org/why accreditation/retrieved May 31, 2013

Apigian, C. H. and Gambill, S. E. (2010). Are We Teaching the IS 2010 Model Curriculum? *Journal of Information Systems Education*, Volume 21, Number 4, Winter 2010, pp. 411-420.

Babb, J.S., Longenecker, H.E., Baugh, J. and Feinstein, D.L. (2013). Confronting the Issues of Programming In Information Systems Curricula: The Goal is Success. Proceedings of ISECON 2013 – San Antonio, Texas.

Couger, J. D., Davis, G.B., Feinstein, D.L., Gorgone, J.T. and Longenecker, H.E. (1997). IS'.97: Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems, *Data Base,* Vol. 26 No. 1, pp. I-94.

Davis, G., J. T. Gorgone, J. D. Couger, D. L. Feinstein, and H. E. Longenecker. (1997). IS'97: Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. *ACM SIGMIS Database*, 28(1).

Davis, G.B., Couger, J. D., Feinstein, D.L., Gorgone, J.T. and Longenecker, H.E. "IS '97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems," ACM, New York, NY and AITP (formerly DPMA), Park Ridge, IL, 1997.

Gorgone, J.T., Davis, G.B. Valacich, J., Topi, H., Feinstein, D.L. and Longenecker. H.E. (2003). IS 2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. *Data Base* 34(1).

Larson, S., Harrington, M.C.R. (2012). A Study of ABET Accredited Information Systems Programs in the USA, *2012 Proceedings of the Information Systems Educators Conference, New Orleans, Louisiana, USA,* p1,18.

Longenecker, H.E., Feinstein, D.L. and Babb, J.S. (2013). Is there a need for a CIS Model Curriculum?, *Proceedings of ISECON, San Antonia 2013.*

Topi, H., Valacich, J., Wright, R.T., Kaiser, K.M., Nunamaker, J.F., Sipior, J.C., and Vreede, G.J. (2010). IS 2010 Curriculum Guidelines for Undergraduate Degree Programs in Information Systems, Association for Computing Machinery (ACM), Association for Information Systems (AIS)", retrieved July 14, 2012: http://www.acm.org/education/curricula/IS %202010%20ACM%20final.pdf

Appendix

Table 2. ABET/CAC Accredited Schools Coverage of IS 2010 Courses

	IS 2010 Curriculum	*Foundations of Information Systems*	*Data and Information Management*	*Enterprise Architecture*	*IS Strategy, Management, and Acquisition*	*IS Project Management*	*IT Infrastructure*	*Systems Analysis & Design*
	LIST OF UNIVERSITIES							
1	ARKANSAS TECH UNIVERSITY	√	√				√	√
2	CALIFORNIA STATE UNIVERSITY	√	√	√				
3	CALIFORNIA UNIVERSITY OF PENNSYLVANIA	√	√			√		√
4	DREXEL UNIVERSITY	√	√	√		√	√	√
5	EAST TENNESSEE STATE UNIVERSITY	√	√	√	√			
6	FLORIDA MEMORIAL UNIVERSITY	√	√			√		√
7	GANNON UNIVERSITY		√				√	√
8	GRAND VALLEY STATE UNIVERSITY	√	√		√	√		√
9	ILLINOIS STATE UNIVERSITY	√	√	√			√	√
10	JACKSONVILLE STATE UNIVERSITY		√					
11	JAMES MADISON UNIVERSITY		√	√		√		√
12	KENNESAW STATE UNIVERSITY	√	√		√	√	√	√
13	METROPOLITAN STATE UNIVERSITY OF DENVER	√	√		√			√
14	NEW JERSEY INSTITUTE OF TECHNOLOGY	√	√		√			√
15	PACE UNIVERSITY	√	√			√	√	√
16	QUINNIPIAC UNIVERSITY		√	√		√		√
17	RADFORD UNIVERSITY		√				√	
18	REGIS UNIVERSITY	√	√		√	√	√	√
19	ROBERT MORRIS UNIVERSITY		√	√	√	√		√
20	SLIPPERY ROCK UNIVERSITY	√	√		√	√		√
21	SOUTHERN UTAH UNIVERSITY		√					√
22	THE UNIVERSITY OF TAMPA	√	√	√		√	√	√
23	UNIVERSITY OF ARKANSAS AT LITTLE ROCK		√					√
24	UNIVERSITY OF HOUSTON – CLEAR LAKE	√						√

25	UNIVERSITY OF HOUSTON, COLLEGE OF TECHNOLOGY	√	√			√		√
26	UNIVERSITY OF NEBRASKA AT OMAHA	√	√			√		√
27	UNIVERSITY OF NORTH ALABAMA		√					√
28	UNIVERSITY OF NORTH FLORIDA		√	√		√		
29	UNIVERSITY OF PUERTO-RICO, RIO PIERDAS CAMPUS		√					√
30	UNIVERSITY OF SOUTH ALABAMA		√		√	√		√
31	UNIVERSITY OF SOUTH CAROLINA		√					√
32	UTAH STATE UNIVERSITY	√	√					√
33	UTAH VALLEY UNIVERSITY	√	√					√
34	VIRGINIA COMMENWEATLTH UNIVERSITY		√			√	√	√
35	WRIGHT STATE UNIVERSITY	√	√	√	√	√	√	√
	Total	**21**	**34**	**10**	**10**	**18**	**11**	**30**

