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INFORMATION SYSTEMS EDUCATION JOURNAL

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Discovering Privacy—or the Lack Thereof

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Abstract

Many IS courses address the issues of ethical decision making and privacy through full course or section of a larger course. In this paper, the author discusses the development of a series of activities in an IS2010.07 course. The primary purpose of these activities is to raise awareness by the students of issues dealing with the collection, analysis, use, and leveraging of consumer data, including their own.

Keywords: Privacy Issues, Ethics, Data Brokers, Pedagogy

1. INTRODUCTION

In the current data-intensive era, one of the primary ethical issues facing consumers and, in turn, enterprises, is the privacy of individual data. Privacy, as stated by Solove (2013), suffers from definitional ambiguity. Privacy depends highly on context and the individual's life experiences. In this paper, privacy is defined using the definition provided at Dictionary.com:

> "freedom from damaging publicity, public scrutiny, secret surveillance, or unauthorized disclosure of one's personal data or information, as by a government, corporation, or individual" (Dictionary.com, n.d.)

Mason (1986) was the first to recognize that privacy is a major ethical issue. Mason named the four key ethical issues of the information age as: Privacy, Accuracy, Property, and Accessibility (PAPA). In a follow-up study, Peslak (2006) reaffirmed privacy as the most essential of the four factors to individuals.

Surprisingly, few people (including students) are aware of privacy abuses that occur almost daily. This despite, admonishments by important people in IT; in 1989 Scott McNealy, co-founder and long serving CEO at Sun Microsystems stated, "You have zero privacy anyway. Get over it" (Maines, 2000).

The essence of the course activities, outlined in this paper, was to make students (primarily seniors) aware of the overt and discrete violations of their own privacy that happens regularly. Making students aware of the two edge sword of technology will hopefully make them better consumers and users of technology.

2. CALLS TO STUDY PRIVACY/ETHICS /SOCIAL RESPONSIBILITY IN IT COURSES

Challenges from a number of different fronts have been leveled recently against business schools (and the same argument can be made for IS/IT programs as well), that we are doing our students a disservice by not exposing them to "wicked problems" (McMillian & Overall, 2016). Colby et al. (2011) have called upon business schools to incorporate liberal education concepts such as critical thinking and "ethical sensitivity".

In 2011, a special issue of the Journal of Information Systems Education (JISE) covered Ethics and Social Responsibility topics relevant to IS education. Harris, Lang, Yates, & Kruck (2011) stated that the articles in the special issue "describe how inclusion of ethics and social responsibility [including the topic of privacy] in

the IS curriculum enhances IS education" (Harris, et al., 2011, p. 183).

One article, within this special issue of JISE, is particularly germane to this work. Fleischmann, Robbins, and Wallace (2011) discuss a framework for ethical decision making and then apply this framework to the development of a course outline to teach IT ethics from both a Western, non-Western, and feminist perspective. Armed with the Quinn (2016) text, and other outside readings, the authors discuss the development of both an undergraduate and graduate course concerning IT ethics.

Many IS courses, similar in nature to the above discussion, incorporate ethics, and privacy, into the content through text supported materials. Most Intro to IS textbooks (Rainer, Prince, & Cegielski, 2013; Haag & Cumming, 2012; Sousa & Oz, 2014; Laudon & Laudon, 2015; Marakas & O'Brien, 2013) and some specialized textbooks on IT ethics such as Quinn (Quinn, 2016) and Reynolds (Reynolds, 2014) have coverage of these issues in various lengths and depth.

The objectives of this work also fits the call by Ives, Valacich, Watson, Zmud, Alavi, et al. (2002) to ensure that students have this knowledge especially in four of the eight key concept areas:

- How do information systems influence organizational competitiveness?
- Why have databases become so important to modern organizations?
- What is the role of the Internet and networking technology in modern organizations?
- How do information systems enable organizational processes?

Certainly, it can be seen that the collection (namely utilizing the Internet), analysis, use, and leveraging (CAUL) of customer data allows companies, primarily through new marketing processes to utilize databases of customer information to gain a competitive advantage. The CAUL of data without concern for ethical considerations is an additional point of knowledge in being an informed consumer and user of the data.

3. COURSE LEARNING OBJECTIVES

At the author's institution, this course is part of the business foundation taught to all business majors within the AACSB-accredited program. The course is modeled on the IS2010.07 guidelines for a course in IS Strategy, Mangement, and Acquisition (Topi, H.; Valacich, J.S..; Wright, R.T.; Kaiser, K.; Nunamaker, J.F.; Sipior, J. C.; and de Vreede, G.J., 2010). Like in the model curriculum this course is taught as part of a two course capstone sequence for all business majors.

In particular, the objectives of the course, as taken directly from the course syllabus, state that the course

> "provides a conceptual framework for introducing, integrating, using, and leveraging enterprise-level **information systems** in today's enterprises. The key elements of successful information system development will be defined during the early part of the course and these will be used extensively throughout discussions and analyses of case studies. Taking a middle/upper-management point of view, the course focuses on the changes and impacts within organizations that need to be accounted for in strategic planning and organizational decision-making. The course prepares students to participate in enterprise information systems development discussions as a member of a team." (Course Syllabus)

While neither the course objectives nor the description of the IS2010.07 course specifically mentions the inclusion of privacy, the model curriculum (Topi, et al. 2010) does list privacy as a knowledge area important to all IS majors (Topi, et al., 2010, p. 422).

Mason (1986) stated that two forces that inhibit privacy: the growth of information technology and the increased value of information. In this particular course students are exposed to four particular perspectives with regard to the CAUL of personal data: (1) the collection of data from multiple sources without the explicit knowledge or permission of consumers, (2) the use of techniques, such as analytics, to leverage consumer data to create consumer profiles, (3) the buying and selling of consumer data by companies to/from data brokers, and (4) the loss/exposure of consumer data through data breaches.

The collection of data stems from the use of information technologies that act as sources of data. Traditional technologies such as RFID and webpages and even everyday appliances such as televisions and toys. With the growth of the Internet of Things (IoT) technologies this collection will only continue to grow.

Analytics, while a highly useful technique to any enterprise, has a dark side as well; Davenport et al. (2007). The ability to find patterns of consumer behavior in multiple, otherwise heterogeneous data sets has become easier and more prevalent. Combine this with the use of personally identifiable information collected from web browsing and enterprises have a powerful new marketing tool to help attract and keep customers; without regard to their customer's privacy.

"Data brokers are companies that collect and aggregate consumer information from a wide range of sources to create detailed profiles of individuals" (Privacy Rights Clearinghouse, Fact Sheet 41: Data Brokers and Your Privacy, n.d.) Nearly 4,000 companies make up this $200B industry. Many of these firms work "under the radar" without government regulation buying, aggregating, and reselling this data (Federal Trade Commission, 2014).

Data breaches seem to be an everyday occurrence. To date for 2016 (as of 6/28/2016), a total of 500 "reported" breaches have exposed over 12 million customer records; many more data breaches go unreported. About 33% of these breaches involve healthcare or medical records (Identity Theft Resource Center, 2016).

These topics relate to course objectives dealing with the use/misuse of information technology and on the ethics of the CAUL of personal data.

4. COURSE ACTIVITIES

The course activities were similar in each offering (Fall 2015 and Spring 2016) of the course; minor refinements were made in the Spring 2016 course.

The students were introduced to the topic of privacy in three prominent ways. An initial lecture was presented that discussed the issue of privacy and the laws (and lack thereof) regarding data privacy. This lecture included some historical context on the development of the issue of privacy in US law as well as some examples of what information is considered private and what is not private. For example, in all states—except FL, ME, CT, MA, and Washington, DC—the books you check out of a library are considered private data.

Next, a series of readings, primarily from the Privacy Rights Clearinghouse and the viewing of a 60 Minutes story dealing with the data brokerage industry were assigned.

The Privacy Rights Clearinghouse is non-profit organization that provides "information and tools" to consumers to empower them to take action to protect their own privacy (Privacy Rights Clearinghouse, n.d.). The web site contains information and access to documents on data breaches and data brokers. The students in particular read the Federal Trade Commision (FTC) report on data brokers (Federal Trade Commission, 2014).

The readings and the 60 Minutes video (The Data Brokers, 2014) highlight the primary functions of the data brokerage industry and the types of data bought, aggregated, and sold by these firms. After these readings and videos were discussed in class a short assignment was given to assess the level of understanding gained by the students from this section of the course.

The next exercise that the students engaged in during the semester was to collect data stories that addressed issues of data privacy. These data stories extended the idea presented by Pomykalski (Pomykalski, 2015) to attempt to create a contemporary issues journal (Barkley, 2009).

The students were required to find at least two "current event" articles. These stories (see (Pomykalski, 2015)) were analyzed using a fairly standard ethics assessment rubric where the students were required to examine the article as an ethical dilemma (see Appendix 1 for more details).

Finally, as part of a team project, examining the use of analytics by various industry groups, the students examined issues of ethics (largely privacy) by these industries (see Appendix 2).

5. FUTURE PLANNED EXTENSIONS

In this first attempt at the introduction of privacy issues into this IS2010.07 course, the readings and activities met expectations, however, additional readings and assignments are planned for the future; specific focus areas currently under consideration are healthcare and social media.

Given the great number of data breaches in the healthcare field, the privacy of patient data is at risk. By allowing students to investigate the impacts of having healthcare information compromised it is hoped that they come to a

better understanding of the need to safeguard all consumer data.

Through the submission of the numerous data stories, students found that many of privacy violations dealt with data extracted from social media. Facebook, for example, has been been guilty of violating the privacy of users' data by conducting "studies" without the consent or knowledge of users (Arthur, 2014). Additionally, Facebook is collaborating "with health industry experts and entrepreneurs" to create health apps and discussion groups. These apps will cluster users based on their particular health conditions. Some social media watchers are concerned about privacy issues with regard to this data (Miliard, 2014). Social media is prevalent in the lives of most of these students, therefore understanding the risks, both personally and professionally, of having personal information compromised might lead many of them to have more control over what they post.

New readings are being reviewed and the development of new assignments are underway. The fuller realization of the contemporary issues journal (Barkley, 2009; Bean, 2011) is also planned for the next time this course is taught.

6. CONCLUSIONS/SUMMARY

The primary motivation for the introduction of the concept of privacy in this particular course is to enlighten students as to the multiple ways data is collected, analyzed, used, and leveraged to gain important insights into consumer behavior. More importantly though, the goal is to make students aware that they need to be good stewards of their own data and, in turn, conscious stewards for other consumer's data in their professional experiences. The recognition and understanding of ethical situations is an important component of acting with integrity (EPS Cloud Fabric, 2012).

Comments, by the students as part of a reflective exercise on the final exam, showed that a number of students were both enlightened and intrigued by the lack of privacy in the handling of consumer data. Many of the students admitted that before this course that had not heard of the data brokerage industry. Some students were made more "self-aware" of how their data is used by marketers and social media companies. One student even commented on the value of the ethical dilemma assessments stating that they add value by being to apply their knowledge to current events.

Through the readings and exercises presented in this course, many students developed an awareness and appreciation of a topic that was not significant in their lives due to their own "privacy conception" (Steijn & Vedder, 2015). It is the author's hope that this awareness and appreciation carries forth in their professional lives.

7. ACKNOWLEDGEMENTS

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APPENDIX 1: Data Stories Submission Template

INFS 472: Management Support Systems
Spring 2015 – Dr. Pomykalski

Name: _____ **Story #: _____/6**

Presentation (in class) Date: _____ Submission (written) Date: _____

Article Title:

Article Source:

Article Date:

Summary:

Relationship to Data+Enterprise Systems-Strategies:

For each of the three stories you will identify and state the facts as best you can in the form of an ethical dilemma with respect to (at least) one of the major stakeholders. You will then generate alternative courses of action and assess the ethics of each of your courses of action. You will conclude the paper with a justified choice of action based on your ethical analysis. A recommended outline is given below.

1. Introduction
2. Ethical Issues
3. Stakeholders
4. Alternative Courses of Action
    a. Alternative 1
    b. Alternative 2 …
    c. Alternative *n*
5. Ethical Assessment of Each Alternative
    a. Alternative 1
    b. Alternative 2 …
    c. Alternative *n*
6. Conclusion (your choice with support)
7. Bibliography/Works Cited/References

APPENDIX 2: Analytic Use in Industry Assignment

Team Project

Industry Use of DDDM/Analytics Techniques

Goal: Gain an in-depth understanding of the applicability of data-driven decision-making (DDDM)/"analytics" within a particular industry.

Overview: The focus of this team-based investigation is to understand how DDDM/analytics is used within a particular industry in the "real-world". In an oral and then written presentation, each group will report on their findings of how "analytics" and data-driven decision-making is being performed within a particular industry. The deliverables for this investigation, and their due dates, are listed below.

Group Members (4 Max)/Topic Selection:	EMail deliverable:	Friday, October 30th
Industry Selections:	EMail deliverable:	Friday, November 6th
Oral Presentation:	December 2, 4, and 7th	
Written Report:	Next class day after presentation	
Team/Peer Evaluation (Individual):	Individual Report:	Friday, December 11th

Please note that a large portion of the final project grade (80%) will be a jointly assigned group grade and the final 20% will be assigned individually; this individual grade will be on a personal contribution and group interaction statement. Based on the consistency of the statement across the group, your instructor reserves the right to reduce the assigned group grade for any one individual in the group. In other words, if you do not put in the effort then you will not be able to share fully in the assigned group grade.

A description of the deliverables is given below; see the table above for due dates.

Group Member Selection (2.5%): This simple deliverable is the selection of a team (of your choice) of no more than four individuals from your section of the course. Once the team is chosen, one team member will be responsible for sending me an EMail with the names of the individual members of the team.

Industry Selection (5%): Each team will be responsible for creating a ranked list of at least three industries that wish to investigate for the use of DDDM/analytics. Your team may choose any industry. Examples of particular industries include (but are not limited to): Automotive, Banking, Consumer Products, Education, Electronics, Energy and Utilities, Financial markets, Government, Healthcare, Insurance, Law Enforcement, Metals and Mining, Media, Oil & Gas, Retail, Telecommunications, Travel and Transportation or you may make your selection from any Professional Sports area such as the MLB, NFL, NBA, Professional Soccer, etc. For introductory information on industries see: http://www.ibm.com/analytics/us/en/industry/.

Oral Presentation (40%): Each team will make a 20 to 25 minute oral presentation (on one of the dates listed above) that describes the use of DDDM/analytics within their industry. All team members will be expected to be present and make a contribution to the presentation. The presentation will include (at a minimum) the following:

1. A brief overview of the industry that describes the need for DDDM/analytics within that industry,
2. A review of the major issues in that industry that shows the factors driving that industry toward the use of DDDM/analytics,
3. An in-depth analysis of at least one enterprise in the industry as to how DDDM/analytics is applied,
4. A discussion of the major impediments left to overcome for more wide-spread use of DDDM/analytics in the industry,
5. A discussion of the ethics related issues respect to DDDM/analytics usage,
6. A final summary of the salient points of the presentation.

Written Report (32.5%): The written report part of the work will be completed as a set of extended notes to be included with the PowerPoint slides. Each of the slides in the presentation will include a one page (approximately two to three paragraphs) discussion of more detail on the material included in the slide. This will include outside sources (in proper APA format), where appropriate, as well. Please note that the entire presentation (and notes) should have (at a minimum) five "new" sources that were used to create the presentation by the team. Grading on the presentation and the notes will be based on completeness, accuracy, and writing criteria. The writing criteria will be similar to the previous deliverables submitted in class.

Team/Peer Evaluation (20%): The final deliverable, which is to be developed individually by each group member, will discuss—in 600-900 words— (1) the overall working relationship and discussion of roles within the group, (2) your individual contribution to the project, (3) a discussion on the division of labor that existed within the group, (4) the individual performance of each of the other members of the team; see the list below for suggested evaluation criteria, and (5) at least one individual lesson learned through the interactions within the group; this is not about content of the project. The criteria you should choose to use to judge your peers are:

1. On an individual basis, did they make substantial contributions to preparation of the team deliverables? In other words, was the team member adequately prepared for team activities?
2. On an individual basis, did they make productive contributions in team meetings? In other words, did this member contribute productively to group discussion, work and leadership during your team meetings?
3. On an individual basis, did the team member facilitate the contributions of other team members? In other words, did the team member encourage others to contribute their ideas?
4. On an individual basis, did the team member foster a constructive team climate? In other words, did the team member help to build a constructive team by fostering mutual respect?
5. On an individual basis, how did the team member respond to conflict or differences within the team? In other words, did the team member engage conflicts in a manner that strengthened the overall team cohesiveness and future effectiveness?

A Mindful Approach to Teaching Emotional Intelligence to Undergraduate Students Online and in Person

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Abstract

In this paper we examine whether emotional intelligence (EI) can be taught online and, if so, what key variables influence the successful implementation of this online learning model. Using a 3 x 2 factorial quasi-experimental design, this mixed-methods study found that a team-based learning environment using a blended teaching approach, supported by mindfulness instruction to teach these skills, can make learning about emotional intelligence accessible and meaningful to undergraduate students. Using peer emotional intelligence assessment scores as a measure of emotional intelligence growth, the study showed a statistically significant impact on the growth of emotional intelligence skills from using a blended approach including direct instruction in mindfulness techniques. Supporting this finding, students clearly expressed a noticeable growth in their emotional intelligence and in that of their peers in interviews conducted at the end of the study. In light of these findings, we propose the RESET cycle model (Recognizing and regulating Emotions through Social and Emotional Team-based learning supported with mindfulness) as a potential foundation for a program to teach EI skills.

Keywords: emotional intelligence, mindfulness, career readiness skills, online learning, team-based learning, Myers-Briggs

1. INTRODUCTION

The ability of technical professionals to work effectively in teams is essential to organizational effectiveness. In fact, "soft skills," such as oral and written communication, collaboration, work ethic, leadership, professionalism, career management, critical thinking, and problem solving, are all considered an integral part of career readiness by the National Association of Colleges and Employers (NACE) (2014a, 2015). However, quite often the focus of information systems and computing education is on the technical capabilities of students (Beard & Schweiger, 2008), and not on these important soft skills. This results in students who enter the workforce with inconsistent interpersonal and teamwork skills, and subsequently these students are not meeting employers' expectations (Mangan, 2007; Mitchell, Skinner, & White, 2010; National Union of Students, 2011). We propose that direct emotional intelligence training, especially when combined with instruction in mindfulness techniques, is an important tool in combating this important issue, and thus allowing us to graduate students who are truly ready for the 21st century workforce.

Emotional intelligence (EI) is a combination of personal and social competences that has been referred to as "soft skills' more scientific and researched counterpart" (Daniel, 2007). A Dictionary of Psychology defines emotional intelligence as "the ability to monitor one's own and other people's emotions, to discriminate between different emotions and label them appropriately, and to use emotional information to guide thinking and behavior" (Coleman, 2008). Goleman, Boyatzis, and McKee (2013) characterize EI using a model with four primary domains—self-awareness, social awareness, self-management, and relationship management — and eighteen associated competencies.

Developing EI competencies affords many benefits to undergraduate students such as increased workplace performance (Bradberry, 2014; Huppke, 2013; Stephen, 2014), leadership talent (Bradberry, 2014; Goleman, 2004, 2013; Goleman et al., 2013), overall job satisfaction (Sener, Demirel, & Sarlak, 2009), and increased earning potential (Bradberry, 2014; Momm, Blickle, Liu, Wihler, Kholin, & Menges, 2014). People with high EI are more self-aware, collaborative, influential, adaptable, reliable, and assertive than their colleagues, and employers look for these traits in job candidates (Bradberry, 2014; Majid & Mulia, 2011). Companies, including Google, Zappos, and Amazon, are using assessments of emotional intelligence during the job search process to vet candidates (NACE, 2015). Yet, employers participating in the NACE Job Outlook 2015 survey indicated that recent college graduates do not possess these characteristics at the same level as past years' graduates (NACE, 2014a). Based on these findings, a good argument can be made for the importance of teaching EI at the undergraduate level.

The Myers-Briggs Type Indicator (MBTI) was used in two central ways in this study. First, it was used as a tool to teach students about self-awareness and awareness of others, both of which are cornerstones of EI (Cherniss, 1999; Cherniss, Goleman, Emmerling, Cowan & Adler, 1998). Second, the study examined whether the MBTI dimensions were associated with individuals' acceptance of online learning as an effective modality for learning about EI.

Team-based learning in an academic setting provides a safe environment to develop these skills for those individuals who might be less comfortable with extensive peer interaction, and this approach was employed with all students participating in this study. To this baseline, we added explicit training in emotional intelligence which, unlike other predictors of success such as IQ and personality type, can be learned and continually improved (Bradberry 2014; Bradberry & Greaves, 2009). In addition, given the evidence based benefits of mindfulness, we also added explicit instruction in mindfulness practices to determine if it could contribute to the success of teaching EI.

Mindfulness has been described as "bringing full awareness into the present moment" (Shapiro, Wang, & Peltason, 2015). As research increasingly bears out the benefits of mindfulness, a wide variety of groups—including corporations, executives, armed forces, primary and secondary schools, and professional athletes—have taken notice and instituted mindfulness programs into their daily routines (Brackett & Rivers; Burton & Effinger, 2014; Oaklander, 2015; Penman, 2012; Puff, 2014). Tan (2012) maintains that, due to neuroplasticity, mindfulness practices offer a way to promote changes in the composition of the brain itself. A study using magnetic resonance imaging before and after a mindfulness program found positive changes in the mindfulness group when compared with the control group, in locations of the brain involved in functions important to EI

such as emotional regulation, self-referential processing, and perspective taking (Hölzel, Carmody, Vanqel, Congleton, Yerramsetti, Gard, & Lazar, 2010).

Much of the research in the area of EI in higher education has been centered on the examination of whether students possess EI and how this factors into predicting work performance, salary and overall wellbeing (Bonesso, Gerli, Barzotto & Comacchio, 2013; Davidson & McEwen, 2012). Moreover, as discussed earlier, the misalignment between employers' expectations and recent graduates' actual emotional intelligence competencies has also been an area of extensive research (Mangan, 2007; National Union of Students, 2011). Other studies have demonstrated that EI is not being taught in undergraduate course offerings (Beard & Schwieger, 2008; Scott-Bracey, 2011). Several authors have noted, however, that fewer studies have been devoted to discovering if and how undergraduate students' emotional intelligence can be improved and what academic curricula and programs can be developed, especially programs with a solid theoretical foundation (Alexander, 2014; Bonesso, et al. 2013; Conley, 2015; Jensen, Cohen, Rilea, Grant, Hannon & Howells, 2007; Lin, Lee, Hsu & Lin, 2011; Malek, Noor-Azniza, Muntasir, Mohammad & Luqman, 2011; Pool & Qualter, 2014; Salami, 2010; Zeidner, Roberts & Matthews, 2008). This study used what is known in the literature, including models, theories and psychometric assessments in the areas of online learning, EI, personality, and mindfulness to address this research gap. An extensive search found no research examining the impact of online EI workshops on the growth of EI and if there are key variables such as mindfulness instruction that influence the successful implementation of this online learning model in a university setting.

Focusing on information systems and computer science students, the recent move to agile development practices, where requirements and solutions evolve through collaboration between self-organizing, cross-functional teams, and on rapid application development, which relies on the rapid development of prototypes, has put a premium on communication and teamwork skills (Singh, Singh, & Sharma, 2012). Software developers typically have interactions with: (1) other developers, especially when their code depends on or needs to interface with routines written by others; (2) software testers, where effective communication between testers and developers is critical to completing cycles of development, testing, deployment, and feedback in a timely manner; and (3) culturally diverse users and customers, especially in global companies, where language and customs differ. The ability of teams to meet customer requirements and deadlines hinges upon the ability of diverse individuals to work collectively and as seamlessly as possible. Individuals that have experience working in teams to accomplish goals tend to be more productive in meeting deliverables on agile software development projects (Woods, 2010). Students that have exposure to team environments before entering the workforce therefore have been shown to have an advantage in terms of a shortened learning curve in becoming productive team members (Cain, 2012).

2. METHODS

Participants

This study was conducted at a small liberal arts college (approximately 3,200 students) and included 159 of the 161 students enrolled in a Management Information Systems course during the Spring 2015 semester (two students opted out of the study). The participants were 57% male and 43% female. The vast majority (94%) of the students were between 20 and 22 years of age, with the remainder ranging between 23 and 56 years old.

The course was three credits and was a core requirement for all students in the college's AACSB accredited business school as well as a required course for the Information Systems minor, and was taught by the computer science department. Weekly class meetings included two one-hour lectures and a two-hour lab session. There were six different course sections, and each one was assigned to receive a different EI workshop and mindfulness treatment. All sections used a team-based learning format.

Procedure and study factors

This mixed-method quasi-experiment used a 3 x 2 factorial design (shown in Table 1). The first factor, the mode of intervention, had three variants: face-to-face (F2F) EI workshops, online EI workshops, and no EI workshops, our control. The second factor was the presence or absence of mindfulness training.

		Factor 1: Type of EI Intervention			
		F2F	**Online**	**None**	**Σ**
Factor 2: Mindfulness Training	**Used**	Inst. 1 (n = 16)	Inst. 1 (n = 30)	Inst. 1 (n = 30)	76
	Not used	Inst. 2 (n = 30)	Inst. 3 (n = 32)	Inst. 4 (n = 21)	83
	Σ	46	62	51	159

Table 1: Study design

The outcome measures or dependent variables were the EI scores from the 153-item Trait Emotional Intelligence Questionnaire (TEIQue) v1.50 self-questionnaire (Petrides, Pita, & Kokkinaki, 2007), and the 15-item TEIQue short-form peer questionnaire (Cooper, & Petrides, (2010). The EI self-assessments were given at the start and end of the semester. The peer assessments were given one month into the semester and again at the end of the semester. The independent variables or co-variates were the Myers-Briggs dimensions, gender, class year, and type of intervention.

In addition, volunteers were solicited from among the participants for interviews. The interviews were conducted at the end of the semester. Twenty-one students were interviewed, with roughly equal numbers from each of the six experimental groups.

Emotional intelligence workshops

The EI intervention included a group that received a series of face-to-face workshops, a group that received computer-mediated workshops, and a control group that received no workshops. In both series, each workshop addressed a different aspect of EI: self-awareness, empathy and awareness of others, and emotional detection. After each workshop was conducted, a manipulation check (survey) was used to measure the immediate influence of the workshop on the EI skills it was designed to teach.

The same instructor taught all of the face-to-face workshops in an effort to achieve consistency among the various experimental groups. These workshops were also designed to require very little instructor interaction to minimize the impact of the instructor on the difference between the online and face-to-face interventions.

Workshop #1: Self-awareness

At the start of the semester, all study participants attended a presentation from a certified Myers-Briggs trainer and administrator that covered the Myers-Briggs trait personality dimensions and each student received their personal Myers-Briggs type. Approximately one week after the presentation, the first EI workshop, entitled "Myers-Briggs: Where to Start," was offered to the non-control EI groups. Students began with a short reading and a review of the Myers-Briggs personality types. Next, students watched a video showing two students (actors) discussing a class project that all students had recently completed. The actors demonstrated behaviors associated with particular Myers-Briggs personality types as well as a variety of emotions due to conflicts caused by the differences in their personalities. The script that used for this video is provided in Appendix A (Author, 2016).

After viewing the video, students were asked a variety of questions about the video and were also asked to identify the Myers-Briggs personality types and emotional conflict that resulted from these differences. In addition, the students were asked to reflect with their teams on issues they had personally encountered that were likely caused by personality differences. The online intervention group completed these tasks in an asynchronous format using a Blackboard discussion forum.

Workshop #2: Empathy

The second EI Workshop, entitled "Augmented Empathy in the Workplace," started with a TED talk by Chris Kluwe (2014) entitled "How augmented reality will change sports… and build empathy." At the end of the video, Kluwe suggested a variety of ways by which augmented reality can foster empathy. Next, students were introduced to empathic concepts based on the work of Michael Sahota (2013) and were given examples of how these concepts applied to the workplace. Students then worked with their teams to develop an idea for an augmented reality application to promote empathy in the workplace. This workshop was delivered approximately two months into the semester, in both face-to-face and synchronous online formats.

Workshop #3: Emotional detection

The third EI Workshop, entitled "Emotional Detection of Facial Expression," was designed to help students learn about how emotion detection fits in with EI training, the importance of non-verbal communication, and the neuroscience behind non-verbal communication. Drawing on Paul Ekman's work (Ekman, Friesen, O'Sullivan, Chan, Diacoyanni-Tarlatzis, Heider, & Tzavaras, 1987) that centers on the six basic emotions: anger, happiness, surprise, disgust, sadness, and fear. The workshop provided a brief tutorial on the defining characteristics of each of the emotions on a person's face. At the end of the intervention, students were offered individual opportunities to practice their emotion detection skills by identifying different emotions portrayed by a variety of facial expressions.

Mindfulness instruction

Mindfulness practice was introduced to three groups of students. The introduction of the mindfulness practice followed a similar format to the Google Search Inside Yourself program

developed by Chade-Meng Tan (2012). This program has been taught at Google since 2007, is solidly grounded in current scientific knowledge (Brefczynski-Lewis, Lutz, Schaefer, Levinson, & Davidson, 2007; Davidson, Kabat-Zinn, Schumacher, Rosenkranz, Muller, Santorelli, & Sheridan, 2003; Lazar, Kerr, Wasserman, Gray, Greve, Treadway, & Fischl, 2005; Lutz, Greischar, Rawlings, Richard, Davidson, & Singer, 2004; Slagter, Lutz, Greischar, Francis, Nieuwenhuis, Davis, & Davidson, 2007), and uses mindfulness to develop EI by drawing from the fields of neuroscience, cognitive science, and psychology. Several different mindfulness techniques were introduced throughout the semester to all students who received the mindfulness intervention; these were practiced in class during the two scheduled lecture sections per week. In addition, students had an assignment to practice on their own 40 times throughout the semester. Appendix B shows the structure of some of the mindfulness instruction elements that were used.

3. RESEARCH FINDINGS

We sought to answer the following questions:

1. Does direct EI instruction influence students' EI?
2. If so, does the mode of instruction (online vs. face-to-face) have an impact?
3. Does mindfulness training improve the effectiveness of EI instruction as measured by the TEIQue assessments?

TEIQue scores

Variable		Mean	Std. Dev.	Possible scores
Trait EI	Pre-Test	4.92	.59	1-7
	Post-Test	4.76	.62	
Peer EI	Pre-Test	91.17	7.75	0-100
	Post-Test	92.50	6.08	

Table 2: Descriptive Statistics (Cotler, 2016)

Table 2 provides descriptive statistics for the independent variables used in this study, including means and standard deviations. An important issue to note here is that the standard deviations for the Pre and Post EI assessments are low, indicating that there was very little variability in these scores. Furthermore, the high score means indicate that there was a lack of room for improvement. In fact, 68.2% of the self-reported (trait) scores fell between 4.35 and 5.54 out of 7 for the pretest and 68.2% of the scores fell between 4.18 and 5.42 out of 7 for the post test. The peer instruments yielded slightly better results but still have low variability. Here, 68.2% of the pre-test peer scores fell between 83.42 and 98.92, and 68.2% of post-test peer scores fell between 86.42 and 98.58. This is important because the low variability influences the results in Table 2 (Author, 2016).

Eight multiple regressions were run using R; all models were statistically significant according to the f-statistic ($p < .001$). Examining the regressions using the Trait EI measure, the only independent variable that was statistically significant was the pre-test score. When looking at the Peer EI measure, individual independent variables were not statistically significant. However, the combination of online EI interventions plus mindfulness training *was* statistically significant. For example, the following multiple regression formula PeerPost = f2f + online + mind + f2f * mind + online*mind + peerpre, (Table 3) showed that the interaction between the online intervention and mindfulness was statistically significant. This means that while neither the emotional intelligence interventions nor the mindfulness intervention alone were sufficient to have a significant impact, the combination of these two types of instruction may be sufficient to improve students' overall EI. The details of the regression showing this result are in table 3. The independent variables explained 55% of the variance (adjusted R-squared) in the dependent variable.

Variable	Est	Std. Error	t-value	p-value
Peer EI pre-test	.60	.05	12.95	**< .001**
Face-to-face	-.19	1.15	-.16	.87
Online	-.39	1.14	-.34	.73
Mindfulness	-1.40	1.23	-1.13	.26
Face-to-face x mindfulness	1.18	1.71	.69	.50
Online x mindfulness	3.25	1.60	2.05	**.04**
Overall regression statistics Adjusted R-squared: .55 F (6,153) = 33.6, p < .001				

Table 3: Regression Analysis for Research Question #3 (Cotler, 2016)

Interview responses

We interviewed four of the students who received the face-to-face (F2F) EI intervention, nine who received the online EI intervention, and eight who were in the control group. Unsurprisingly, students who received either type of intervention were more likely to report changes in specific EI skills than those who did not receive any intervention. Notably, we saw little differentiation between the face-to-face and online groups. Based on the student reports, face-to-face and

online interventions were equally successful. The interview responses are summarized in Table 4.

	EI intervention type		
	None	F2F	Online
Reported improvement in ability to monitor own emotions	50%	75%	78%
Reported improvement in ability to monitor others' emotions	38%	75%	78%
Reported improvement in ability to empathize with others	25%	75%	100%
Reported improvement in ability to work collaboratively on a team	63%	100%	89%

Table 4: Differences in self-reported changes in aspects of emotional and social intelligence across Factor 1 groups (Cotler, 2016)

Consistent with the regression findings, the students in the online groups that also received the mindfulness training reported a greater increase in emotional intelligence growth when compared with the control. Furthermore, students in the online mindfulness group also reported that the mindfulness practices affected overall growth of emotional intelligence.

When given the opportunity for more open-ended responses, a key theme emerged in all groups and dominated interviews of students in the online group: the impact that team-based learning had on the opportunity for experiential learning. For example, one student reported that "I noticed it [awareness of others] more this semester since I was working with the same group all semester long."

Other themes that were important across the groups focused on the workshops, learning about the Myers-Briggs dimensions, and mindfulness. When asked about improved awareness of others, one participant credited "definitely the online team [EI] workshops we had to do, especially the facial recognition workshop we did." Another student found that the Myers-Briggs workshop was helpful and said, "I think that when we did the Myers-Briggs thing, that was really helpful to visualize the actual differences between different types of people. I thought that was cool." In support of the findings from the regressions, students reported that the mindfulness instruction and practice was helpful in developing emotional intelligence. Specifically, one student was asked how often he noticed and used an improved ability to monitor his emotional state and replied, "After we started doing the meditation, I'd say regularly."

4. DISCUSSION

The purpose of this study was to examine whether a team-based learning environment with a blended approach (i.e., using online instruction to teach emotional intelligence), supported by mindfulness to teach these skills, could make learning about EI accessible and meaningful to undergraduate students. As a follow-up question, it is important to ask whether it is possible to develop programs to teach these skills in a scalable and systematic way that makes it feasible for institutions of higher education to provide such instruction to their students, even if they are unable to develop, test and implement their own programs. While not all findings of this study relate directly to the question of the effectiveness of online learning as a medium for teaching EI, they are still useful to present here because some of these findings show no difference between the online and face-to-face group. As a result, it is reasonable to assume that if emotional intelligence skills can be taught using a face-to-face approach, they can also be taught online.

As previously discussed, with the exception of the mindfulness + online interaction predicting the peer post-score at a significant level, the major regression findings did not show a correlation between the independent variables (EI intervention, mindfulness training, Myers- Briggs dimension, gender, and age) and the measurable EI outcomes. One possible explanation for this was noted earlier: There was very little variability among the test scores of the participants for any of our four measurements, and most of the post-test variance was explained by the pre-test scores. It is possible that in a population with more diverse pre-test scores, a stronger response to the interventions would be observed.

Change typologies (Faerman, 1993) offer another possible explanation. Researchers who study changes in attitudes and behaviors have developed a typology of change that includes three types of change: alpha change, (α), beta change (β) and gamma (γ) change. Alpha change is defined as the true change that occurs. Beta change occurs when respondents' "standard of measurement used to assess a stimulus changes from one testing period to another" (Armenakis, 1988, p. 165). Gamma change occurs when the respondents' "understanding of the criterion being measured changes from one testing period to the next" (Armenakis, 1988, p. 165). When evaluating change, if beta and/or gamma change cannot be shown to be responsible for the change observed, one could argue that alpha change, or real behavioral change, has occurred. The results of this study may have been influenced by gamma (concept redefinition) change. This possibility is supported by interview responses,

where students consistently indicated that they saw changes in themselves, but in ways that also indicated that their understanding of the concept had changed. For example, the following were typical of comments made in the interviews: "It was a big eye opener for me," "Now I have an understanding of where people are coming from," and "I have never done this type of stuff."

Interestingly, interview respondents in the online emotional intelligence treatment group emphasized the team-based learning experience, especially the emotional intelligence workshops. When the activities were taught online, the students found that maintaining the same teams throughout the semester made a difference in what they learned from the workshops. Interviews with students in the online treatment, compared to interviews with students who received the face-to-face treatment, focused more on specific aspects of what was taught in the emotional intelligence online workshops such as awareness of self and others and facial recognition. While students in the face-to-face treatment also discussed team-based learning and the workshops, the primary focus was on the workshops themselves and secondarily on the team-based learning aspect of the class.

Combining what is known from the literature with new insights found in this study, a new model for teaching EI online, the RESET Cycle Model (Recognizing or regulating Emotions through Social and Emotional Team-based learning supported with mindfulness) is offered. The model starts with a face-to-face introduction to team-based learning and mindfulness. As discussed earlier, a Myers-Briggs workshop is presented in a face-to-face setting in order to set the stage for becoming aware of self and others. These face-to-face experiences and exposure to content create a foundation of knowledge that funnels into the RESET Cycle. This cycle moves between the online collaborative workshops that focus on course content and online collaborative EI workshops with the introduction to new mindfulness instruction in between each workshop; the mindfulness instruction is taught face-to-face to promote the continued face-to-face interaction among the students. As evidenced through the study, introducing different types of meditation assists students in seeing what may work for them in their own personal practice. Moving the "classroom" into virtual space in a way that creates a sense of community, collaboration and trust among the students is critical to the design of any online experience (Shea, Li, & Pickett, 2006). One way of achieving this is through a "strong and active presence on the part of the instructor" (Shea et al., 2006, p. 185). In this study, the instructor presence is achieved through the face-to-face component at the beginning of this model in order to set the foundation and then regularly throughout the period of instruction through the mindfulness training. Another benefit of conducting the workshops online is the decrease in the use of class time to teach these critical skills.

5. LIMITATIONS

The results of this study should be viewed in light of issues related to the internal and external validity of the design. Issues of internal validity (ability to attribute causality) include that the mindfulness practices were only taught by one instructor; therefore, this factor cannot be separated from the instructor. As noted earlier, there is also a question about the measurement of change. The interview data suggest evidence of gamma change, i.e., a change in students' understanding of emotional intelligence from the pre- to the post-test. Thus, caution should be taken when making assumptions about students' initial understanding of EI and the changes that they did or did not experience.

Team-based learning was used in all sections of this class as a way to apply what was learned in the emotional intelligence workshops immediately with peers in a cooperative experiential learning environment. This practice presents a limitation to the external validity (ability to generalize to other populations/settings) of this research in that findings may not be generalizable to non-team-based learning settings. Furthermore, a convenience sample of mostly business students at a small liberal arts college presents additional challenges to attempts to generalize results to other, dissimilar, higher educational institutions and groups of students, or to the population at large.

An additional limitation of this study relates to the nature of the data collected for this study. For example, the study examined changes in students' emotional intelligence based on a sample of students who took a course over a four-month time period. This does not allow us to know whether any changes that the students experienced maintained over time. Future longitudinal studies should include long-term change, which can be measured by asking participants to take the EI self-assessment again six months after the study has concluded as well as to answer some targeted survey questions.

Such a survey could include several open-ended questions, which would allow more in-depth responses from all students, not just those students being interviewed. An interesting approach may also include following the students post-graduation to study if the EI training has been useful to them in personally and in their careers.

Finally, in this study the peer assessments were only given to teammates and not to others outside of the course, who may know the participant better. Future studies may include multiple sources of peer evaluation, including, for example, roommates or others with whom the student interacts and who may be able to better assess the students' emotional intelligence, especially in the pre-test.

6. CONCLUSION

The findings from this study, designed primarily to examine whether emotional intelligence could be taught online, offer statistically significant evidence that these skills can be taught using a blended approach and that the mindfulness factor makes a difference in the emotional intelligence growth observed, as measured by the peer assessment scores. The study also showed that team-based learning and the use of the Myers-Briggs instrument were important factors influencing students' perceptions of their personal growth. Furthermore, the overall findings from this study show no difference in growth between the online and face-to-face group.

Although no prior studies could be found that address these specific research questions—i.e., teaching emotional intelligence online supported by mindfulness instruction and a team-based learning environment—literature from related disciplines such as online learning and teaching soft skills online were used as a template to create the RESET Cycle Model for teaching emotional intelligence online. The implications for practice include the importance of using a team-based learning format with a hybrid delivery model because it offers students the opportunity to interact regularly with a consistent group of peers as well as with the instructor of the course. An early opportunity for face-to-face sessions is critical and should include mindfulness instruction and a Myers-Briggs workshop. Following this foundational instruction, the rest of the content can be moved online with the option to either move the mindfulness exercises online or to enhance the presence of the class (peers and instructor) and maintain this aspect of the class face-to-face. Arguably, this model is appropriate in both higher education and organizational settings.

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Appendix A: EI Intervention #1: Myers-Briggs Script

GOAL:
Demonstrate differences between the Myers Briggs dimensions N/S and P/J. The emotions that are highlighted are often the result of the conflicts between these types.

After viewing the video, participants will be asked to individually answer seven questions about what they saw. The questions will ask participants to identify personality dimensions the student actors were portraying as well as the emotions they were exhibiting. After answering the individual questions, students will be asked to discuss the same questions as a team in an asynchronous online format. Students will be asked as a team to discuss methods that the student actors could use for conflict management; and what they could have done to create synergies rather than conflict. The last part of this workshop will be for students to identify characteristics they witnessed in the video within themselves and other experiences they have had. The computer-mediated delivery will use Blackboard's learning modules, will be self-contained within the module and copied into the course sections of the two classes involved with the online interventions.

Introduction of characters:
(This information is not provided to the students.)
Katie portrays an ESFJ (12.3% of US population) — *The caregiver*
She is a senior marketing major. She is categorized as having an ESFJ personality type and deals with things according to how she feels about them or how they fit in with her personal value system. She has a strong desire to be liked and for everything to be pleasant and is highly supportive of others. ESFJ has a special gift for making people feel good about themselves. She takes her responsibilities very seriously and is very dependable. She has well-formed ideas about the way things should be and is not shy about expressing her opinions.

Lauren portrays an INTP (3.3% of US population) — *The thinker*
Lauren is a senior accounting major. She is categorized as having an INTP personality type. INTPs live in the world of theoretical possibilities. INTPs do not like to lead or control people. Lauren is generally very independent, unconventional, and original. She is at her best when she can work independently.

Video transcript:
Katie (ESFJ): Okay, how should we start? I don't even know how we are going to do this. It's so vague. What's our first step? [Frustration]
Lauren (INTP): Well, I know it is confusing [Compassion]. I have a friend who graduated like three years ago and she used WebEx at her work recently so I know that it is useful and I think it is always important to try new things.
[As an N, she is seeing the big picture of why this assignment may be helpful in the future]
Katie (ESFJ): Umm, Yeah I guess. I just don't understand how helpful this is going to be for us. We are going to make a presentation and then not present it, that makes zero sense and its going to take so long. Umm, and she never gave us specific instructions as to how we are supposed to go about doing this. She just said, "Alright, here's the project good luck."
Lauren (INTP): Well I take 18 credits, so it is crazy… I never know when I will be free.
[P doesn't want to schedule and would prefer to work independently.]
Katie (ESFJ): Yeah I work a lot but we should definitely try to schedule a time to meet in Google docs. I am free Fridays around two o'clock and if you are that would probably work fine for me. [as a J, she wants to get things scheduled]
Lauren (INTP): Oh, I think it would be better if we did pre-decided parts instead. I have no idea what I am going to be doing on Friday, it's Wednesday.
Katie (ESFJ): personally, I would like to meet in Google presentations as well and you can just send me a text whenever you are free and if I am near a computer I can just log on, its not a big deal.
[J, really wants to schedule and her frustration is growing.]
Lauren (INTP): Sure, no problem.
Katie (ESFJ): Can we at least, you said you want to do your part so let's decide what parts you want to do and that way we can get started.
(J, wants to get started and not wait until the last minute).