Table 4. CAC/ABET Programs Compliance with ABET Accreditation Specifications

	LIST OF UNIVERSITIES	BASIC PROGRAMMING	DATA COMMUNICATIONS AND NETWORKING
1	ARKANSAS TECH UNIVERSITY	√	√
2	CALIFORNIA STATE UNIVERSITY	√	
3	CALIFORNIA UNIVERSITY OF PENNSYLVANIA	√	
4	DREXEL UNIVERSITY	√	√
5	EAST TENNESSEE STATE UNIVERSITY	√	√
6	FLORIDA MEMORIAL UNIVERSITY	√	√
7	GANNON UNIVERSITY	√	√
8	GRAND VALLEY STATE UNIVERSITY	√	√
9	ILLINOIS STATE UNIVERSITY	√	√
10	JACKSONVILLE STATE UNIVERSITY	√	√
11	JAMES MADISON UNIVERSITY	√	√
12	KENNESAW STATE UNIVERSITY	√	
13	METROPOLITAN STATE UNIVERSITY OF DENVER	√	√
14	NEW JERSEY INSTITUTE OF TECHNOLOGY		
15	PACE UNIVERSITY	√	√
16	QUINNIPIAC UNIVERSITY		√
17	RADFORD UNIVERSITY	√	√
18	REGIS UNIVERSITY	√	√
19	ROBERT MORRIS UNIVERSITY	√	√
20	SLIPPERY ROCK UNIVERSITY	√	√
21	SOUTHERN UTAH UNIVERSITY	√	√
22	THE UNIVERSITY OF TAMPA		
23	UNIVERSITY OF ARKANSAS AT LITTLE ROCK	√	√
24	UNIVERSITY OF HOUSTON – CLEAR LAKE	√	√
25	UNIVERSITY OF HOUSTON, COLLEGE OF TECHNOLOGY		√
26	UNIVERSITY OF NEBRASKA AT OMAHA		√
27	UNIVERSITY OF NORTH ALABAMA	√	√
28	UNIVERSITY OF NORTH FLORIDA	√	√
29	UNIVERSITY OF PUERTO-RICO, RIO PIERDAS CAMPUS	√	√
30	UNIVERSITY OF SOUTH ALABAMA	√	√
31	UNIVERSITY OF SOUTH CAROLINA		
32	UTAH STATE UNIVERSITY	√	√
33	UTAH VALLEY UNIVERSITY	√	√
34	VIRGINIA COMMENWEATLTH UNIVERSITY	√	√
35	WRIGHT STATE UNIVERSITY	√	√
	Total Programs	29	29

Table 5. IS industrial expectations versus outcomes of IS 2010 Curriculum compared with ABET student outcomes.

ABET Specification	Competencies			IS Industrial Skills Demand			Average Total Demand	Academic	Gap
				Survey	Survey	Department of Labor			
1	2		3	4	5	6	7	8	9
Student Outcomes and Curriculum	**Definition**		**Sub-Category**	**Recent Grads Colvin 2008**	**IT Professionals Aasheim 2012**	**IS related Jobs Sys. Analyst, DBA, App Develop, Web Develop**	**4 +5 +6**	**IS 2010 Outcomes**	**7 - 8**
Professional, ethical, security, social, security issues; communicate with a range of audiences; engage in life-long learning; fundamentals of IT and mathematics	People Skills	1	Personal	3.2	3.2	2.56	2.89	0.00	2.89
Function on Teams to Accomplish Goal		2	Interpersonal	3.6	3.16	2.40	3.05	0.00	3.05
Background in topics regarding the IS environment		3	Organizational	3.64	2.84	2.80	3.11	3.00	0.11
Role of IS in Organizations; integrate IT solutions into user environment	Technology	4	IT Alignment	3.16	2.88	2.64	2.89	2.68	0.21
Networking and Data Communications		5	Networking and Operating Systems	2.68	2.84	2.84	2.79	3.00	-.21
Data Management		6	Database	2.96	2.8	3.08	2.95	3.04	-.09
Systems Analysis & Design; processes supporting delivery of IS; local & global impact of IT on individuals and organizations		7	Sys Analysis & Design	3.28	3.08	2.76	3.04	3.00	0.04
Modern Programming Language; design and implement a solution based on current techniques		8	Programming	3.04	2.96	3.32	3.11	0.00	3.11
Participate in Project Planning		9	Project Management	3.64	2.40	2.76	2.93	3.00	-.07