Lauren (INTP): Okay, I think this project has a lot of possibilities. We can automate the presentation it so it is colorful and fun to watch and maybe link to a movie or some websites about cultural issues we need to consider.
[N]
Katie (ESFJ): That's great idea but I think we need to get down our main part of the presentation with the content before we start adding these colors and videos and stuff
[S] What are the facts/steps we need to address?
Lauren (INTP): Humm, well we will need to know who is going to submit it and we need to address accessibility concerns. I still like the idea of linking to a website or video, and make it really cool.
Katie (ESFJ): Yeah sure, umm I know for the presentation we need 10 – 12 slides total. We can just assign 3 slides to each person. Have them make it and then meet on the Google docs once everyone is done with that and share comments and say what we think about each and try to improve it since we will all get the same grade.
Lauren (INTP): Okay, I will start looking at how to create the links and other cool things we can do with Google presentations to make it a great presentation.
Katie (ESFJ): Okay so how about you just text me when you are ready to meet?
Lauren (INTP): [Looking away] Yeah, sure.

Appendix B: Abbreviated schedule of mindfulness intervention

The mindfulness intervention began with a video interview with Dan Harris (https://www.youtube.com/watch?v=FAcTIrA2Qhk). Week 1 – 3 of the schedule is outlined below.

Week One	**Easy/Easier way** "The easy way is bringing gentle and consistent attention to the breath for two minutes. Start by becoming aware that you are breathing, and then pay attention to the process of breathing. Every time your attention wanders ways, just bring it back very gently." (Tan, 2012, p.26) Tan (2012, pp. 26-27) describes the easier way as sitting "without an agenda for two minutes. Idea is to shift from "doing" to "being" whatever that means to you, for just two minutes. Just be."
Week Two	**Introduction to breath awareness** **Mindfulness meditation** was read to the students during this week. "Let us begin by sitting comfortably. Sit in a position that enables you to be both relaxed and alert at the same time, whatever that means to you. Let us take three slow breaths to inject energy and relaxation into our practice. Now, let us breathe naturally and bring a very gentle attention to the breath. You can either bring attention to the nostrils, the abdomen, or the entire body of breath, whatever that means to you. Become aware of the in breath, out breath, and the space in between. [Short pause] If you like, you can think of this exercise as resting the mind on the breath. You can visualize the breath to be a resting place, or a cushion, and let the mind rest on it, very gently. Just be. [long pause] If at any time you feel distracted by a sensation, thought, or sound, just acknowledge it, experience it, and very gently let it go. Bring your attention gently back to the breathing. [long pause]" (Tan, 2012, pp. 45-46).
Week Three	**Mindful listening (monologue) using behavioral interview questions.** Students were asked to break into pairs (A & B). Student A was asked to begin by answering a behavioral interview question, Student B was told to give student A his/her full attention. Student B was told that he/she could acknowledge by nodding and with facial expressions but no speech. After two minutes, the students switched with a new behavioral interview question. (Adapted from Tan, 2012, pp. 62 – 63)

Closing the Gender Gap in the Technology Major

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Abstract

Technology makes up our daily lives and is a part of everything we do. The tech job market is expanding with more and more jobs needing to be filled by those with the necessary qualifications. Students are realizing the vast opportunities a career in technology can offer them and many are making the conscience decision to major in a technical field, such as computer science, management information systems, or information technology. However, women only make up a small percentage of those students who major in technical fields. With the job market in technology expanding and opportunities widely available, why is it that women hold only a small percentage of those students majoring in those fields? The purpose of this thesis is to show the influences that impact the choice of a woman's selection in a degree of study related to technology. This research is the result of survey prepared to explore the influences behind the gender gap. Survey questions were sent to and conducted on undergraduate students registered in Computer Science, Computer Information Technology, and Management Information System courses at the local university.

Keywords: Stereotypes, Social Encouragement, Women in Technology, Gender Gap.

1. INTRODUCTION

Technology is becoming one of the most in-demand job markets. "Employment of computer and information technology occupations is projected to grow 12 percent from 2014 to 2024, faster than the average for all occupations" (U.S. Bureau of Labor Statistics, 2014). These occupations are expected to add about 488,500 new jobs, from about 3.9 million jobs to about 4.4 million jobs from 2014 to 2024 (U.S. Bureau of Labor Statistics, 2014). Jobs in technology are increasing at such a high rate that soon there will be more jobs than qualified people to fill the positions (Robaton, 2015). An increase in students deciding to major in a technology-related field has occurred with over 47,000 graduating in 2012 with a degree in computer and information sciences (10 percent increase than the year before) (Bachelor's, Master's, and Doctor's Degree, 2012-13). However, women only make up 18 percent of the students who earn an undergraduate degree in computer and information sciences (Bachelor's, Master's, and Doctor's Degree, 2012-13). In 2014, women accounted for 57 percent of professional occupations in the United States, but only 26 percent of professional computing occupations

(U.S. Bureau of Labor Statistics, 2014). With the job market in technology expanding, why women are only a small percentage of those students majoring in technology-related fields is a question that needs to be researched.

The purpose of this study is to find out what influences affect the choice of a woman's selection of a degree of study related to technology. The influences that will be discussed in this paper are whether the perception of technology is viewed as a field only for men, how the media portrays women in technology as "geeky", role models that are reinforcing negative stereotypes, parental encouragement, access to computer courses prior to college, and confidence in technical abilities among women. This research is the result of multiple methodologies taken to explore the influences behind the gender gap. Specially, the objective of this study is to find out what the influences behind whether or not women decide to pursue a major in the technology field are.

2. THE GENDER GAP

In recent years, there has been a rise in the number of women enrolled in four-year institutions. This rise has led to more women enrolled in college than men. According to the U.S. Department of Education, in 2012 women made up 57% of the total number of undergraduate students enrolled in a four-year institution in the United States (U.S. Department of Education, 2011-12).

Although, women outnumber men in college, men dominate the technology field. Women earned only 18% of undergraduate degrees awarded in computer and information sciences in 2012 (Bachelor's, Master's, and Doctor's Degree, 2012-13). Only 12.9% of those in 2012 who were awarded an undergraduate degree in computer science were women (See Figure 1) (Snyder, T.D., and Dillow, S.A., 2015). In 2012 the percentage of women who were awarded an undergraduate degree in information technology, computer science and management of information systems were respectively 21%, 13% and 26% (Snyder, T.D., and Dillow, S.A., 2015).

Three decades ago, women were more likely to earn a degree in technology. From the late 1970's to 1984, the percentage of women in technology was on the rise with numbers steadily increasing. In 1984, the number of women obtaining a computer science degree was at its peak at 37.2%, which surpassed the number of women going to medical school, and trailed closely behind the number of women going to law school (see Figure 1). However, as shown in Figure 1, in 1985 the percentage of women graduating with a computer science degree began to decline (National Science Foundation, 1). The descent continued and dropped to a low 18.2% in 2010, which is almost half of the 1985 percentage of women graduating with a degree in computer science. The percentage of women earning degrees in computer and information science degrees continues to wane while the number of women in law school, medical school and other STEM fields steadily increases. This trend begs the question of what has contributed to the dramatic drop in the number of woman in technology since 1984.

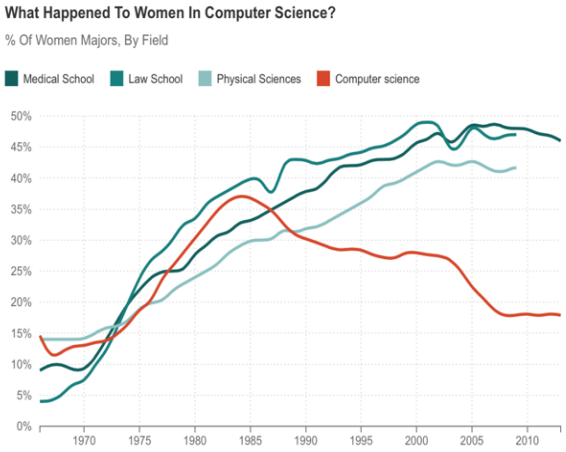

Figure 1 Percent of Women Majors, By Field. (National Science Foundation, 1).

3. MAJOR INFLUENCES

After an extensive review of literature, the major influences impacting the decision of women were narrowed down to the influence of marketing, media portrayal of women in technology, role models, social encouragement and impact of education.

Influence of Marketing

Marketing plays a huge role in impacting society's point of view (Rashotte, 2007). With marketing, if you want a certain demographic to buy your product then that demographic needs to appear in all forms of the marketing scheme. In doing so, it makes it easier for the target audience to picture themselves in the role of actually using the product. The marketing of personal computers towards men may have shifted women's view of computers since "individuals are influenced by the majority: when a large portion of an individual's referent social group holds a particular attitude, it is likely that the individual

will adopt it as well" (Rashotte, 2007). When Apple marketed the Apple II, and many of its other lines, primarily to men, it helped the stereotype that personal computers are meant for only men to use. "Over 20 years of showing the visual of men with computers is one of the many reasons why women don't even think to pursue this avenue" (Rajai & Paria, 2015).

Media Portrayal of Women in Technology

"Media has a strong influence on girl's impression of computer science and technology and may play an important part in why there are fewer women deciding to major in technology" (Gürer, Camp, 2002). How a social group is represented in the media including broadcast media (e.g., television, film), Internet media (e.g., blogs), and print media (e.g., newspapers) influences how people think about that group and their relation to it (Cheryan, Plaut, Handron & Hudson, 2013). In addition, academic fields possess stereotypes, or mental representations of the group's characteristics (Cheryan, Plaut, Handron & Hudson, 2013).

With more positive female television characters in the media to represent a field that is dominated by men, more women may consider technology as a major (Forrest, 2014). In a study when conducted by Stefanie Simon, a psychology professor at Tulane University, it was found that viewing media images of powerful women decreased women's negative self-perceptions and increased their leadership aspirations (Simon & Hoyt, 2012). Forensics was a field dominated by men in 1980s while in today's world it is one of the few sciences that are dominated by women (Potter, 2015). This increase could be attributed to primetime shows, such as CSI and Bones, due to these shows are populated with female role models, including real-life professionals or fictional characters, such as Temperance Brennan in Bones and Sara Sidle on CSI, and have become extremely popular (Chandler, 2012).

Role Models

One of the influences that has been cited as contributing to the educational gender gap in technology is the lack of female role models in the technology field (Pearl, Pollack, Riskin, Thomas, Wolf & Wu, 1990). "The U.S. Department of Education (2007) says that exposing girls to female role models who are successful in math and science can counteract "stereotype threat"—negative stereotypes that girls may develop about themselves" (Lyon & Jafri, 2010). However, many of the role models available to young girls at an early age, such as Barbie, send negative message to young girls.

Barbie has long been one of the most popular toys for young girls in the United States (Turkel, 1998). "Dolls like Barbie because of their iconic status are likely to act as salient role models, at least for very young girls" (Dittmar, Halliwell & Ive, p. 283-292). In 1992, Mattel introduced Teen Talk Barbie to the public at the American International Toy Fair (Driscoll, p. 423). One of these phrases Teen Talk Barbie would say was "Math class is tough". The negative reinforcement coming from Barbie only helped to highlight negative stereotypes about math abilities of females (Adya and Kaiser, 2005).

Since its introduction in 1959, Barbie has been portrayed with many different careers. In 2010, the first Barbie to have a career in technology was introduced as Computer Engineer Barbie along with the accompanying book called Barbie: I Can Be a Computer Engineer. While this book had the potential to portray Barbie as a positive role model, it instead reinforced negative stereotypes of women in technology. In the book, Barbie is working on designing a computer game that will show kids how computers work. However, Barbie states she is only able to create the design of the game and is not able to program the game without her male companions doing the work (Bartlett, 2014).

Social Encouragement

According to the National Center for Women & Information Technology (NCWIT), another influential factor on whether women choose a technology-related major might reside with parental support. In a study conducted by Casey George-Jackson in 2012 at the University of Illinois, undergraduate students at nine large universities were asked to participate in a survey to gather data about their pre-college and college majors. When asked who most influenced them to choose their current major, 30% of the respondents selected "myself" 25% selected parents,19% selected high school teachers and less than 10% selected peers (George-Jackson, 2012).

According to another study by NCWIT, the encouragement of parents to go into a field of technology may be the most influential factor compared to one's peers, teachers, and counselors (Ashcraft et al., 2013). The survey results also showed that women most frequently chose their father (37%) or mother (29%), as the most influential person in their decision to pursue a computing career (Ashcraft et al., 2013).

A study conducted by Google in 2014 observed women who were computer science graduates

were more likely to have their mother or father encourage them to study computer science when compared to graduates from other degrees (Google, 2014).

According to a study conducted by Turner, Bernt, and Percora in 2002 at Ohio University, the occupation of one's parents might also contribute to the reasoning as to whether or not women choose to major in technology.

Impact of Education

The lack of opportunity to take computer courses before entering college may be a contributing factor as to why many students as well as women are not pursuing technical majors (Google, 2014). "Greater access to and use of computers and other IT at home and in schools are viewed as generating interest among students to pursue CS/CE majors at the university level" (Adya & Kaiser, 2005). Taking computer courses before college can help familiarize women with technology and could lead to a decision to pursue it as a major. "Early exposure to Computer Science is important because familiarity with a subject can generate interest and curiosity while establishing a sense of competency" (Google, 2014).

4. METHODOLOGY

In order to further investigate the impact of the influences, survey questions were sent to undergraduate students registered in Computer science, Computer Information Technology, and Management Information Systems courses at a local university. While previous research has looked at only the female population, this study is conducted on both the male and female population in order to separate and better assess the influences that affect each gender and note the differences.

Pilot testing was conducted to make sure the survey questions are easily understood, conducted in a clear manner, and to eliminate poorly worded questions. A survey was conducted to find out the influences behind the choice to pursue a degree in technology.

The survey focused on collecting data from two target groups among the current students that are currently registered and taking undergraduate Management Information Systems, Computer Information Technology, and Computer Science major specific courses. The first target group was comprised of both male and female students that have already decided to major in technology and the second target group students was compromised of students that may not necessarily have chosen to major in technology.

See appendices for the survey questions.

5. DATA AND RESULTS

Demographics

Target group one for the survey received 107 responses while target group two for the survey received 116 responses. The overall background demographics of the respondents collected from the survey questionnaires for each target group are shown in Table 1.

	Target Group 1	Target Group 2
Gender		
Male	68.22% (73)	59.48% (69)
Female	31.78% (34)	40.52% (47)
Other (Please Specify)	0%	0%
Age Range		
0-18	.93% (1)	6.9% (8)
19-22	50.47% (54)	69.83% (81)
23-30	34.58% (37)	16.38% (19)
31-40	10.28% (11)	3.45% (4)
Over 40	3.74% (4)	3.45% (4)
Ethnicity		
Black or African American	11.21% (12)	4.31% (5)
Hispanic or Latino	1.87% (2)	5.17% (6)
White or Caucasian	74.77% (80)	84.48% (98)
Native American or A10merican Indian	.93% (1)	1.72% (2)
Asian or Pacific Islander	5.61% (6)	1.72% (2)
Other	5.61% (6)	2.59% (3)
Class Year		
Freshman	1.87% (2)	16.38% (19)
Sophomore	7.48% (8)	37.93% (44)
Junior	27.10% (29)	35.34% (41)
Senior	57.94% (62)	10.34% (12)
Graduate	5.61% (6)	0.00% (0)

Table 1: Background demographic for the survey: Target group one and two

Results

The survey questions captured the impact of major influence factors determined in section 3.

The responds of the participants show that parents are overwhelmingly the most important group for both male and female majors/minors in selecting the major. Overall, results indicate that the respondent themselves and their family are two of the most important role models that encouraged both male and female respondents to major in technology. While the participants stated that parents' profession, friends, siblings, high

school advisors and media role models had no impact on their choice, the impact of college professors, college advisors and high school teachers were inconclusive.

The survey questions investigating the reasons for selecting technology as major had similar responses from both female and male students. Future hiring potential/salary, I wanted to learn more about technology, I encouraged myself, and my family encouraged me were in the top four responses (not in order) for female respondents who are/were majoring/minoring in technology. For the male respondents, the top four responses included: Future hiring potential/salary, I encouraged myself, I wanted to learn more about technology, and I enjoyed computer courses in high school (not in order). However, for male respondents, I enjoyed computer courses in high school ranked above my family encouraged me when compared to female respondents who are technology majors/minors. Based on the results, future hiring, potential/salary, wanting learn more about technology, family encouragement, encouragement from oneself, and computer courses in high school are motivating factors that may lead males and female to major in technology.

Continuing to assess the perception of technology and the impact of the media on women deciding to major in technology, participants were asked to "List two women in technology that appear on television/media? (If you do not know write N/A)", and then asked to "List two men in technology that appear on television/media?" (If you do not know write N/A). These questions were asked in order to assess the influence of media on women deciding to major in technology and if there is a lack of role models for women in technology. In every group the percentage of those who could list two men in technology far exceeded those that could list two women. Bill gates was the most popular name listed for both male and female respondents, followed by Steve Jobs and Mark Zuckerberg. Carly Fiorina was the top listed women in technology for men respondents while Sheryl Sanberg and Penelope Garcia were the top listed women in technology for female respondents. Since a high percentage of participants could not identify women in technology, but could identify men in technology on television or in the media gives creditability to the assumption that women in technology are rarely portrayed in the media or on television.

When asked about the availability of AP computer science classes only 5.9% of female respondents that are majoring/minoring in technology at UNCW or were registered in non-pre-requisite CSC, CIT, or MIS courses stated their high school offered AP computer science and took the course. Most female respondents who majored in technology responded that their high school did not offer AP computer science and I did not take the course in high school, which shows the limited opportunity of advanced computer courses to high school students. Based on the results, a high percentage of women and men selecting "If my high school did offer AP computer science I would have taken the course" indicates the need for more AP computer science opportunities available to both male and female students, which may result in more women and men majoring in technology..

Participants were asked to check if they took any computer courses while in elementary school, middle school, or high school or none? Female respondents in pre-requisite UNCW CSC, CIT, or MIS courses had a high percentage of responses for taking computer courses in both elementary and middle school. The group also had a low percentage of responses that was much lower than female UNCW respondents in pre-requisite technology course that did not decide to major in technology for "none", which help validate that exposure to computer courses helps encourage women to major in technology. However, among female respondents at UNCW that did not major in technology, there were high percentages of responses for both taking computer courses in middle school and high school. Overall based on the results, more exposure to computer courses did not positively improve women's decision to major in technology as shown by the high percentages of computer courses taken before college for those female respondents who did not major in technology at UNCW.

47% of those female student responses who are majoring/minoring in technology in non-prerequisite CSC, CIT, and MIS courses at UNCW stated that they originally entered UNCW as a CSC, CIT, or MIS major while 53% or 39 stated that they switched to a technology major. However, 79% of males that are majoring/minoring in technology in pre-requisite CSC, CIT, and MIS courses at UNCW stated that they did not switch to technology as their major while 21% (9 respondents) of those males who responded stated they did switch their major to CSC, CIT, MIT. For males majoring/minoring in technology at UNCW, the major most switched from was business administration to CSC, CIT, or MIS, and the second most popular was biology. Based on the results, there is not a specific major

that female respondents are switching from in order to major in technology, however many of the majors respondents switched from resided in business, or science, which could be a potential area when recruiting more women into the major.

When asked what adjectives they would use to describe technology majors, the results show that both male and female student's view technology majors are "smart/intelligent", and "nerdy". This may be a deterring factor as to why women are not choosing to pursue this major. The perception that students must be academically advanced to learn it may discourage certain types of students from participating, especially if parents, teachers and school administrators reinforce this belief (Google, 2014).

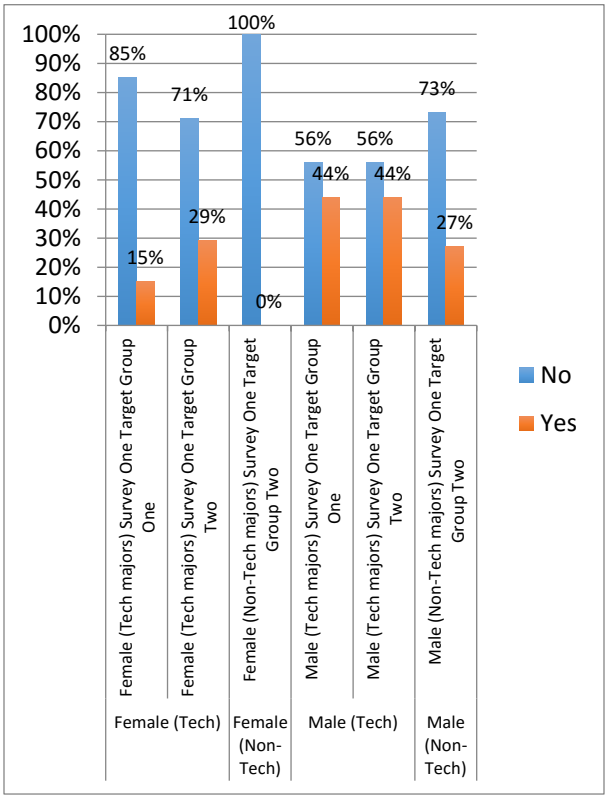

Figure 2: Percent of respondents that had previous programming experience

According to the literature review, lacking prior programming experience may be a deterring factor as to why women are not choosing to major in technology (Margolis & Fisher, 2000). In addition, female students in technology with less experience felt vulnerable in unfamiliar territory, and confidence issues among women may lead to fewer women entering the major because as confidence drops, so does interest (Margolis & Fisher, 2002). Figure 2 reflects the percentage of respondents that had prior programming knowledge.

For both female groups, a high percentage of women selected that they did not have prior programming experience ranging from 71%-100% (see Figure 2). It is important to note that 100% of the female respondents who were not majoring in technology did not have prior programming experience before entering college. There were still more men coming to college without prior programming experience ranging from 56%-73%, however, there was a higher percentage of men enter with programming experience when compared to their female counterpart ranging from 27%-44%.

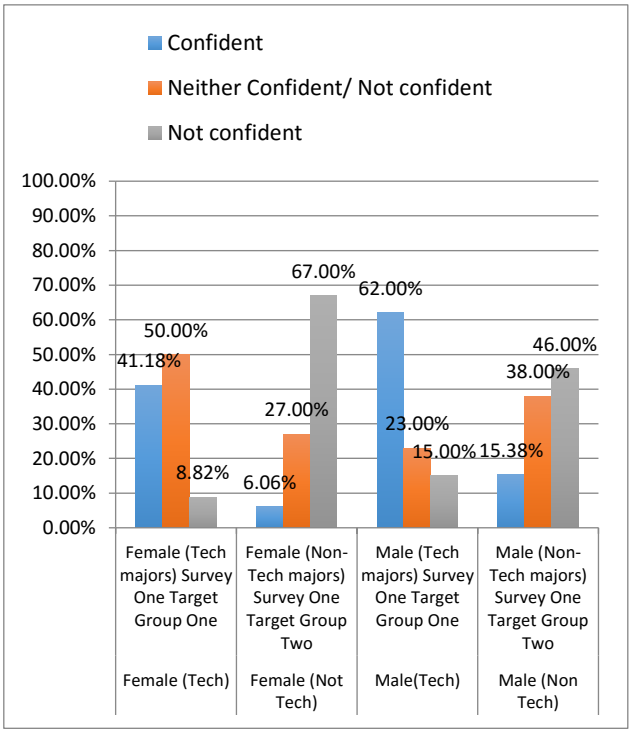

Figure 3: Confidence levels in programming abilities for both genders

Students in both pre- requisite and major specific CSC, CIT, and MIS courses at UNCW were asked how confident they were in their programming abilities in order to assess if women in computer-related majors are less confident than their male peers shown in Figure 3. 62% of male respondents stated they were confident in their programming abilities while only 41% of female respondents were confident in their abilities. Based on these results, it is shown that men majoring in technology are more confident in their programming abilities when compared to their female peers, which could be attributed to

men having more programming experience entering college.

6. CONCLUSIONS AND IMPLICATIONS

This study uses a survey to investigate the factors influencing female and male students' decisions majoring in a technology field.

When confidence in programming abilities questioned male respondents majoring in technology in major specific courses 62% of male respondents stated they were confident in their programming abilities while only 41% of female respondents were confident in their abilities. There are more men in pre-requisite and non pre-requisite CSC, CIT, and MIS than women majoring in technology (46 women compared to 116 men) in our sample. One factor behind the higher male concentration could be the confidence level differences between two genders. Based on the questions investigating the prior programming experience, the low percentage of women entering college with programming experience gives credibility to the assumption that men enter college with more programming experience, which encourages men to major in technology more often than women.

In addition, the survey results show that more exposure to computer courses (K-12) did not positively improve women's decision to major in technology as shown by the high percentages of computer courses taken before college for those female respondents who did not major in technology at UNCW.

Another factor studied in this survey is the impact of exposure to positive role models on young women's desire to major in technology. The fact that majority of participants could not identify women in technology, but could easily identify men in technology on television or in the media gives creditability to the assumption that women in technology are rarely portrayed in the media or on television, and could be why women are not choosing to major in technology.

The results have shown that most respondents surveyed believed you have to be smart in order to major in technology. This may be a deterring factor as to why women are not choosing to pursue this major. The perception that students must be academically advanced to learn it may discourage certain types of students from participating, especially if parents, teachers and school administrators reinforce this belief (Google, 2014). Based on the results, both male and female student's view technology majors are "smart/intelligent", and "nerdy", which could be causing women not to choose technology as a major.

As a result of this study, several recommendations can be made to administrators of higher education in order to increase the number of women majoring in technology.

- College campuses should continue to emphasize how majoring in technology will create future job possibilities and a good salary because according to results this was one of the main motivators as why to why women decide to major in technology.
- The technology major needs to be reimaged, and more inclusive, instead of having the major portrayed as being only for those who are "smart", or "nerdy", it should be portrayed as inclusive and not just for students that are highly intellectual.
- Recruitment to major in technology should be implemented in science courses as an alternative major because as shown in the results, most males and females switch their major from a science related course or engineering due to "difficulty".
- Beginners programming courses should be made more readily available to middle school, high school, and college students in order to increase their exposure to programming at an early age.
- One-on-one tutor should be used to help tutor students in the programming courses, in order to increase student's confidence and understanding before college.
- AP Computer Science should be made more readily available to students in high school.
- Female technology role models should be more prominent on television, incorporate more women in technical roles on television or in the media. These women should be depicted as doing working that is helping other people and show the benefits of majoring in technology, and not always follow the "nerd" stereotype.

Although the main objective of this study was to find out the influences behind whether or not women choose to major in technology, retention of women in the major is another important factor. It is important to encourage women to join the major, but it is also just as important to keep them in the major. To further this research, another survey could be sent out targeting women in CSC, MIS, CIT courses at UNCW and assessing their satisfaction with the courses and

the major in order to find out the influences behind why women may be leaving the major at UNCW.

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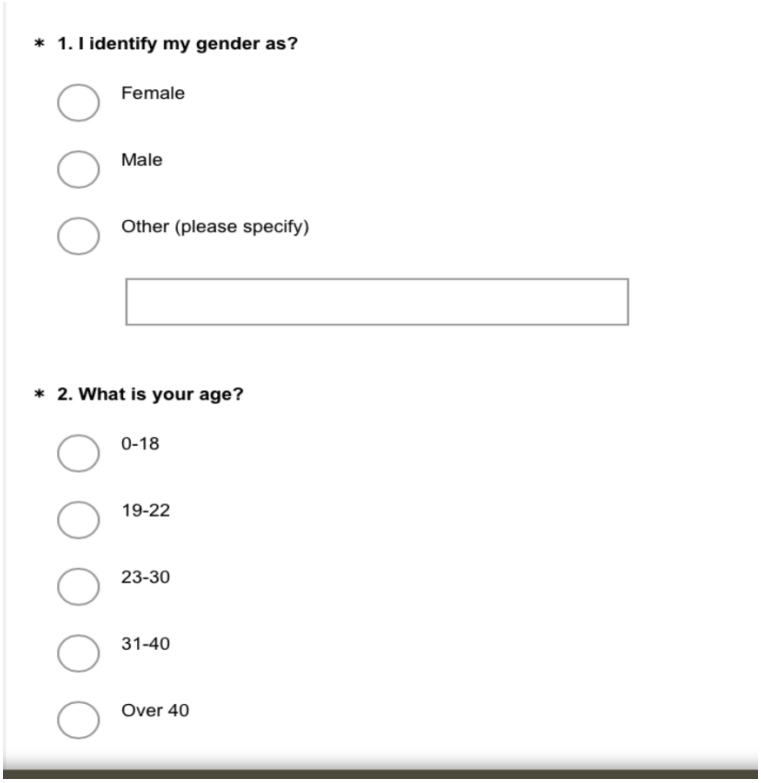
APPENDIX A

Survey Questions



* 1. I identify my gender as?

- Female
- Male
- Other (please specify)

* 2. What is your age?

- 0-18
- 19-22
- 23-30
- 31-40
- Over 40

* 3. What is your ethnicity?

* 4. What year in school are you?

- Freshman
- Sophomore
- Junior
- Senior
- Graduate

*** 5. Are any of the following your current major or minor? (Check all boxes that apply)**

- ☐ Management Information Systems
- ☐ Computer Information Technology
- ☐ Computer Science
- ☐ N/A
- ☐ Other (please specify)

*** 6. If you checked one or more of the boxes to the question above why did you decide upon this major? (Check all that apply)**

- ☐ My friends encouraged me
- ☐ My family encouraged me
- ☐ I encouraged myself
- ☐ I enjoyed computer courses in high school
- ☐ I enjoyed computer courses in middle school
- ☐ I enjoyed computer courses in elementary school
- ☐ Future hiring potential/salary
- ☐ I wanted to learn more about technology
- ☐ My friends were in the classes
- ☐ My high school teacher
- ☐ N/A
- ☐ Other (please specify)

*** 7. Did anyone in your family encourage you to major in Management Information Syst that apply)**

- [ ] Mother
- [ ] Father
- [ ] Sister
- [ ] Brother
- [ ] Aunt
- [ ] Uncle
- [ ] None
- [ ] N/A I did not choose to major in any of those fields listed above
- [ ] Other (please specify)

* **8. Did any of your teachers encourage you to major in Management Information Systems, Computer Science, or Computer Information Technology? (Mark all that apply)**

- [ ] Elementary school teacher
- [ ] Middle school teacher
- [ ] High school teacher
- [ ] None
- [ ] N/A I did not choose to major in any of the fields above.
- [ ] Other (please specify)

* **9. Did you switch your major to Computer Science, Computer Information Technology, Management Information Systems?**

- ( ) No
- ( ) Yes (please list what major you switched from?)

* **10. If you selected yes in the previous question please explain why you switched your major to Computer Science, Computer Information Technology, or Management Information Systems? (If you did not switch write N/A)**

*** 11. Did any role models encourage you to major in Management Information Systems, Computer Science, or Computer Information Technology? (Mark all that apply)**

- [ ] Family
- [ ] Friends
- [ ] Teacher
- [ ] Academic Advisor
- [ ] Myself
- [ ] People on television/media
- [ ] None I am not majoring in any of the fields listed above
- [ ] Other (please specify)

*** 12. Please rate each answer according to what your view is:**

	Strongly Agree	Agree	Neutral/Unsure	Disagree	Strongly Disagree
I believe my friends played a significant part in my selection of major.	○	○	○	○	○
I believe my college professors played a significant part in my selection of major.	○	○	○	○	○
I believe my college advisors played a significant part in my selection of major	○	○	○	○	○
I believe my high school teachers played a significant part in my selection of major.	○	○	○	○	○
I believe my high school advisors played a significant part in my selection of major.	○	○	○	○	○
I believe my parents played a significant part in my selection of major.	○	○	○	○	○
I believe my siblings played a significant part in my selection of major.	○	○	○	○	○
I believe that I would have picked my major regardless of the field my family is in.	○	○	○	○	○
I believe people on television/media played a significant part in my selection of major.	○	○	○	○	○

*** 13. Who do you think is more likely to be successful in Management Information Systems, Computer Science, or Computer Information Technology?**

- ◯ Men
- ◯ Women
- ◯ Both
- ◯ Don't Know

*** 14. Who do you think is more likely to major in Management Information Systems, Computer Science, or Computer Information Technology?**

- ◯ Men
- ◯ Women
- ◯ Both
- ◯ Don't Know

*** 15. Check if you took any computer classes while in elementary, middle, or high school? (Mark all that apply)**

- ☐ Elementary School
- ☐ Middle School
- ☐ High School
- ☐ None

*** 16. Did your classroom in elementary, middle, or high school school offer a computer literacy class? (Mark all that apply)**

- ☐ Elementary School
- ☐ Middle School
- ☐ High School
- ☐ None

*** 17. Select all that apply?**

- ☐ My high school offered AP computer science and I took the course in high school
- ☐ My high school offered AP computer science and I did not take the course in high school
- ☐ My high school did not offer AP computer science and I did not take the course in high school
- ☐ If my high school did offer AP computer science I would have taken the course

18. Did you have any experience with computer programming (coding) before entering college?

- ◯ No
- ◯ Yes (Please write which programming languages you had experience with)

*** 19. How confident are you in your computer programming abilities?**

	I am confident in my programming abilities	I am neither confident nor unconfident in my programming abilities	I am not confident in my programming abilities
How confident are you in your programming abilities?	○	○	○

*** 20. How interested in computers/technology were you before attending college?**

	I was extremely interested in computers/technology before entering college	I was somewhat interested in computers/technology before entering college	I was neither interested nor disinterested computers/technology before entering college	I was somewhat not interested in computers/technology before entering college	I was extremely not interested in computers/technology before entering college
How interested in computers/technology were you before attending college?	○	○	○	○	○

*** 21. List three adjectives that come to mind when thinking about technology majors in general?**

*** 22. List 2 women in technology that appear on television/media? (If you do not know write N/A)**

*** 23. List 2 men in technology that appear on television/media? (If you do not know write N/A)**

*** 24. What do you think could be done to attract more females into the technology major?**

Facebook Enhanced College Courses and the Impact of Personality on Sense of Classroom Community

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Abstract

The impact of personality type on students' sense of classroom connectedness was examined in a study of university-level business courses that used Facebook to enhance classroom learning. The study was conducted using an independent measures static group comparison research design. Nearly 600 students registered in six different business courses at the regional campuses of two major universities participated in a study lasting one term. The study focused on the extent to which the Big Five personality variables – extroversion, agreeableness, openness, neuroticism, and conscientiousness – impacted students' sense of connectedness in Facebook-enhanced and non-enhanced courses. Correlation and regression analyses demonstrated that extroversion and agreeableness were related to sense of connectedness, a significant pattern for students in the Facebook-enhanced group. Future research opportunities and provisos are discussed.

Keywords: Facebook, Big Five personality traits, sense of connectedness, instructional innovation, social networks, sense of learning, technology in college classrooms.

1. INTRODUCTION

The purpose of this paper is to analyze the role of personality on students' sense of classroom community in Facebook-enhanced university level business courses. A number of studies have assessed the Facebook effect on classroom community, perceptions of quality, motivation, and community of practice (Duncan & Barczyk, 2016). This study focuses on whether students' personality type impacts on their sense of classroom connectedness (SCC). This is important because SCC is thought to affect students' engagement and ultimately their learning processes and performance. We should care about the relationship between personality and SCC because when students are more engaged and perform better academically, their time and resources are utilized more effectively and efficiently.

Facebook is a form of social networking media that is gradually and steadily transforming education and the way most subjects are taught. It enables users to edit and share information. Unlike traditional one-way media such as

television, social media are two-way conversations in which control is decentralized and open to masses of users (Barczyk & Duncan, 2012).

Facebook has the potential to become an exciting instructional tool given its popularity and students' familiarity with its site. Research suggests that Facebook's focus on peer-to-peer interactions enhances informal learning experiences (Goodwin, Kennedy, & Vetere, 2010; Madge et al., 2009; Selwyn, 2009). Other studies have shown that students have effectively used Facebook for learning and activism (Bosch, 2009; Grosseck, Bran, & Tiru, 2011).

Junco (2012) reports that faculty are using social media sites for course-related purposes and that usage is rapidly increasing. However, some college educators are hesitant to embrace Facebook as an instructional tool (Moran, Seaman, & Tinti-Kane, 2011; Roblyer, McDaniel, Webb, Herman, & Witty, 2010). A study by Kirschner and Karpinski (2010) reported that Facebook users had significantly lower grade point averages than non-users; and they spent fewer hours per week engaged in study compared to non-users. In sum, the current research suggests that Facebook is a promising, but not a perfect, educational tool that warrants further application and study.

This paper will discuss the results of a study designed to determine whether the Big Five personality traits affect students' SCC when Facebook is introduced into the instructional design of business courses. Specifically, the extent to which personality types can explain a portion of the variance in students' SCC will be measured. Students' scores on the dependent variable, SCC, will be assessed for subjects in the Facebook-enhanced (experimental) and non-enhanced (control) groups.

Organizationally, this paper is divided into four parts. The first reviews the literature on classroom community, the Big Five personality measures, and relative autonomy. This section of the paper summarizes the two research questions. The second describes the method used to address the research questions and begins with a description of how the Facebook-enhanced courses were designed. The third summarizes the results associated with the research questions. The fourth part discusses the findings of this study and opportunities for further research.

2. LITERATURE REVIEW AND STATEMENT OF RESEARCH QUESTIONS

Sense of Classroom Community

Classroom community has been described as the sense of trust and interaction between groups of learners (Graff, 2003). It has been suggested that sense of community is imperative to successful learning. It is a type of mutual interdependence among members of a learning community which has shared goals and values. While classroom community is a shared phenomenon, it is conceivable that individuals differ on the extent to which they sense this trust and interaction. As such, sense of community may be more crucial to some learners than to others. Rovai (2001), for example, noted that females report a greater sense of classroom community than their male counterparts (Graff, 2003). In the context of this paper, SCC refers to student-learners in a course and does not include instructors.

According to Rovai (2002b), a classroom community is a "feeling that members have of belonging, a feeling that members matter to one another and to the group, that they have duties and obligations to each other and to the school, and that they possess shared expectations that members' educational needs will be met through their commitment to shared learning goals" (p. 322). Rovai (2002b) contends that classroom community consists of two factors. The first is learning, which is "the feeling that knowledge and meaning are actively constructed within the community, that the community enhances the acquisition of knowledge and understanding, and that the learning needs of its members are being satisfied" (p. 322). The second is connectedness, which is "the feeling of belonging and acceptance and the creation of bonding relationships" (p. 322). A strong classroom community demonstrates characteristics such as shared common interests, active engagement in two-way communications, and trusting and helping other members (Rovai, 2002b; He, Xu, & Kruck, 2014).

Social media, especially Facebook, has the capacity to enhance student engagement and satisfaction. In a study by deVilliers (2010), Facebook groups were used to foster optional discussions in an online course. She found that the voluntary Facebook group members benefited in the course by critically thinking about required material and contributing to the online discussion.

Barbour and Plough (2009) analyzed the pedagogical use of social media in an online program at a charter high school. The high school attempted to increase students' SCC by

incorporating technologies such as Facebook, Ning, and others. Incorporating social media into the blended learning courses at the charter school enhanced students' learning experiences, and was found to be effective and well-regarded by faculty as well as students. This body of research suggests that social media enhance the learning experience and student engagement in various learning communities – professional, informal, and online.

The Big Five Personality Measures

The Big Five personality traits represent five broad domains that describe the distinctive individual psychological qualities of a person. The theoretical perspective underlying the Big Five personality traits is known as the five-factor model. The five factors are extroversion, agreeableness, openness, neuroticism, and conscientiousness.

The Big Five model is able to account for different traits in personality without overlapping. Empirical research has shown that the Big Five personality traits show consistency in interviews, self-descriptions and observations. Moreover, this five-factor structure seems to be found across a wide range of participants of different ages and of different cultures (Schacter, Gilbert, & Wegner, 2011).

Studies conducted on college students have concluded that hope, which is linked to agreeableness, has a positive effect on psychological well being (Singh, 2012). It could be that agreeableness may be linked to the well being associated with student connectedness. Recent studies have suggested that an individual's personality may affect their educational identity (Klimstra, Luyckx, Germeijs, Meeus, & Goossens, 2012).

Although the Big Five personality traits have been effective in explaining a number of variables such as employment selection and work success, they are not frequently used to explain aspects of the classroom environment. However, the Big Five traits have been shown to predict the educational identity of students. These findings have led researchers to believe that there might be a large influence of the Big Five traits on academic motivation that then leads to predicting a student's academic performance (Klimstra, Luyckx, Germeijs, Meeus, & Goossens, 2012). Eshet, Grinautski, Peled and Barczyk (2014) surveyed higher education students to assess their personality traits and their willingness to commit acts of academic misconduct. There are also a few studies linking classroom community and personality traits (Berryhill & Bee, 2007; Lounsbury, Loveland, & Gibson, 2003; DeNeui, 2003; and Lounsbury & DeNeui, 1996). A description of the Big Five personality traits and their link to SCC are discussed below.

Conscientiousness is a trait prevalent in some students. When high on this trait, they may be described as dependable, achievement-oriented, persistent, responsible and honest (Barrick & Mount, 1991). That student operates as an effective regulator of his/her own actions, and is able to restrain and regulate behavior through "effortful control" (Day, Hudson, Dobies, and Waris, 2001). Persons high on conscientiousness may not exhibit a high SCC, but they would likely have a high degree of relative autonomy. A student who scores low on conscientiousness is expected to be irresponsible, disorganized and impulsive. As a consequence, these characteristics might lead to poorer study skills. Another personality trait – Neuroticism – reflects students' feeling of anxiety, coupled with a low sense of security (Barrick & Mount, 1991), which causes them to be tense, worried, and likely to become strained in stressful conditions. Agreeableness involves cooperating with others and maintaining harmony. Thus, individuals who are high in this trait are expected to foster harmoniousness and would likely have a high sense of connectedness. The personality trait of Extroversion is characterized as the tendency to be sociable, talkative, energetic and sensation-seeking. It is thought that this trait might also be associated with a high sense of connectedness. Finally, high Openness to Experience includes tendencies toward intellectualism, imagination, and broad-mindedness (Barrick & Mount, 1991). Research findings show that this personality trait is related to academic success and to learning orientation, reflecting a desire to understand concepts and master material (Day, Hudson, Dobies, & Waris, 2001).

Motivation – Relative Autonomy

Ryan and Deci (2000) state that "to be motivated means to be moved to do something" (p. 54). People vary in their motivational level and orientation. They have different amounts and different kinds of motivation (Deci & Ryan, 1985, 1991; Deci et al., 1991). Human motivation can be placed along a continuum of self-determination, from which one can distinguish whether its origins are internal or external to the subject (Moreno-Murcia, González-Cutre Coll & Chillón Garzón, 2009).

According to Deci and Ryan's (1985; 2000) Self-Determination Theory (SDT), there are two types

of motivation: intrinsic and extrinsic, which are based on the different reasons or goals underlying an action. Intrinsic motivation refers to doing something because it is inherently interesting or enjoyable, while extrinsic motivation refers to doing something because it leads to an enjoyable but external and separable outcome (Ryan & Deci, 2000). In other words, an intrinsically motivated person is moved to act because of the fun or challenge it entails, while an extrinsically motivated person is moved to act because of external prods, pressures, or rewards.

Motivation plays an important role when one chooses to participate and remain connected in a technologically-enhanced or online course (Moore & Kearsley, 2005; Rovai et al., 2007) as intrinsic motivation, or one's level of relative autonomy, is considered to be a significant predictor of persistence, connectedness, and achievement in distance education (Coussement, 1995; Fjortoft, 1996). In contrast, Grolnick and Ryan (1987) found that controlling environments reduce a student's sense of autonomy, decrease intrinsic motivation, and result in poorer attitudes and performance in the classroom. A meta-analysis by Deci, Koestner, and Ryan (1999) confirms that virtually every type of expected tangible reward made contingent on task performance undermines intrinsic motivation.

Research Questions

Two research questions are posited in this paper. They are:

RQ 1: What role does personality play in fostering students' SCC in Facebook-enhanced and non-enhanced college level courses?

RQ 2: What role do demographic variables and motivational orientation play in fostering students' SCC in Facebook-enhanced and non-enhanced college level courses?

3. METHODOLOGY

Description of the Facebook-Enhanced Courses – Experimental Group

Students at two universities in California and Indiana were encouraged to voluntarily participate in the Facebook component of six different business courses. The courses were accounting, business law, human resource management, compensation, training, and organizational staffing. While the subject matter in these courses was different, the classroom style and teaching philosophy of the instructors were similar. Both used a participative, student-focused, collaborative approach to teaching.

The instructors agreed on a uniform teaching protocol so that presentation of the courses was consistent and similar. Thus, course design and instructor differences were minimized. Only students registered for the course were allowed to access the Facebook group page. This protected privacy and provided an environment conducive to postings and the general use of Facebook. What follows is a description of how Facebook was integrated into the instructional design of the business courses. All courses used Blackboard as the official course management system and Facebook was employed as an instructional supplement and the experimental intervention.

Students were assigned a term project in their respective courses and worked in teams, usually comprised of four members. The project was a required element of the course. Teams using Facebook held virtual meetings, posted YouTube links and research findings relevant to the team project and commented on one another's works. Initially some students were quite unfamiliar with social media technology, but as the course evolved, they became more comfortable with using Facebook. Some students needed reassurance that their postings were private and would only be viewed by members of the class. They also needed reassurance about the security of the information posted, because while they had no objections to sharing thoughts and opinions in a classroom, they did not want those ideas revealed to employers, outsiders, or even Facebook "friends".

It appeared that Facebook, more so than BlackBoard, facilitated student interactions and had a positive influence on their sense of connectedness. Students in some teams used Facebook for other course work and discussions, even beyond their assigned projects.

Students in the control group were enrolled in non-Facebook-enhanced courses. As such, they were not exposed to the experimental intervention. They collaborated with each other on the assigned project using face-to-face meetings as well as telephone and email communication. All other aspects of their courses mirrored those in the experimental group.

Students who participated in the Facebook and non-Facebook-enhanced courses were encouraged to complete a paper-based

questionnaire, which was designed to assess their course experiences.

The Questionnaire

The questionnaire consisted of 52 closed and open-ended items. To assess students' Big Five personality traits, questions from the Ten Item Personality Inventory (TIPI) were adopted (Gosling, Rentfrow, & Swann, 2003). Students responded to those questions as seven-point Likert-type items where 1 represented strong disagreement and 7 represented strong agreement. Five questions were reverse scored. The reliability of this questionnaire, measured by Cronbach's alpha, was 0.72. Alpha levels were .68, .40, .50, .73, and .45 for the Extroversion, Agreeableness, Conscientiousness, Neuroticism, and Openness scales (Gosling, Rentfrow, & Swann, 2003).

To assess SCC, a series of questions from Rovai's (2002a) Classroom Community Scale was adopted. The questions that have been validated in other studies (Hung and Yuen, 2010; Black, Dawson, & Priem, 2008; Rovai, 2002a, 2003) were used to measure students' feelings of connectedness. Students responded to these questions as five-point Likert-type items where 1 represented strong disagreement and 5 represented strong agreement. Four questions were reverse scored. Analysis of the questionnaire was carried out such that higher scores on the five SCC questions reflected a stronger sense of connectedness.

To assess students' motivational orientation, or relative autonomy, 14 items from the Learning Self-Regulation Questionnaire (SRQ-L) were used. The questionnaire examines two types of motivation: autonomous regulation, which is commonly known as intrinsic; and controlled regulation, commonly known as extrinsic. Students responded to these items using a seven-point Likert scale where 1 represented "Not at all true" and 7 represented "Very true." High scores on relative autonomy indicate that students are intrinsically motivated, while low scores indicate that students are extrinsically motivated.

Previous studies report the alpha reliabilities of the SRQ-L as ranging from 0.75 to 0.80 for the autonomous regulation subscale and 0.67 to 0.75 for controlled regulation subscale (Black & Deci, 2000; Williams & Deci, 1996). The reliability of the SQR-L in this study was verified with a reported Cronbach's alpha on the autonomous regulation subscale and the controlled regulation subscale being 0.77 and 0.73, respectively.

The questionnaire for the control group was modified to preserve the essential content of each question, but to reflect the fact that students in the courses of that group did not participate in the Facebook intervention.

The questionnaire also assessed several demographic variables, which included age, gender, online experience, student level (number of years at the university roughly corresponding to freshman, sophomore, junior, or senior) and status (full-time or part-time). It was administered in a paper-and-pencil format.

Respondents

Respondents included 586 students from 22 face-to-face business classes at two public universities located in California and Indiana, USA. There were a total of 671 registrants in the courses taught by the authors of this paper. Students in those classes voluntarily participated in the survey, which was approved by the universities' Institutional Review Board. They completed the questionnaire anonymously.

Procedure

The study was conducted using a survey methodology in an independent measures static group comparison research design (Campbell & Stanley, 1963). "This is a design in which a group which has experienced X is compared with one which has not, for the purpose of establishing the effect of X" (Campbell & Stanley, 1963, p. 12). The incorporation of Facebook into the instructional design of the respective courses served as the experimental manipulation. There were two groups of courses, with the experimental group receiving the Facebook intervention. The courses in the control group had identical content but did not have the Facebook intervention. During the last week of classes, students in the Facebook-enhanced courses (experimental group) and in the non-Facebook-enhanced courses (control group) were surveyed. Each student received a paper questionnaire and was informed that completion of the survey was voluntary and would not affect her/his course grade. Each student was also informed that all data collected would be maintained anonymously. Students completed the questionnaire in approximately 12 minutes.

4. FINDINGS

The statistical techniques used to analyze the data in this paper are based on the approach used by Berryhill and Bee (2007). Those authors examined whether race, personality, and demographic factors predicted sense of community.

The initial analyses in this paper explored whether students in the Facebook-enhanced courses differed from those in the non-enhanced courses on nominal variables. Pearson's Chi-square demonstrated that there was no significant difference between the groups on gender χ^2 (1, N=585) = .092, p > .05. There were significant differences between the groups on online experience, enrollment status (full or part-time), and age. Means for students in the Facebook-enhanced group and the non-enhanced group for other variables were compared with a one-way analysis of variance (ANOVA). These data are summarized in Table 1 (in Appendix). The data show that there was a significant difference for students in the Facebook-enhanced group compared to those in the non-enhanced group on the Big Five personality variable of conscientiousness F(1,576) = 3.97, p < .05). There were no significant differences between the Facebook-enhanced and non-enhanced groups for all the other variables tested.

Table 2 (in Appendix) summarizes the data from the correlation analysis for students in the Facebook-enhanced and non-enhanced groups. For both groups, the principal variable of interest was SCC. It was significantly, but inversely, related to age in the Facebook-enhanced group, r(301) = -.12, p<.05. For both groups, students' status was significantly inversely correlated with SCC at the p < .05 level. The inverse correlation indicates that full-time students experience a lower SCC than their part-time counterparts. In the Facebook-enhanced group students' academic level at the university was significantly correlated with SSC, r(301) = .15, p < .01. In both groups students' relative autonomy was significantly correlated with SCC, with r(301) = .14, p < .05 in the Facebook-enhanced and r(282) = .24, p < .01 in the non-enhanced groups.

The data in Table 2 also show that for students in the non-Facebook-enhanced group, all five personality variables were significantly correlated with SCC, with extroversion, agreeableness, and conscientiousness being significant at the p < .01 level. However, for the Facebook-enhanced group, only two personality variables – extroversion and agreeableness – were significantly correlated at the p < .01 level.

To determine whether the Big Five personality variables predicted SCC after controlling for other variables, two hierarchical multiple regression models, one for students in the Facebook-enhanced group and one for the non-enhanced group were tested. Demographic variables and relative autonomy noted to be significant predictors of SCC were entered as step one and the five personality variables in step two. The hypothesis that personality variables would predict SCC was confirmed. The data in Table 3 (in Appendix) summarizes the equations for both groups. After controlling for other variables, two of the five personality variables (for which higher scores indicate a greater presence of that variable) in the Facebook-enhanced group were found to be significant predictors of SCC, β = .15 (p < .05) for extroversion and β = .28 (p < .001) for agreeableness. The change in R^2 was .08 (p < .001). None of the personality traits significantly explained students' SCC in the regression model for the non-Facebook-enhanced group. However, neuroticism was nearly a significant negative predictor of SCC for students in the non-enhanced group, β = -.12 (p = .06) and a change in R^2 of .07 (p < .001). Table 3 also indicates that relative autonomy was a significant predictor for SCC in the non-Facebook-enhanced group, β = .15 (p < .05) and nearly a significant predictor in the Facebook-enhanced group, β = .12 (p = .07).

The full models were significant predictors of SCC, both for the Facebook-enhanced group F (11, 263) = 3.67, p < .001, and for the non-enhanced group, F (11,260) = 4.05, p < .001). The regression models for both groups were equally predictive of SCC, with an adjusted R^2 of .10 for the Facebook-enhanced group and .11 for the non-enhanced group. These R^2 values indicate that between 10% and 11% of the variance in SCC for all students could be accounted for by the linear combination of variables.

5. DISCUSSION

Research Question 1 – The Personality Effect
This study demonstrated that personality variables significantly account for students' SSC in Facebook-enhanced courses, even after controlling for other variables previously thought to be related to sense of classroom community. It was found that extroversion and agreeableness were two of the Big Five personality traits that significantly explained part of the variance in students' SCC scores. This is an important finding for instructional staff.

While students' personality cannot be controlled, nor can faculty select learners on the basis of personality dimensions, knowing that SCC is impacted by psychological traits such as extroversion and agreeableness can affect instructional decisions on group formation and classroom activities. If a course requires group

work, instructors can foster an increased SCC by socially engineering the group membership to include individuals high on extroversion and agreeableness. These individuals, by virtue of their personality composition, would provide the attitude and support that creates a group atmosphere conducive to connectedness. The reason is that extroverts are socially outgoing and are stimulated by their association with others. They are enthusiastic, like to talk, and are open to new opportunities. The reason individuals high in agreeableness contribute to a group atmosphere of connectedness is that they generally have a concern for social harmony, are generous, helpful, and willing to compromise personal interests for the sake of their group.

It has long been suggested that many university instructors attempt to foster learning environments rich in classroom community (Chickering & Gamson, 1987). The thought is that when students have a strong sense of connectedness with their classmates, it may promote satisfaction and retention. These are crucial outcomes to institutions of higher learning. Studies have shown that Facebook and other social media enhance student satisfaction and engagement, which are strongly linked to retention and academic success (deVilliers, 2010; Barbour and Plough, 2009). Tinto (1975; 1993) supported this position when he argued that students who possess strong feelings of classroom community are more likely to persist in their academic programs than students who feel alienated and alone. He suggests that instructional strategies that strengthen SCC will result in an increase in student retention.

Research Question 2 – Demographic Variables and Relative Autonomy

This study provided clarification on the linkage between certain demographic variables and students' SCC. The correlation analyses summarized in Table 2 indicate that SCC was significantly, but inversely, correlated with age in the Facebook-enhanced group. Younger students experienced a higher SCC, as compared to their older counterparts, in their Facebook-enhanced courses. Perhaps the younger students in this study viewed the Facebook enhancement as a facilitator of needed connectedness, whereas the older students were more mature and independent individuals who did not need classroom connectedness. This finding is contrary to that reported by Smith (2008), who reported that non-traditional aged students (26 and above) displayed a higher sense of community than traditional aged students (18-25).

Students' motivational level, as measured by the relative autonomy variable, was significantly related to SCC. Intrinsically motivated students, as contrasted with those that are extrinsically motivated, perceive learning as challenging and fun. In this study they perceived their engagement in learning as a challenging and connected social experience. This is consistent with the work of Coussement, 1995 and Fjortoft, 1996. Given this finding, the task for university instructors and instructional designers is to develop course materials that are intrinsically motivating so as to enhance SCC.

In this study we found no significant relationship between SCC and gender or online experience. In other words, there is no documented gender effect or novice/experienced level effect associated with SCC. This is consistent with the work of Bernard, Brauer, Abrami, and Surkes (2004) for previous online experience and the work of Smith (2008) for gender. Our findings, however, run counter to those reported by Rovai (2002b) and Rovai and Baker (2005). The results of this study suggest that classroom instructors do not need to incorporate gender-specific or experience-level factors into the instructional design of their courses so as to increase students' SCC.

Future Research Opportunities

Among other things, future research should consider using a more precise measure of personality. Perhaps the finding that only two of the five personality variables were significantly related to SCC may have been due to methodological factors. In the interest of time and convenience, this study used a brief measure of the Big Five personality traits, making the measurement of those constructs less than optimal (Gosling, Rentfrow, and Swann, 2003). As such, it is possible that additional personality variables would have been related to SCC had they been measured more precisely.

Additional research might also be directed to explaining whether certain Big Five personality traits might have a tendency to motivate students toward the use of Facebook or other social media in their classrooms. Perhaps students' relative autonomy, as measured in this study to assess motivational orientation, could be analyzed to determine if it is impacted by any of the Big Five personality traits. This could provide an added dimension toward the development of a comprehensive model for explaining SCC.

By continuing this work, we hope to provide specific recommendations to classroom

instructors and course designers for creating learning environments that are rich in connectedness and learning so as to address the needs of students in higher education.

Provisos

This study has two potential provisos. The first relates to its dependence on self-report measures. Even though the student respondents completed the questionnaire anonymously, there is the potential for social-desirability bias. The second proviso relates to the study's use of a single survey instrument, which could result in common method bias. Future research should use additional methods for collecting data such as interviewing or focus groups. This would buttress the survey results and lessen the threat to validity occasionally observed in educational research that uses a single data collection instrument (Donaldson & Grant-Vallone, 2002).

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Editor's Note:

This paper was selected for inclusion in the journal as an EDSIGCon 2016 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 2016.

APPENDIX

	Facebook-Enhanced (n= 301)		Non-Enhanced (N=282)		
Variable	*M*	*SD*	*M*	*SD*	*F(1,576)*
SCC	16.46	3.26	15.94	3.89	3.14
Extroversion	4.32	1.27	4.39	1.51	0.37
Agreeableness	4.67	1.07	4.76	1.17	0.94
Openness	5.32	1.09	5.36	1.08	0.17
Neuroticism	2.98	1.19	2.97	1.35	0.00
Conscientiousness	5.50	1.20	5.69	1.14	3.97 *
Student level	3.54	0.90	3.48	0.97	0.52
Relative autonomy	9.53	8.00	8.66	7.74	1.75

Notes: * p < .05

Student level = 1 to 4 corresponding to number of years at the university;

Relative autonomy = Difference score between intrinsic and extrinsic motivation (R = -6 to 32)

Table 1

Means and ANOVA Results for Students in Facebook-Enhanced and Non-Enhanced Groups

Variables	1	2	3	4	5	6	7	8	9	10	11	12
Students in Facebook-enhanced Group (n=301)												
1 SCC	-	.02	-.12*	.07	-.14*	.15**	.14*	.17**	.27**	.09	-.11	.07
2 Gender		-	-.05	-.07	-.10	.03	-.10	.01	-.21**	-.07	-.04	-.08
3 Age			-	.07	.34**	-.33**	-.18**	-.11	-.22**	-.11	.19**	-.11
4 Online				-	-.02	.17**	.01	-.02	.04	.15**	-.05	.10
5 Status					-	-.23**	-.07	-.10	-.17**	-.04	.12*	-.16**
6 Student Level						-	.08	.17**	.20**	.23**	-.11	.17**
7 Rel Auton							-	.18**	.17**	.33**	-.25**	.26**

8 Extroversion								-	.07	.34**	-.19**	.24**
9 Agreeableness									-	.17**	-.35**	.16**
10 Openness										-	-.29**	.31**
11 Neuroticism											-	.36**
12 Conscientiousness												-

Variables	1	2	3	4	5	6	7	8	9	10	11	12
Students in Non-enhanced Group (n=282)												
1 SCC	-	.04	.09	-.05	-.12*	.10	.24**	.18**	.16**	.22*	-.24*	.21**
2 Gender		-	.02	-.02	.02	-.03	-.08	.05	-.13*	.03	.01	-.12*
3 Age			-	.06	-.17**	.30**	.12	.11	.04	.01	-.02	.07
4 Online				-	.03	.12*	.01	.05	-.04	.06	.02	-.03
5 Status					-	-.24**	-.11	-.14*	-.08	-.02	.06	-.13*
6 Student Level						-	.04	.04	-.03	.10	.01	-.02
7 Rel Auton							-	.19**	.00	.22**	-.22**	.23**
8 Extroversion								-	.03	.31**	-.11	.20**
9 Agreeableness									-	.15*	-.26**	.26**
10 Openness										-	-.27**	.29**
11 Neuroticism											-	-.38**
12 Conscientiousness												-

Notes: * $p < .05$; ** $p < .01$

Student level = 1 to 4 corresponding to number of years at the university

Relative autonomy = Difference score between intrinsic and extrinsic motivation (R = -6 to 32)

Online = 1 if students had previous online experience and 0 if students had no online experience

Table 2

Correlations between Model Variables for Students in Facebook-enhanced and Non-enhanced Groups

Variable	Facebook-enhanced group (n = 273) B	SE B	β	Non-enhanced group (n = 271) B	SE B	β
Step 1						
Gender	-.26	.40	.04	.49	.46	.06
Age	.17	.45	-.03	.39	.54	.05
Online	.36	.49	.05	-.84	.66	-.08
Status	-1.16	.69	-.11	-.75	.63	-.07
Student level	.34	.24	.09	.29	.25	.07
Relative autonomy	.05	.03	.12*	.11	.03	.22***
Step 2						
Gender	.26	.40	.04	.55	.45	.07
Age	.11	.44	.02	.27	.53	.03
Online	.58	.48	.07	-.84	.64	-.08
Status	-.71	.67	-.07	-.47	.62	-.05
Student level	.29	.24	.08	.33	.25	.08
Relative autonomy	.05	.03	.12	.08	.03	.15*
Extroversion	.40	.16	.15*	.24	.16	.10
Agreeableness	.86	.20	.28***	.33	.20	.10
Openness	-.35	.21	-.11	.28	.24	.08
Neuroticism	.06	.19	.02	-.35	.19	-.12
Conscientiousness	-.06	.18	-.02	.15	.23	.04

Notes: * $p < .05$; *** $p < .001$

Student level = 1 to 4 corresponding to number of years at the university
Relative autonomy = Difference score between intrinsic and extrinsic motivation (R = -6 to 3
Adj $R^2 = .03$ ($p < .05$) for Step 1 in Facebook-enhanced group; $\Delta R^2 = .08$ for Step 2 ($p < .001$)
Adj $R^2 = .06$ ($p < .01$) for Step 1 in non-enhanced group; $\Delta R^2 = .07$ for Step 2 ($p < .001$)
Coding for nominal variables: gender (male = 1, female = 0); online (1 = student had previous online course experience, 0 = student had no online course experience); status (1 = full time status, 0 = part-time status)

Table 3
Summary of Hierarchical Regression Analyses for Variables Predicting SCC

Cloud Computing e-Communication Services in the University Environment

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Abstract

The use of cloud computing services has grown dramatically in post-secondary institutions in the last decade. In particular, universities have been attracted to the low-cost and flexibility of acquiring cloud software services from Google, Microsoft and others, to implement e-mail, calendar and document management and other basic office software. These products have helped universities migrate from in-house legacy software platforms to current generation products. This paper explores the Google and Microsoft cloud service offerings for educational institutions, and compares the implementation experiences of six Canadian universities. However, although acquisition costs are minimal or non-existent, members of the academic community including faculty and students are often reluctant to entrust all of their emails, documents and calendar schedules to a complex, global, for-profit third party. The overwhelming tide is for cash-strapped university administrators to adopt third party cloud services, and cautiously manage privacy issues with alternate in-house services. Finally, the move from in-house to cloud services requires the universities to move to a cloud-aware governance model that is sensitive to information privacy and security issues. Results of this research may lead to a better understanding of benefits, advantages, risks and challenges of the cloud computing initiatives at universities and may serve as an objective source of information for other public sector institutions which are considering cloud services implementation.

Keywords: Cloud Computing, Google Apps for Education, Microsoft Office 365, Information Privacy & Security, Software as a Service, IT Governance

1. INTRODUCTION

This paper reviews cloud computing e-communications implementations at six post-secondary educational institutions with emphasis on their implementation at Canadian universities. The majority of these universities considered utilizing cloud services for the systems which were traditionally hosted at the institution; systems that had become old and inefficient, systems which required significant financial investments to be brought up to current versions and standards. Very often these systems would run old versions of software that were no longer supported and therefore were exposed to security and privacy risks. All these reasons lead to universities being more open to consider other options of providing systems and services utilizing Software as a Service (SaaS) through cloud computing offerings. Universities and other education entities have been attracted to the low-cost and flexibility of acquiring cloud software

services from Google, Microsoft and others, to implement e-mail, calendar and document management and other basic office software.

According to Educause (2016), cloud services are becoming a norm for higher education institutions, and Information Technology model in higher education is shifting from an independent in-house model to interdependent model. In order to exercise the advantages of cloud computing, it is necessary to make improvements of the management of university data and records through on-going education, development of standards and policies, governance and information security.

These changes in service provisioning, where services are not hosted in-house but rather off-premises creates the need to develop cloud-aware IT governance. Cloud aware IT governance must drive and support strategic decision process, balance opportunities and risks associated with cloud services and support top-down decision making process needed to accomplish strategic university goals with bottom up needs of students, faculty and staff (Educause, 2015).

Bohaker et al. (2015) argue that Canadian universities frequently utilize cloud services by outsourcing their email systems to one of two biggest vendors – Google and Microsoft. This trend began 10 years ago when Lakehead University in 2006 switched to Google Apps for Education.

The structure of this paper is as follows. First, overview of e-communication products available for educational institutions from Google (Google Apps for Education) and Microsoft (Microsoft 365 for Education) is discussed. Second, the implementation of these cloud services is examined at six Canadian Universities. Third, the overall trends are summarized from the six examples. Finally, a six stage implementation model is introduced, based on the examined university examples.

2. GOOGLE APPS FOR EDUCATION

Through Google Apps for Education, Google offers free services for educational institutions which help improve communication, collaboration, productivity and efficiency. Core services and applications available through Google Apps for Education include Gmail, Calendar, Contacts, Classroom, Drive, Docs, Forms, Groups, Sheets, Sites and Slides.

Some users fear about the ownership of their data once the data goes to the cloud, hosted by Google. According to Google (2016), the company does not own data and only keeps the personal information of its users. At any given time, if the organization decides to stop using Google, the data can be "taken back", downloaded and then migrated to another solution. Google ensures the security and privacy of its users' data and it has signed the Students' Privacy Pledge as its commitment to secure students' personal information. The company does not share personal information of Google Apps for Education users with third parties unless required by law, nor sells the user data. This applies to core services only.

However, a group of students at the University of California at Barkley filed a suit against Google claiming that the company violated the Electronic Communications Privacy Act. The plaintiffs claimed that Google created advertising profiles by using their Google Apps for Education email accounts without their notification or consent (Nichols, 2016). Google users who use other applications outside of core applications may see ads. In order to ensure compliance with policies and standards, Google engaged services of an independent auditor, Ernst & Young, to review the company's data protection practices with the goal to ensure that the company's practices, Google Apps and data centers are compliant with ISO standards (Google, 2016b).

Additional product information about Google Apps for Education and a case study are provided in Appendix 2.

3. MICROSOFT OFFICE 365

Microsoft Office 365 is another cloud-based e-communications suite which includes email and calendaring, secure file sharing and storage and text and video chat capabilities. There are more than 100 million users of Office 365 worldwide. Office 365 for Education is now free of charge to educational institutions. Some of the products included in the offerings are Exchange for emailing, calendaring and storing contacts, OneNote, Skype, 1 TB of OneDrive for cloud storage, Word, Excel and Classroom. According to Microsoft (2016a), the company guarantees 99.9% uptime, financially backed service level agreements, web support for IT related questions and issues and 24/7 phone support for critical issues. Using Active Directory integration, users' credentials and permissions can be easily managed (Microsoft, 2016b).

Additional information about Microsoft Office 365 for Education and a case study are provided in Appendix 2.

4. CLOUD COMPUTING SERVICES AT CANADIAN UNIVERSITIES

For the purpose of this paper, initiatives related to assessment and implementation of e-communication systems as cloud services were analyzed and researched at the following six Canadian Universities:

1. Lakehead University (Google)
2. University of Toronto (Microsoft)
3. University of Alberta (Google)
4. Ryerson University (Google)
5. Queen's University (Microsoft)
6. Western University (Microsoft)

Canada has 96 universities with approximately 865,000 full-time undergraduate students and 157,000 full-time graduate students (Universities Canada, 2015). The 2015 full time student enrollment figures for these six universities are presented in Table 1 in the Appendix. The six universities described below represent 19% of the undergraduate and 22% of the graduate population of full time students in Canada.

These universities were selected because they had publicly announced their plans to move to cloud based e-communications and each university is a large well established institution with a diverse population of students, faculty, administrators and alumni.

The research approach was two-fold. First, the research team at Ryerson University conducted interviews with those responsible for the Google implementation. Data presented in the Ryerson section (4.4) below reflects semi-structured interviews conducted by the research team and access to source documents such as emails, plans etc. The second research approach was to examine the public websites of the five other universities, through a content analysis approach and limited interviews with the university implementation team. Further research plans described below in section 6 will include semi-structured interviews with members of each university's e-communication team and members of the university administration.

Result of this research will lead to better understanding of benefits, advantages, risks and challenges of the cloud computing initiatives at universities and may serve as an objective source of information for other public sector institutions which are considering cloud services implementation. The descriptions that follow are sequenced according to the year of implementation, from Lakehead University in 2006 to Western University in 2015.

4.1 Lakehead University

In its goals to reinvent itself, Lakehead University stands as the first Canadian university to utilize cloud services for its email and calendaring systems. In 2006, the University signed a deal to start using Google Apps for Education for its email and calendaring. A decision to move to cloud services was described as a strategic decision which would put the University in a better position to be up front with the technology and to mitigate issues related to server overcapacity, email system crashes, slow response time or messages not being delivered (Abaya, 2006).

Migration of Lakehead University accounts from Sun 2003 Microsystem servers to Google Apps for Education started at the end of November 2006 (Jackson, 2009). In a week, 38,000 student, staff, faculty and alumni accounts were migrated to Google Apps for Education (Abaya, 2006). Google implementation did not require any payment and all support was provided by Google.

Now, Lakehead University has more than 68,000 Google accounts provided for its students, faculty, staff and alumni. It is estimated that by utilizing cloud services offered by Google, the university saves between $200,000 and $250,000 annually (all financial values are in Canadian dollars). Lakehead University is frequently used as an example of pioneering cloud computing in higher education and often gets calls from other universities which are interested in Google Apps for Education (Marar, 2012).

The Google Apps for Education implementation at the Lakehead University was not without some controversy. Some faculty members at the University expressed their concerns about email system being hosted by Google and email users being subject to the US Patriot Act. A case was brought to an external arbitrator who determined that, according to the Collective Agreement, the university was not required "to provide privacy assurance for email communications" (Jackson, 2009) and that email communications should be considered to be as confidential as postcards. Later, in 2014, after the Freedom of Information and Protection of Privacy Act (FIPPA) was submitted to the University, Shaw (2014) reported that it was found out that there was no signed contract between the University and

Google; neither the University nor Google were able to locate the signed contract – only an unsigned draft was found. It was concluded that both the Lakehead University and Google are bound by the general Google Apps for Education agreement terms. It was also reported that the Privacy Impact Assessment (PIA) was included in general research when the University was exploring other options to its old and unstable email system, but the main results of the assessment were produced in 2007 after the Lakehead University completed migration to Google Apps for Education in 2006 (Shaw, 2014).

4.2 University of Toronto

In order to review the students' communication systems and services offered at the University of Toronto such as email or other communication services, in November 2009 a consultation group was created with a mandate to review the range and adequacy of these systems, to make recommendations to the CIO about future communication services to improve student's engagement and experience and be aligned with financial priorities of the institution and identify any concerns related to protection of privacy and information security. The consultation group was made of representatives from around the institution including students, faculty and staff from all three university campuses (University of Toronto, n.d.b). In addition, a full PIA was completed after which two vendors were short listed: Microsoft with its Office 365 for Education and Google with Google Apps for Education. After further evaluation and assessment, a decision was made that University of Toronto should implement Office 365 for Education email system for its students with an option for students to opt-out and receive a University of Toronto domain address. At the same time, it was determined that due to the identified privacy concerns and risk, staff email addresses would remain on the University of Toronto internal hosted email services: Microsoft Exchange and UTORmail (University of Toronto, n.d.b).

The biggest concern related to implementation of Office 365 for Education was related to potential exposing of the users to the laws of governments outside of Canada. Email and other communication services offered to the University of Toronto students available through Office 365 for Education are hosted on the servers in the United States and therefore subject to the United States Patriot Act. The Patriot Act allows the US Government, in case of the investigation which will protect national security or help intelligence activities, with a court order or a National Security Letter, to get access and disclosure of any personal information, including emails or other information that are housed in servers in the US territory (University of Toronto, n.d.b).

With email cloud services for students being provided by Microsoft, student email servers will be hosted by the vendor which will ensure data integrity, protection, security and virus protection and will not have any corporate advertising. This will lead to improved efficiencies, reduction of the cost related to infrastructure, heating, cooling and software licensing and will enable the University to take on other initiatives which will be aligned with University's mission and its strategic planning.

Since its rollout in 2010, more than 162,000 of eligible students and alumni have switched to Office 365 for Education. Office 365 for Education provides University of Toronto students with various email and communication features such as 1TB Inbox & OneDrive, Calendar and contacts, OneDrive (used for collaboration and online document editing), as well as it offers free Microsoft Office for students which are currently enrolled in the courses offered at the University of Toronto (University of Toronto, n.d.b).

After successful implementation of Office 365 for Education for students at the University of Toronto, with direction of the provost, the University started faculty and staff e-communications consultation process which lasted from September 2013 to September 2014. The e-communications Advisory Committee, in collaboration with Information Technology Services at University of Toronto was tasked to assess how University of Toronto can enhance its existing communication system (University of Toronto, n.d.a). It was found that the current email system does not meet industry standards. This ultimately impacts efficiency of the work done at the institution, as well as it has negative impact to work done with the institution's partners both in Canada and aboard (University of Toronto, 2014).

In order to gather information from community members, various meetings took place - from town hall and committee meetings to meetings with departments including Office 365 demo and question period. Community members were also able to provide their feedback about this consultation initiative through web site (University of Toronto, n.d.a).

In September 2014, Vice President and Provost of University of Toronto provided official response to the report. Some of the major risks that were

identified were the end of the cycle of the technology systems which are very often unsupported and which can easily be compromised, as well as across the institution practice of using cloud services which more often than not have not been risk assessed (University of Toronto, 2014).

According to the report produced by e-communications Advisory Committee, new services need to ensure security and protection of the valuable assets which will be supported by data encryption. The report also indicated and emphasized a need for educating users on best IT security practices including how to best protect and handle information.

The Committee was not able to reach unanimous recommendation if the faculty and staff at University of Toronto should switch to Office 365 for Education. As discussed earlier, from 2010, all students and recent alumni were required to use Office 365 for Education. The report also identified that, if the University was to implement Office 365 for Education, it will be free for the University and will not require any one-time-only (OTO) investments or any additional annual investments. Some other options were also considered such as in house and off-premise alternatives. However, these alternatives would not be free of charge for the University. It was estimated that the in house alternative would cost the University just over $1.3 million in OTO and then $1.2 million annually. Off-premise alternatives would not require any OTO spending, but it was estimated that it would cost the university $3.4 million annually (University of Toronto, 2014).

To date, a decision has not been made about future of cloud services for University of Toronto faculty and staff.

4.3 University of Alberta

Prior to making a decision to move its e-communications to cloud, IT services at the University of Alberta were supported by two centrally-supported IT services and with 30-50 small IT groups across the campus. At the time, there were 82 independent email systems across the University. This led to duplication of systems and resources, privacy and security issues, the lack of calendaring system, numerous Blackberry servers etc. (University of Alberta, 2010a). In order to eliminate these issues, the Office of Vice Provost (Information Technology) made a proposal that all 82 email systems be replaced by a single, centrally supported email, calendaring and Blackberry service which will potentially be provided by an external provider. It was suggested that centralization would enable IT professionals to spend more time on initiatives related to their own units and would free up physical space and reduce power needs. Centralization would lead to unification of all email addresses, improve email security and enable consolidation of Blackberry services. At the same time, some potential concerns related to centralization of services were identified such as reluctance for change - faculty and staff would need to learn a new system and they would need to let go of their own systems (University of Alberta, 2010a).

For almost a year University of Alberta assessed the possibility of implementing a central email and calendaring system either hosted in house or outsourced. Two alternatives for in-house service Microsoft and Zimbra required a multimillion dollar up-front investment, and on-going annual cost associated with ever-greening, resources, space, heating and cooling were determined not to be viable and it was recommended that central email and calendaring solution be provided by Google utilizing Google Apps for Education (University of Alberta, 2010a).

Even though Google was recommended as a vendor, actual implementation did not start until all technical issues were resolved, the University got official approval by the planning committee, a PIA was completed and the contract signed by Google (Scaeffer, 2010). Finally, in December 2010, it was announced that University of Alberta is moving to Gmail. Through a phased approach and adoption, in March 2011, the University invited first 7,760 people to test Google Apps and at the end of the month it allowed all students to switch to Google. In less than two weeks, more than 29,000 students switched to Google. By the September 2011, over 60,000 users switched go Google and migration teams started migration of departments and business units. By the end of 2011, over 89,000 users migrated to Google Apps, central webmail server was put to read-only mode and efforts were put in place to start migration of the departmental servers to uAlberta Google Apps (University of Alberta, 2010a). With so many departmental email servers to be migrated, complete migration was estimated to go well into 2012 (University of Alberta, 2010b). It is estimated that now there are more than 120,000 uAlberta accounts hosted by Google (Contact North, 2012).

4.4 Ryerson University

In January 2011, the Advisory Committee on Academic Computing (ACAC) and Computing and

Communications Services (CCS) at Ryerson University initiated a consultation process with the community members to assess and determine the future of email and collaboration systems for the University. At the time, Ryerson used two central mail systems (RMail which was available for students, faculty and staff and GroupWise which was available for faculty and staff) as well as some departmental email systems. The mandate of the team was that, through consultation process with the Ryerson community, determine benefits and risks of using cloud services versus in-house services and to make recommendation on improvements or replacement of the email and collaboration system to the Provost and Vice President Academic, and to the Vice President Administration and Finance (Lesser, 2011). As part of the consultation process, various town hall and departmental meetings took place, as well as a symposium was organized by the Ryerson's Privacy and Cyber Crime Institute: *Exploring the Future of E-mail, Privacy, and Cloud Computing at Ryerson.*

According to Lesser (2011), community requirements were gathered, an RFP was posted, proposals were received and the unanimous recommendation by the ACAC was to acquire Google Apps for Education. It was also recommended that students and faculty who do not want to use Google for their email could choose to stay with the 1990s Ryerson e-Mail (RMail) system. The recommendation was accepted in January 2012 by the Provost and Vice President Academic and the Vice President Administration and Finance, when the University started negotiating a contract with Google and extending the privacy risk assessment, as well as financial risk assessment (Lesser, 2012).

Starting in August 2012, the University began migration of RMail and GroupWise accounts to Google Apps. The phased approach was used by migration of the pilot users first – "alpha phase", then CCS staff, followed by selected "early adopters" users. Then, in October 2012, all staff and faculty and students who opted in to use Gmail instead of Ryerson RMail system were migrated to Gmail. Over the Thanksgiving long weekend in 2012, 138,830 new Google accounts were created and 19,266 email accounts were migrated to Gmail (Ryerson, 2012c). Currently, there are over 87,000 active Ryerson Gmail accounts.

Some of the identified benefits provided by Google were large/unlimited storage, enhanced organization of the messages, real-time collaboration functionality and calendar sharing (Ryerson, 2012b).

4.5 Queen's University

IT governance at Queen's University is driven by a strong partnership between the Office of the CIO and Associate Vice-Principal, Information Technology Services department and various steering and advisory committees who together with the community members ensure that information technology initiatives support Queen's university Academic and Strategic Research plans (Queen's University, 2014).

After extensive consultations about the new student email and calendaring solution and completion of an independent privacy risk assessment, Queen's implemented Office 365 for students in January 2013. This was the first time the institution had used cloud services hosted outside of the University. By switching to Office 365, students got 250 times more storage than what they had before migration. The University was able to decommission six servers which were no longer needed (Queen's University, 2013).

After the success of Office 365 implementation for Queen's undergraduate and graduate students, the Associate Vice-Principal and Chief Technology Officer lead a year-long consultation process with various groups at the University as well as with the individual faculty and staff members about exploring implementation of Office 365. Similar to cloud service implementation at other universities, increased security and privacy risks were identified as a potential showstopper for Microsoft 365 implementation. The consultation and assessment process revealed that Microsoft can provide better system security than can be provided by the institution (Leroux, 2016). It was also determined that features and functionality offered by cloud based services, including large storage and better security outperform current services available at the University (Queen's University, 2015).

In February 2016, Queen's University began migration of its faculty and staff email system to Office 365 for Education which provided access to email, calendar and file sharing and file storage. Queen's University faculty members had an option to opt-out of using Office 365 with an option to opt-in to using Office 365 at a later time, if they chose to do so (Leroux, 2016).

4.6 Western University

Starting January 2015, Western University started with migration of the student accounts to Office 365. The initial migration included pilot

users - students who have chosen to participate in the pilot migration. In the following months and until August 2015, all undergraduate and graduate students as well as new students were migrated to Office 365. In July 2015, migration of Administrative support units' accounts started with Information Technology Services being the first unit to be migrated to Office 365, followed by migration of other units throughout Fall of 2015 (Western, 2015a).

By early 2016, all students and Administrative staff have been migrated to Office 365. Faculty accounts were scheduled to be migrated from May 2016 to July 2016. Faculty members had an option until March 31, 2016 to choose to delay that their accounts be migrated to Office 365 until Microsoft provides hosting of email servers in Canada. Office 365 users at Western got 50 gigabytes of email storage which was 1000 times more for the undergraduate students than they had before migration (Western, 2016).

Western University completed a full PIA prior to making decision to move to Office 365. The assessment was completed by Western's Information Technology office, Legal Counsel and Privacy Office. The PIA document was prepared in August 2014 and then revised and updated in October 2015. The document was also reviewed prior to making a decision to migrate faculty and academic accounts to Office 365 and it was determined that there was no need for any material change to the document (Western, 2015b). The assessment outlined issues and deficiencies related to an old email and calendaring system (Convergence) hosted in-house and growing needs of Western users for more efficient and robust systems. It was reported that authentication and identification information such as email address, full name and email token, user created content such as emails or calendar info and system captured content such as cookies will be "shared with, collected and used by Microsoft in delivering Microsoft Office 365" (Western, 2015b). The report outlined data usage and destruction issues, potential privacy risks such as the loss of data management and user data, access by foreign governments, student calendar being exposed to other users as well as recommended solutions to mitigate potential risks. Being a late entrant to cloud services for e-communication, Western was able to benefit from knowledge and experiences from other universities which have already migrated their email and calendaring systems to cloud and through consultation leverage at the technical and legal levels (Western, 2015b).

5. DISCUSSION

This paper shows that majority of Canadian institutions who switched to using cloud services for their email and calendaring system as well as for document sharing and collaboration, have chosen one of two dominant commercial vendors – Google with Google Apps for Education or Microsoft with Office 365 for Education.

From the six examples above, the key stages in evaluating and migrating to cloud communication services are as follows;

A. Establish a university committee with broad representation including students, administration and faculty members, to assess the costs, risks and opportunities of moving to cloud communications.
B. Consult widely with stakeholder groups: faculty members, administrative staff, students and alumni. Review the experience of comparable universities with similar projects.
C. Conduct a PIA using a third party, and prepare a business case that focuses on cost reduction and improved services. Identify benefits for each stakeholder group.
D. Confirm and communicate the plan with executive level commitment, such as Provost, Vice President or President. The changes will have a major impact on the university.
E. Plan a phased implementation, typically with student groups migrating first.
F. Consider options for stakeholders who resist migration, such as remaining on the legacy in-house system.

Table 1 in Appendix 1 provides a summary of the six implementations.

6. CONCLUSION AND FURTHER RESEARCH

Cloud computing became an important strategic resource for the high education institutions because it enables them to provide efficient and scalable services for its students, faculty and staff while freeing its resources to do the work they are committed to do – provide support for academic and business goals of the organization. Cloud computing e-communications implementation in these six Canadian Universities and around the world shows that there are many benefits associated with cloud computing such as free and on demand e-communication services which are available at anytime from anywhere, smaller operational expense, less infrastructure cost such as power, heating and cooling costs. It also shows

that the major e-communications service providers – Google and Microsoft have their servers hosted outside of Canada which creates some issues and concerns related to data privacy and security. It also shows that before making decision to switch to any cloud service, there is a need to complete a full PIA and, through consultation process, to involve all university stakeholders and decision makers into the process. This will lead to better customer engagement, make users happier and most likely lead to creation of better positive outcomes for the universities as well as for their community members.

This report shows a strong competition between Google and Microsoft in gaining and continuing to keep their presence at educational institutions. Out of six Canadian universities, three chose Google and three chose Microsoft for their e-communication service providers. With free e-communications offerings available for educational institutions, it is expected that educational institutions will continue gaining benefits of cloud computing offered by two of the world's most valuable companies.

Further research is underway by the research team, to develop the findings presented in this paper. A series of semi-structured interviews are being conducted at each of the six universities with two or three representatives from the university administration and a similar set of representatives from the implementation team, typically in the IT department. This further research will endeavor to answer two questions: 1) are there measurable differences between Microsoft and Google in terms of implementation or user satisfaction, and 2) what are the long-term costs of allowing some members to opt-out?

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Appendix 1 – Table of Comparison

University	Full time undergrad / graduate students enrolled in 2015	Cloud Service Provider and Product	Implementation Year (start)	The latest recorded number of accounts – students, faculty, staff, alumni	User Group	Opt-out available
Lakehead University	5,800/ 880	Google Apps for Education	2006	68,000	Students, faculty and staff	No
University of Toronto	63,800/ 15,900	Microsoft Office 365 for Education	2010	162,000	Students	Yes
University of Alberta	27,470/ 5,950	Google Apps for Education	2011	120,000	Students, faculty, staff	No
Ryerson University	25,150/ 2,200	Google Apps for Education	2012	87,250	Students, faculty and staff	Yes (students and faculty only)
Queen's University	19,200/ 4,200	Microsoft Office 365 for Education	2013	See note below	Students	No
		Microsoft Office 365 for Education	2016	See note below	Faculty and staff	Yes (faculty only)
Western University	22,600/ 5,300	Microsoft Office 365 for Education	2015	See note below	Students and staff	No
		Microsoft Office 365 for Education	2016	See note below	Faculty	Yes (only if they opted out by March 2016)

Table 1 – Summary of cloud service implementations at Canadian Universities

Note: According to information from Microsoft, there are currently tens of thousands users of Office 365 for Education at this institution.

Appendix 2 –Product Information and Case Studies

Additional Google Apps for Education information

According to Google (2016b), Google Apps for Education is used by more than 50 million users in more than 190 countries all over the world, including seven out of eight Ivy League Schools. Google states that it is an affordable and easy-to-use system supported by the top 500 engineers; Google Apps for Education provides the best security measures for data privacy and protection.

The initial offering of Google Apps for Education included a 30GB storage limit for Google Drive files and Gmail messages. In October 2014, Google removed this storage limit and it now offers unlimited storage with the only restriction that files cannot be larger than 5TB in size.

According to Google, the service provides 99.978% availability without scheduled downtime. Robust and scalable infrastructure ensures fast and reliable services including more than 100 billion search queries each month. System redundancy and data replication over clustered servers ensure that data will be accessible at any given time and will not be lost in case of one data center failure (Google, 2016c). Google not only ensures system reliability by robust infrastructure, network and applications but also by a business continuity plan which accounts for major disasters such as earthquakes. The plan is designed to ensure the delivery of services in situations when major people and services may not be available for up to a month (Google, 2016c).

The number of users using Google Apps for Education is growing quickly. In just two years, from 2010 to 2012, the number of Google Apps for Education users doubled, from 10 million to 20 million. Many K-12 students in the United States are using Google Apps for Education including the state of Oregon which adopted Google Apps for Education for all K-12 classrooms (Koetsier, 2013). Now, with 60 million users worldwide, Google is proving its dominance in the cloud computing market.

More than 10 million of 60 million Google Apps for Education users are using Google Classroom, the tool which was created in collaboration with teachers in order to help them save time, be more efficient and improve communication with students (Google, 2016a). Using Google Classroom, teachers can create classes, organize documents, manage multiple classes, distribute paperless assignments and quizzes, transfer grades to be uploaded to other systems and communicate with the class. Google Classroom works with other Google products such as Gmail, Google Drive, Google Documents or Google Calendar and benefits not only teachers, but also students who can access class documents on Google Drive or see assignments on Google Calendar (Google, 2016a). Classroom is receiving a great uptake and Google is focusing its efforts to making enhancements to the application based on feedback from users (Panettieri, 2016). Google Classroom can be integrated with more than 20 applications.

According to Panettieri (2016), the majority of Google's educational customers are North American customers. In 2011, 61 of the top 100 US universities including Yale University, the University of Notre Dame and Boston University selected Google as a provider of e-communications and collaboration systems offered through Google Apps for Education (Google, 2011). This was another testament of Google's strong dominance in the US education sector. Google is also expanding its free offerings to educational institutions in Europe, Asia and other regions.

Case Studies of Google Apps for Education in Europe

The Vedruna Schools of Catalonia in Spain have approximately 22,000 students from Kindergarten up to High School located in 36 centres across the region. In their goals to increase digital literacy of their students and enable competency-based teaching and learning, in 2013, the Vedruna Schools started a pilot project with 150 Chromebooks and Google Apps for Education (Google, 2016e). The pilot lasted three months and showed good results. Students appreciated the benefits that Google Apps brought to their learning results and their relationships with their teachers. Teachers identified benefits of using the Google Groups product available through Google Apps core products to communicate with their students. The success of the pilot lead to a second implementation in January of 2014, followed by 2,000 new Chromebooks and 3,000 users using Google Apps for Education (Google, 2016e).

According to a case study report prepared by Google (2016e), some of the benefits identified by the introduction of Google Apps and Chromebooks included improved digital competency of students which went from 30% before their introduction to 80% after they were widely used, a new teaching methodology, improved communication between teachers and students and greater motivation and learning capacity. It is expected that with elimination of maintenance and licensing costs, the Vedruna Schools will save more than 600,000 euros due over the next four years.

Microsoft Office 365 for Education information

Similar to Google Classroom, Office 365 for Education now includes Microsoft Classroom.
The application enables teachers to manage their classes, organizes classes into sections, create assignments and set due dates, post them in Outlook calendar and provide feedback to students. Students can access their assignments not only on their computers, but also on their mobile devices using Microsoft Classroom for iOS or Android (Microsoft, 2016a).

To increase its openness and transparency, Microsoft launched an Office 365 for Education Roadmap which provides information about updates currently planned for applicable subscribers. The roadmap includes information about updates that are in the development phase, updates that are beginning to roll-out, fully released updates as well as previously planned updates that are being cancelled (Microsoft, 2016c).

Microsoft Office 365 for Education in Australia
During the summer of 2013, the majority of Australian universities including the University of Technology Sydney, Curtin University, Victoria University, Flinders University, Sydney University, the University of Wollongong and the University of NSW who in the past used Microsoft Live@edu email services either migrated or have scheduled an upgrade of free services offered by Microsoft to Office 365 for Education. At that time, CIOs of Australian universities were given the option for their data to be hosted either in the United States or Singapore. Some universities chose to store their data in the United States due to "perceived similarities between United States and Australian privacy law" (Coyne, 2013). For the University of Technology Sydney (UTS) or the University of Wollongong, having data stored in United States servers was not a big issue. Over 60% of UTS users were forwarding their emails to another email accounts. In addition, there were indications that similar rules would apply in Australia as in the United States – if the Australian Federal Government and Police asked that data be handed to them, the university would need to comply with this.

Other universities, such as Victoria University, chose to have their data stored in Microsoft data centers located in Singapore. According to Zoran Sugarevski, the acting director of Information Technology Operations at Victoria University, hosting data in Singapore was better aligned to Australian law. By completing a regular, six-month assessment of all companies the university has contracted with, the university ensures that its contractors, including Microsoft, follow policies, practices and procedures related to data storage and security, as well as data archival and destruction (Coyne, 2013).

In 2014, Information Integrity Solutions (IIS), a large consulting company in the Asia Pacific region which provides services in data protection and information privacy (Information Integrity Solutions, n.d.a), prepared a PIA report for the Education and Training Directorate (ETD), Australian Capital Territory (Information Integrity Solutions, n.d.b). A PIA was conducted on planned implementations of Microsoft Office 365 for Education and Google Apps for Education. The goal of this engagement was to make an assessment of the implementation of the cloud offerings available from Microsoft and Google. Based on the assessment done by IIS, "the risk of privacy harms to students and teachers through misuse or inappropriate disclosure of personal information collected about students and teachers" by using Google Apps for Education was identified as low, and through Microsoft Office 365 was identified as minimal (Information Integrity Solutions, 2014). The report stated that Google has a complex privacy framework, making it difficult to understand its approach to privacy and data protection. Google reduced a risk associated with advertising by its announcement that it will not scan Gmail for advertising purposes for users of Google Apps for Education. The report also indicated that even though both companies state their commitment to privacy and data protection, Microsoft was more transparent in its approach to achieve those objectives and the company was prepared to undertake such contractual agreements which would ensure its commitment to privacy and security.

The Role of Industry Certifications in an AACSB-Accredited Institution

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Abstract

Instructors, practitioners, and students have different goals, and as such, different perspectives on industry certifications. University and technical school programs focusing solely on certifications struggle to retain relevance and compete against boot camp certification programs; yet programs without certifications may not be serving the needs of their students as well as they could be. This paper explores possible roles for certification in an Information Systems program at an AACSB-Accredited College of Business. Using mixed-methods to analyze survey results from recent graduates, the role of certifications as a signal of continued learning is supported

Keywords: Education, certifications, assurance of learning.

1. INTRODUCTION

The Association to Advance Collegiate Schools of Business (AACSB) accreditation provides "the longest standing, most recognized form of specialized/professional accreditation an institution and its business programs can earn" ("AACSB Accreditation," n.d.). AACSB provides schools with a framework to ensure a quality education for students and continuous improvement. And AACSB accreditation provides students, future employers, and other schools to which the student may later apply with evidence of a program's quality.

Standard 8 of the 2016 update to the 2013 AACSB eligibility procedures and accreditation standards requires schools to "demonstrat[e] that degree program learning goals have been met" ("Eligibility procedures and accreditation standards for business accreditation," 2016, p. 29). This assurance of learning occurs at the program level rather than at any course level. This assurance of learning should signal to external stakeholders that the school meets program goals and assist the school to improve courses and programs.

In information technology (IT), professionals can demonstrate their knowledge through industry certifications. These can be vendor-specific certifications (such as certifications provided by Microsoft, Cisco, Oracle, IBM, etc.) or vendor-neutral (such as certifications provided by CompTIA, (ISC)^2, SANS, etc.). The vendor-specific certifications provide name recognition for commonly-used solutions while vendor neutral certifications provide some level of general knowledge that should be applicable to solutions from multiple vendors.

Some employers require that employees maintain certification to qualify for jobs. For instance, the United States Department of Defense directive 8570 lists certifications required to qualify for Information Assurance work, both at the technical and managerial level. These certifications include vendor-specific options (such as Cisco Certified Network Administrator-Security certification) and vendor-neutral certifications (such as the (ISC)^2 Certified Information Systems Security Professional) with different certification options for different job levels ("DoD Approved 8570 Baseline Certifications," n.d.).

Four-year schools have been slower than community colleges and high schools to embed IT certifications within programs (Randall & Zirkle, 2005). This should concern faculty, as certifications impact both the hiring and earning potential of graduates (Quan, Dattero, & Galup, 2007). Some attempts have been made to provide model curricula to enable the embedding of certifications into courses (Al-Rawi, Lansari, & Bouslama, 2006), but with a few notable exceptions (Shackleton & Bentley, 2008), the certifications have been tied to a course rather than a program. And AACSB accreditation standards are "concerned with broad, program-level focused learning goals for each degree program, rather than detailed learning goals by course or topic, which must be the responsibility of individual faculty members" ("Eligibility procedures and accreditation standards for business accreditation," 2016, p. 30). Finding a certification that includes all of the over-arching goals for a degree program can be problematic. Certifications often fit within a few courses rather than across the curriculum.

If accreditation bodies such as AACSB do not expect to see certifications that cover specific topic areas found in a single course, does that mean that such certifications are unlikely to benefit students or the programs? This leads to the following research questions:

RQ: Do industry certifications provide value to graduates of an AACSB-accredited institution, and if so, which certification(s) provide the most value?

This study uses the lenses of signaling theory and the resource-based view to address this research question. A mixed-methods survey of recent graduates from an AACSB-accredited information systems program in the American Midwest supports the use of industry certifications as a signal to employers of student quality, though the certifications do not provide sufficient value to be the focus of the program.

2. THEORTICAL DEVELOPMENT

When two parties interact, there is a natural information asymmetry. This is true at both the organizational level and the individual level. When two people are flirting, each knows their own level of actual interest in the other party; however, they can only guess at the other party's actual interest in them. Similarly, when an organization is selling a service or product, the customer does not know the capabilities and processes within the bidding organization and therefore the resulting quality likely to be achieved. Yet people and organizations must make decisions based on incomplete information. Signaling theory focuses on this asymmetry between two people, groups, or organizations (Spence, 2002). It provides a mechanism through which parties articulate intangible benefits to potential partners (Bird & Smith, 2005). Upon interpreting these signals, recipients leverage the information to discriminate between different options in selection problems (Connelly, Certo, Ireland, & Reutzel, 2011). When a bird wishes to attract a mate, that bird signals that it has ideal characteristics making it desirable for the mate (Bird & Smith, 2005). When people want to know if a product has quality, they look at the warranty that the producer provides (Boulding & Kirmani, 1993). And when employers want to know the capabilities of a potential employee, they look at that candidate's degree information on the resume (Spence, 1973). All of these are examples of how signaling is used to overcome information asymmetry.

Spence (1973) applies signaling theory to the job market. Candidates differ in their quality and suitability for a position, but objective measurements of the candidates' abilities are unavailable to the employers. This puts employers at risk of adverse selection where a suboptimal choice is made, which is concerning due to the significant investment employers make in hiring and training new employees. This is especially true where barriers to terminating employment exist such as some European countries with strong employee protections and some unionized employers in other locations.

Candidates invest time and money to enable them to signal their knowledge, skills, and abilities by paying the signaling costs. For instance, a university education costs tens of thousands of dollars and usually about four years, so to send the signal of that education, individuals must pay those signaling costs. With the well-established accreditation system for colleges and universities, the signals provided by a university education are difficult to fake. For AACSB-accredited colleges of business, an extra layer of assurance of the quality of education is provided to potential employers.

Even with the value of a university education, employers such as the United States Department of Defense still require certifications for employment. CompTIA claims high school graduates earn 22% more with certification and associate degree holders earn 18% more than

their uncertified peers ("The value of IT certifications," n.d.). In a 2014 survey, IT executives indicate a higher preference for technology-specific training and certification courses than college courses or an MBA for advancing their careers (Salchow, 2014). Surprisingly enough, this holds true for those in managerial positions as well as those in technical positions. In IT certification rankings, it is claimed that employers want both degrees and certifications, though no underlying sources are provided (Tittel, 2014). While locating a systematic review of the marginal value of IT certifications for college graduates proves difficult, it is expected that some value will probably still stem from earning the certifications.

This leads to our first hypothesis:

H1: IT Certifications will provide some benefit to graduates from an AACSB-accredited program.

In the resource-based view (RBV), resources which are valuable, rare, inimitable, and non-substitutable can lead to a sustained competitive advantage (Peteraf, 1993; Wernerfelt, 1984). Thus, an organization competes based on the resources it can marshal to create unique products and services. In a similar way, IT job applicants can use IT certifications to signal skills and abilities. These certifications will differ based on the skills employers expect from a certified applicant (i.e. how valuable the employer will perceive the certification), how many professionals have obtained the certification (how rare the certification is), how difficult it is for professionals to obtain the certification (the degree to which the certification is inimitable), and how many other similar certifications are available (or how non-substitutable the certification will be perceived by employers).

While several of these dimensions are difficult to measure, some information on the number of IT professionals holding various certifications is available. Using a survey from Global Knowledge (Hales, 2014), approximate percentages are determined. For the Microsoft Professional certification, the MCSE, MCP, MCSA, MCITP, and MCTS categories are combined. For the Cisco certifications, the CCNA, CCNP, and CCENT categories are combined. The Microsoft Office User certification is not included in the survey because the target frame for the survey is IT professionals rather than for general office users. For any certification that does not appear in the report of the top 15 most common certifications, the word "rare" is inserted. This implies that fewer than 2% of IT professionals surveyed hold the certification. The only common certifications not included in this study are CompTIA's Network+ and Security+ and VMWare's certification. Table 1 provides the percentages of professionals holding the studied certifications.

Table 1: Percentages of IT Pros with Studied Certifications

A+	11.3%
Cisco	13.0%
Citrix	3.4%
ITIL	11.5%
$(ISC)^2$	Rare
Linux	Rare
Microsoft Professional	25.1%
Microsoft Office	N/A
Oracle	Rare
PMI	5.2%

This leads to our second hypothesis:

H2: Rare IT certification will provide more benefit to job applicants than common certifications.

3. METHODOLOGY

To address the research question, recent graduates from an AACSB-accredited information systems (IS) program are asked to provide information on the value of certifications. The Midwestern university has forty graduates in the last three years for which the alumni office has contact information. 22 of the 40 complete the online survey, giving a response rate of 55%. The respondents provide both scalar responses to survey questions about the value of certification in general and the relative value of specific certifications, as well as free-form response boxes. The survey instrument provided to respondents is in an online format, but a printed representation is provided in Appendix 1.

The general value questions use a scale of -10 to +10, with negative values indicating disagreement and positive values indicating agreement. The relative value of specific certifications is measured on a scale of 0 to 100, with 0 representing very unimportant and 100 representing very important. All of the questions are answered based on a slider bar, and questions where the respondent didn't click on the slider bar to adjust the value are treated as 0, as that is the default position of the slider.
The two hypotheses are tested using mixed methods, meaning a combination of quantitative and qualitative data will be used to measure

support for the hypotheses. Quantitative analysis is completed using t-tests, one-way ANOVA, and post-hoc comparisons in SPSS version 24. Because of the small amount of qualitative data, it will be analyzed through informal textual analysis.

4. FINDINGS

H1 predicts that certifications will provide benefits to job candidates. The responses to two statements are analyzed to test this hypothesis. The first statement is "Employers expect that their IT/IS employees will have certifications when they are hired" and respondents provided a rating from -10 (strongly disagree) to 10 (strongly agree). Respondents agree with this statement though not strongly. The sample mean is 2.86. Because 0 is the midpoint of the scale on the first two questions, a 2-tailed t-Test is used. The mean is significantly different from zero with a t statistic of 2.37 ($p = 0.027$).

The second statement is, "Industry certifications will help recent graduates to get a decent IT/IS job." Respondents again agree with this statement. The sample mean is 4.64. The mean is again significantly different from zero with a t statistic of 4.16 ($p < .001$). Based on the quantitative data, H1 is supported.

The comments support the finding as well. One respondent writes, "The A+ certification is very important in the IT field. It was a requirement for my hire at [the university], and other jobs." Another respondent says that when hiring, "if two candidates are equally matched, only then I might look at certifications." A third says, "Students should have some certifications coming out of college, especially if they do not have any industry experience. This shows the ability to continue learning outside of class." Another respondent writes, "Any … type of Networking Certification is a bonus."

There are some cautions about the value, however. As one respondent puts it, "As nice as the certifications are, nothing beats the hands-on training and experience that they will need. The pieces of paper are nice and may get you in the door, but it's how much experience you have and how well can you apply it that will keep you from being sent out the door you just came in." Another agrees by saying, "We see many recent grads that have certs but have no idea what they are doing, they usually dont [sic] last long. Certifications will help on the resume but you need to make sure you actually can master the content and not just cram for a certification exam." Another respondent adds, "Certifications are important. However, they don't necessarily teach to what people need to know… I think certifications should be offered in college but should not be considered or framed as the end-all-be-all."

But there is some disagreement. "The job I have taken was directly related to the quality of the education I was afforded while attending [the University]. Certifications would not change the broad education base that I received, nor would they change the type of job I was offered… if they are truly important to a specific organization on-the-job training would be available." While the points made are valid, all but one respondents agree that certifications have some value, even if only to get one in the door. Thus, qualitative data also support H1.

H2 predicts that rarer certifications will have more value than more common certifications. Respondents provide how important particular certifications are for their workplace on a scale of 0 (very unimportant) to 100 (very important). Using a one-way ANOVA, a between-groups effect is observed with an F statistics of 2.38 ($p = .014$). Table 2 presents the results of the ANOVA. Bonferroni post-hoc tests reveal that the only different means that are significantly different are between Cisco and ITIL (mean difference of 34.5, $p = 0.04$). Both Cisco and ITIL are relatively common at 13% and 11.5%, respectively. None of the rare certifications show a difference with any common certifications. Thus, H2 is not supported by the quantitative data analysis.

Table 2: ANOVA Results

	Sum of Sq.	df	Mean Sq.	F	Sig.
Between Groups	25127	9	2792	2.38	.014
Within Groups	243895	208	1173		
Total	269022	217			

Qualitative analysis also does not support H2. One participant states that, "'Certification bootcamps' have cheapened the effect of any IT/IS certification, in my opinion." Another respondent suggests that, "A CCNA level certification doesn't make it significantly easier to get a job since so many people have the entry level certifications." These statements suggest the inverse of H2, which is that common certifications do not have much value but do not directly address the hypothesized value of rare

certifications. Based on this, H2 is not supported, though some qualitative evidence suggests that future research should further examine the interplay between rarity and value of certifications.

5. DISCUSSION

The research question that this study attempts to address is the value of certifications for graduates from AACSB-accredited institutions. Certifications can signal aspects that are different from those of the degree. Both have value for job seekers and the best solution seems to be some combination of both education and certification. Respondents discuss how certifications can signal a continued learning beyond the classroom, and that certification can signal real-world skills to potential employers. Also, while certifications are not enough to enable job seekers to compete for some opportunities, it can be a tie-breaker when multiple well-qualified applicants compete for an interview.

This study could not differentiate the relative value of multiple certifications, which is unexpected. Based on RBV, rare certifications should provide more value; however, the only statistically significant difference in value occurs between two common certifications. In qualitative analysis, different respondents have starkly contrasting opinions. For instance, one respondent feels that the A+ is an important foundation and opens doors for entry-level positions while another respondent suggests it is worthless and should be omitted from resumes.

One potential explanation for how this seeming discrepancy can be resolved is that there may not be a certification in particular that provides value; rather, the fact that there is any certification held by the applicant provides the symbolic value needed. If the certification is about signaling continued learning, or the application of school knowledge to a real-world skill, then any certification may be as good as another. Perhaps it is more important to be certified than to be certified in anything in particular.

As more students graduate from undergraduate studies, the need to prepare students in tie-breaker situations is increasingly important. Adding opportunities to the curriculum can make students eligible for jobs that require certification, such as the DoD requirements. But even for students destined for the private sector, the certification can differentiate the graduate from the other scores of students graduating at the same time. For students graduating from high-quality programs, the signaling cost is likely to be low. Students should already understand the foundations that will be tested on an exam, giving them the opportunity to pass the certification exam with minimal extra study. And if students find themselves unprepared to pass the certification exams, it's possible that students are not retaining the information that instructors are delivering. In such cases, updating pedagogy to ensure students fully understand the topics will help improve student prospects and make university programs higher quality. In the end, certifications can become part of the assurance of learning program, though they may not rise to the level for reporting to AACSB when the certification domain only covers a few courses.

However, respondents to the survey urge caution in focusing too strongly on IT certification. They suggest that IT certification cannot substitute for a broad education because employers do not completely trust the signals sent by IT certifications. The signal that an IT certification was designed to send has been tempered in the minds of respondents for two potential reasons: boot camps and cheating.

IT certifications are a big enough business that several training providers have created intensive courses to help students cram for certification exams. In such programs, students typically live in a hotel for a week and participate in all-day classes, an experience which culminates in sitting for the exam on the last day of the training. Commonly called boot camps, these training sessions often come with a guarantee of passing the certification exams on the first attempt. Any person can join a course and learn strategies to enable passing certification exams, even when starting with no experience or formal education. Certifications do not differentiate between people with real-world experience and those with a conceptual knowledge sufficient to pass the exams. In addition, the proliferation of boot camps has led to a proliferation of certified professionals.

Another possible explanation for participants being unable to differentiate the value of certifications involves potential cheating. Individual self-interest can create challenges. This is not new. The prisoner's dilemma is a famous game where two individuals have to choose to cooperate or compete. The first player to compete (i.e. turn on the other prisoner) receives a payout while the other player gets nothing or a negative payout. If both players choose to cooperate, they each get something

smaller than the payout for competing. In cases where two players will only play against each other a finite number of times, players tend to cooperate until the last few rounds of the game, whereas with infinite (or an unknown number of) rounds, players tend to cooperate rather than compete (Selten & Stoecker, 1986). Because applying for jobs is usually a one-off process, the applicants are in the final stages of the game. As such, choosing to cooperate does not work in individual self-interest. Thus cheating to send a signal of skills one may not fully possess can provide a payoff (i.e. getting the job).

Cheating occurs with signaling in the natural world. Fig wasps estimate their own ability to win a fight based on mandible size and back away from fights they are unlikely to win; however, mandible size does not estimate success in fighting (Moore, Obbard, Reuter, West, & Cook, 2009). When a fiddler crab loses a claw, which serves the dual function of attracting mates and fighting off rivals, it grows a weaker replacement, in effect signaling an inaccurate view of the crab's fitness as a mate (Backwell, Christy, Telford, Jennions, & Passmore, 2000). These situations cause the assertion that, when the cost of assessing a signal is high but the value is low, the receiver will settle for cheaper information, making signaling systems open to cheating. In fact, research suggests that complete honesty in signaling is unlikely to occur (Johnstone & Grafen, 1993). Some organisms such as the paper wasp socially enforce the signals of quality by more aggression to cheaters (Tibbetts & Dale, 2004).

Sadly, cheating occurs in IT certifications as well. This has progressed to the point that certification agencies have banded together to form the IT Certification Council (ITCC) to combat fraud (Musthaler, 2008b). And yet fraud is shown to continue to rise (Marsan, 2011; Mitchell, 2014). It can be accomplished by using "brain dumps" that include actual certification exam questions (Brodkin, 2008), paying someone else to take the exam (Marsan, 2011), or using training from an "unauthorized third party" that was obtained either illegally or from a brain dump ("CompTIA Unauthorized third-party training sites," n.d.). Tales of cheating are rampant on social media, including unintentional cheating where a boot camp instructor passed out brain dumps as study materials, and certification agencies are using analytics to clamp down on cheaters (Brodkin, 2008; Marsan, 2011; Musthaler, 2008a).

As students enter the workforce, it is important that they have the tools to succeed. This goes far beyond simple certification. They need skills to prevent, as one respondent discussed, being sent out the same door they came in. There is a remarkable similarity between the paper wasps (Tibbetts & Dale, 2004) and certified IT professionals. When someone signals a high level of proficiency through certification, the expectations are higher. In the wasps, this means that the fraudulently signaling wasps meet more aggression than those with honest or underestimated signals of dominance. As one respondent put it, "it's how much experience you have and how well you can apply it that will keep you from being sent out the door you just came in." Lacking skills in which one is certified would indicate a mismatch between performance and the signals sent. If the students do not have proficiency, certification could be a disservice to them and their potential employers.

This leads to the caution reiterated by several participants: schools cannot afford to focus solely on the certification. Such a myopic view would rob students of what they value most: a broad education that teaches them to think carefully through problems. This equips the students to continue to succeed as the world changes and leads to long-term success. Certification can help signal skills and qualities that students possess, but it can only be one of a portfolio of signals.

6. CONTRIBUTIONS

This research discusses the value of IT certifications for graduates from an AACSB-accredited university. It demonstrates that certification has value for graduates, even if no particular certification emerges as the most valuable. This research contributes to three groups of stakeholders: the researcher, the faculty in charge of programs, and students.

For researchers, the present study applies signaling theory to certifications, extending the prior work on university education as a signal to future employers. Certifications are demonstrated to provide value, even for graduates from education. In addition, this study provides a demonstration of why mixed methods can be valuable: for H2, quantitative findings provide little support while reviewing what the participants wrote provides far more support. Ironically, some of the comments in support of the differences in certification quality come from respondents marking the relative value of the certifications as all being 0. Thus, while those respondents marked the survey with little variance or information, the free text responses provide more insight into their perceptions.

For faculty members that are in charge of programs, this study highlights that providing encouragement and opportunities for certification can help the student succeed in the job market upon graduation. Improving placements can help institutions to attract better students and satisfy stakeholders of the quality of the program. Additionally, certifications can assist in the assurance of learning. Thus, external stakeholders can also be assured of the quality of the program. But more importantly, gaps in instruction can be identified and rectified.

For students, this research indicates that investing time and money into certifications can provide value. The relative value of the various certifications remains unclear, but earning at least one certification can signal proficiency and an aptitude to continue learning beyond the classroom. The symbolic nature of having any certification may be higher than the value of any particular certification. Thus, to compete in the market, students would be well-advised to earn a certification. It may not guarantee a job, but it can be a tie-breaker in cases where multiple qualified candidates vie for the same position.

7. LIMITATIONS AND FUTURE WORK

There are several limitations which must be acknowledged. The first limitation is that this study draws from a single institution in the Midwestern United States. While the students found jobs throughout the nation, it is possible that idiosyncratic aspects of the organization can influence the findings. This is especially true as the program is relatively small. Only forty graduates were available to be included in the sample. Future work should examine that value of certifications across regions and institutions.

Another limitation is the focus on AACSB as the accrediting body. While the concepts cited from AACSB's standards apply to several accrediting bodies, the possibility of a systematic bias in institutions maintaining AACSB accreditation should not be overlooked. In fact, the idea that there is a systematic difference underpins the value of accreditation.

The final limitation is that the survey instrument focuses on ten certifications. This choice provides an instrument that fits on a single survey page online and allows participants to complete the survey in an average of three minutes. The chosen certifications cover the most commonly earned certifications, though the relative commonality between them is substantial. Respondents suggest the inclusion of CISSP and project management certifications in future surveys. While CISSP was indeed included because it is an $(ISC)^2$ certification, and project management is most commonly associated with Project Management Institute (PMI), respondents didn't seem to recognize those nuances.

While this work theorizes the value of certifications from a signaling perspective, it is possible that a different theoretical lens could provide value as well. Future work should look at the value of certification for graduates from multiple theoretical perspectives to build a richer understanding of the interactions of value between certification and degrees.

8. CONCLUSIONS

Students of traditional four-year IS programs benefit from earning IT certifications. This benefit appears to stem from the signals that earning certification sends to potential employers. The relative value of individual certifications may not be as important as the general signals of an ability to learn outside the classroom. Program directors should consider providing opportunities for students to become certified to give graduates an advantage in the job market. Certifications can provide an assurance of learning for classes, sequences of classes, and programs.

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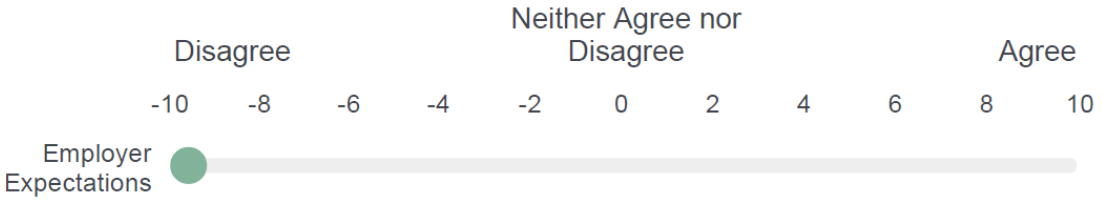
Editor's Note:

This paper was selected for inclusion in the journal as an EDSIGCon 2016 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 2016.

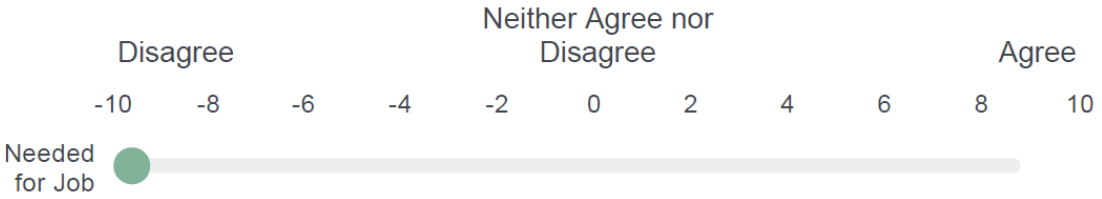
Appendix 1: Survey Instrument

We are considering changing our IS curriculum so that students can earn IS/IT certifications along the way to graduation. We would appreciate your help in answering the questions below about why a student should (or should not) work toward these certifications while also working on their degrees. Thank you for your time and help.

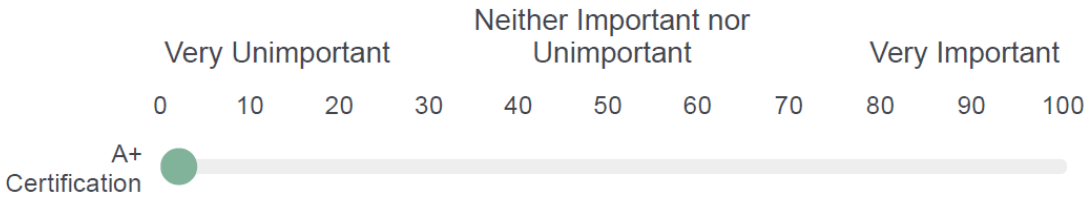
Employers expect that their IT/IS employees will have certifications when they are hired.



Industry certifications will help recent graduates to get a decent IT/IS job.

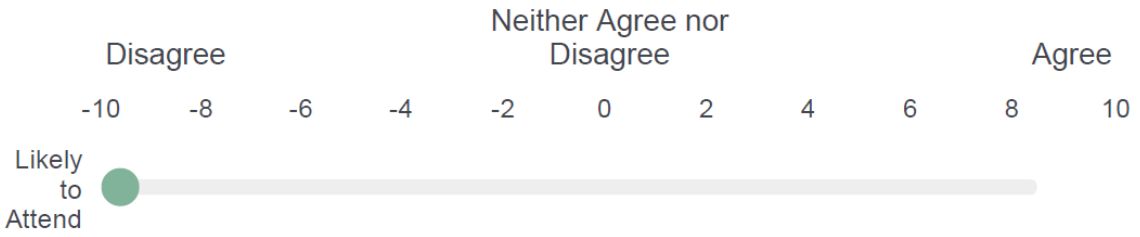


How important is each of the following types of computer certifications in your workplace?



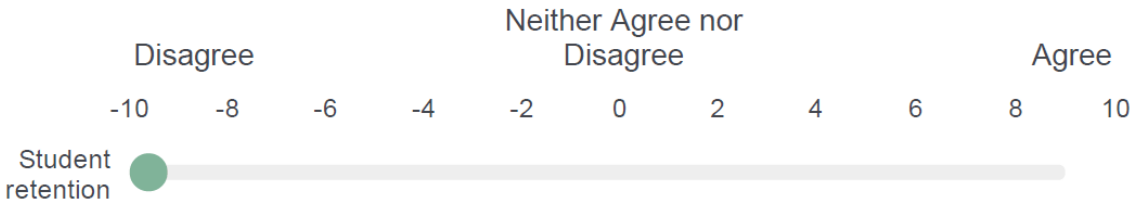
If you answered "Other" please indicate which types of IT/IS certifications you would deem important.

Students will be more likely to attend a university if they know that they will receive useful IT/IS certification training as part of their major curriculum.



I would be more likely to recommend a university to a student if I knew that they will receive useful IT/IS certification training as part of their major curriculum.

Students will be more likely to stay in their chosen IT/IS major if they have the opportunity to accomplish certifications while earning their degree.



If you have any other recommendations or comments about IT/IS certifications and the curriculum, please comment here. Thank you for your time and help.

Programming in the IS Curriculum: Are Requirements Changing for the Right Reason?

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Abstract

All curricula for any given academic discipline evolves over time. This is also true for the Information Systems (IS) model curriculum. Curriculum evolution is driven by several factors, such as changes in technologies, industry shifts to meet customer needs, and perceived student deficiencies. One outcome of such factors has been a change in the entry point into the IS major due to the perception that IS majors need a different method of entry from other computing majors (e.g., Computer Science (CS)). The current entry point for many IS majors is a programming course, often taken by a variety of majors. This paper addresses the question: is there a difference in performance in this initial programming course for students of different majors? More precisely, does major differentiate performance in the first programming course, such as CS1? The data clearly show this is not the case when there is a level playing field. The paper demonstrates that non-computing majors perform as well as computing majors given equal preparation. It is a misconception that changes to the IS curriculum are necessary when based on the belief that IS majors, as compared to other computing majors, need a different entry point. The data presented in this paper suggest the underlying presuppositions for IS curricular changes are misguided – supporting the need for preparation prior to a first programming course.

Keywords: IS Model Curriculum, CS1, Prior Programming Experience, Student Success

1. INTRODUCTION

Identifying which learning units to require in a curriculum is always challenging; and getting it "right" often takes several iterations. These learning units ultimately are linked directly to courses that are offered at an institution. Model computing curricula (Computer Science (CS), Information Systems (IS), and Information Technology (IT)) are no exception to this process, and evolve through several iterations prior to acceptance by the computing community.

The IS model curriculum has gone through several revisions; the 1997, 2002 and 2010 model curricula are examples of recent editions with significant changes. The reason for these changes are often linked to changes in

technologies, attempting to meet new requirements that industry places on new IS graduates and other related factors. "All aspects of the global computing field continue to face rapid and frequent change. As a result, university-level Information Systems curricula need frequent updating to remain effective." (Topi, Valacich, Wright, Kaiser, Nunamaker, Sipior, & de Vreede, 2010).

An important characteristic in the development of any model curriculum is the assumptions that are made about the student's ability to succeed in the initial set of programming courses, which are often at the beginning of the major. In this paper, this is referred to as the entry point into the major. This is an important feature for any curriculum, since the depth of knowledge within a major is dependent on where a student begins required coursework. If the entry point for a model curriculum programming sequence assumes a too-high level of preparation for the typical student, then a high failure rate occurs in these initial classes. In this scenario, capable students are not prepared to take these initial courses. If, on the other hand, an entry course begins with material already known by the typical student, then there is little to gain from these initial courses, and the depth of knowledge that can be obtained by a four-year degree has been decreased due to wasted time in those initial courses. Getting this entry point "right" is difficult, since students come from diverse backgrounds and have different skill sets.

The problem is further complicated in that many of these initial courses are populated by students that are not in the major. Subsequently, instructors are faced with teaching students with a wide range of interests and goals for the course.

2. BACKGROUND

Woszczynski, Haddad, & Zgambo (2005) reported that "IS students continue to struggle to complete the programming courses often required in their course of study," stating an observation held by many IS faculty. They go on to describe the need to inform IS faculty of the factors that contribute to success in programming courses in order to help advise students with course selection. Their methodology was to survey IS educators asking them what factors they believe predict success in programming principles courses.

It seems this is a case where the IS and CS worlds have not kept pace with each other's insights. As early as 1968, computer scientists were examining factors that contribute to success in programming courses (Bauer). Since then, several factors have been investigated: gender (Byrne & Lyons, 2001), learning style (Allert, 2004), abstraction (Bennedsen & Caspersen, 2006), and math and science background (Bergin & Reilly, 2005).

The one significant factor identified in several studies is prior programming experience. Kersteen, Linn, Clancy, & Hardyck (1988) discovered that the "amount of prior computing experience was found to predict course performance for males", but that females generally had little prior computing experience, and what little they did have, had no effect on course grade. Taylor & Mounfield (1989) found that "high school computer science as well as prior college computer science coursework were found to be significant factors in the success rate". Later Taylor & Luegina (1991) found "students who arrived from high school without some computer science preparation were at a great disadvantage." In a follow-up study Taylor & Mounfield (1994) found that prior computing experience for females specifically did help their performance: "The results show a significant correlation between early prior computing experiences and success by females." The pattern is clear that prior programming experience has a positive influence on the grades in early programming courses such as CS1. Another recent study found that even with the addition of new pedagogies "they have not yet leveled the playing field based on prior experience" (Alvarado, Lee, & Gillespie, 2014). While these conclusions appear to be self-evident, little interest has been exhibited for a change in the entry point for the first programming course in Computer Science programs. This ignores the differences in prior knowledge, leaving those with no prior programming experience to catch up on their own.

Only one study looked specifically at IS students, (Zhang, Zhang, Stafford, & Zhang, 2013), and they corroborated the findings of the CS community: "students' current programming skills, prior programming experience, and grade expectations are significant antecedents of learning performance". Further, there were no studies that looked specifically at the performance of non-Computing majors in CS1.

3. THE PROBLEM

The entry point for all computing majors at our institution is an introduction to programming course using Java, commonly referred to as

Computer Science I (CS1). There is a growing belief at many institutions that CS1 is not a valid entry point for IS majors. This belief is based upon an assumption that IS majors do not do as well in a CS1 course compared to CS majors. This paper dispels that assumption. Further, this paper shows that non-majors within CS1 do as well as their computing counterparts if they are adequately prepared. The methodology of this study was to evaluate all four sections of a first programming course during the same semester by comparing student success with prior preparation. For the purposes of this study, success is defined using final course grades where a B- or above is considered successful.

Students in each class were given a brief survey asking about their prior experience with programming. The possible answers were: None, Self-Taught, High-School, College Course, or repeat of this class. When students checked multiple options, the most recent one was recorded (e.g. High School and College Course would have been coded as College Course). Out of 133 students, 105 answers were given for a response rate of 79%.

The students were divided into three groups: Computer Science majors, Information Systems majors, and non-Computing majors. The following major hypotheses reflect this grouping and for each hypothesis there are five tests evaluating each of the five survey answers.

1) Are CS majors more successful than IS majors in the first programming course?

> *H_1: The percentage of CS majors with a grade of B- or higher in the first programming course will be different, regardless of prior preparation, when compared to IS majors.*

2) Are CS majors more successful than non-Computing majors in the first programming course?

> *H_2: The percentage of CS majors with a grade of B- or higher in the first programming course will be different, regardless of prior preparation, compared to non-Computing majors.*

One might argue that CS majors, regardless of their level of success, are more prepared for a first programming class, thus the following hypotheses:

3) Are CS majors more prepared than IS majors for a first programming course?

> *H_3: The percentage of CS majors will be different, regardless of prior preparation, when compared to IS majors.*

4) Are CS majors more prepared than non-Computing majors for a first programming course?

> *H_4: The percentage of CS majors will be different, regardless of prior preparation, when compared to non-Computing majors*

Finally, some might suggest that there is a significant difference in prior preparation that leads to success in the first programming course, thus the final hypothesis:
5) Are successful students, regardless of major, more prepared for a first programming course?

> *H_5: Based on prior preparation, the percentage of students with a grade of B- or higher in the first programming course will be different from those with a grade below B-.*

Statistical Methodology

For each of the five hypotheses, the null hypothesis will be accepted or rejected using the significance level of .05. To compare two independent groups based on binary variables, most statistics guidelines suggest using the chi-square test of independence as long as the sample sizes are large enough. Sauro and Lewis (2008) contend, however, that the "latest research suggests that a slight adjustment to the standard chi-square test, and equivalently to the two-proportion test, generates the best results for almost all sample sizes" (p. 75).

To determine whether a sample size is adequate for the chi-square test, calculate the expected cell counts in the 2x2 table to determine if they are greater than 5. When the values in this study met this test, the chi-square test results were used. When the values of one or the other of the subgroups did not meet this test, the N-1 chi-square test was used. The formula for the N-1 chi-square test (Sauro and Lewis, 2008) is shown in the next equation using the standard terminology from the 2x2 table:

$$\chi^2 = \frac{(ad - bc)^2(N-1)}{mnrs}$$

When the values for both groups in the study failed to meet the threshold, the more

conservative Fisher Exact Test was used. The formula for this test is also given by Sauro and Lewis:

$$\rho = \frac{m!\, n!\, r!\, s!}{a!\, b!\, c!\, d!\, N!}$$

Test Results

Hypotheses are supported when the null hypothesis is rejected. In this study, the null hypothesis is rejected when there is a statistically significant difference between the proportions represented by $p<.05$. The first hypothesis (H_1) is rejected for all categories of prior preparation except those who answered "None." There is a significantly higher percentage of successful CS majors (23%) who had no prior programming experience. All successful IS majors in this sample had some type of prior experience.

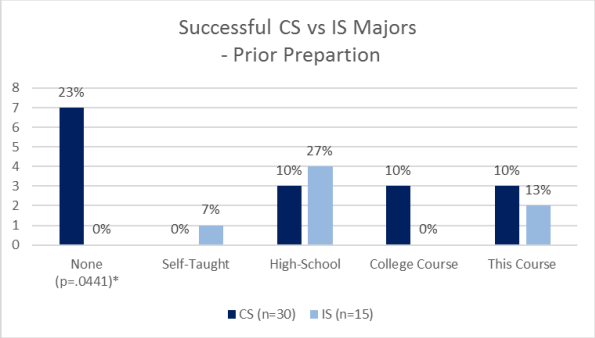

Chart 1.0 – Successful CS vs IS

The second hypothesis (H_2) is also rejected for two of the four categories of prior preparation. There is a significantly higher percentage of successful non-Computing majors (17%) taking the first programming class who had previous High School programming experience. There is also a significantly higher percentage of CS majors (10%) who are re-taking this first programming course compared to non-Computing majors.

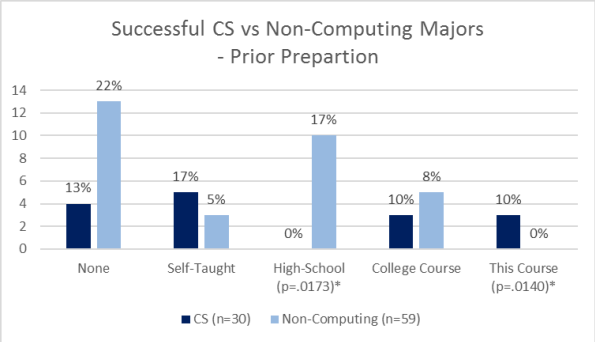

Chart 2.0 – Successful CS vs non-Computing

When comparing all CS majors to all IS majors, the third hypothesis (H_3) is also rejected for all categories of prior preparation except for those who answered "High School." There is a significantly higher percentage of IS majors (40%) who had prior programming experience.

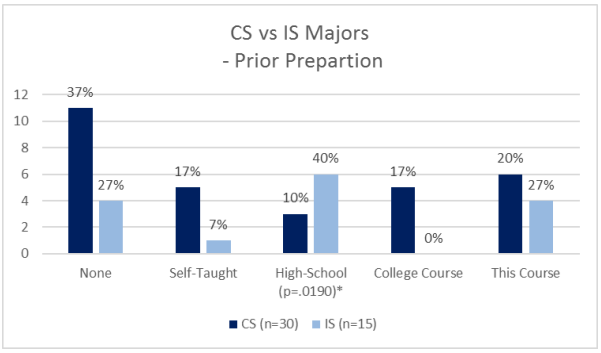

Chart 3.0 – All CS vs IS

The fourth hypothesis (H_4) is also rejected for all categories of prior preparation except for those who are re-taking this course. There is a significantly higher percentage of CS majors (20%) who had taken this course before.

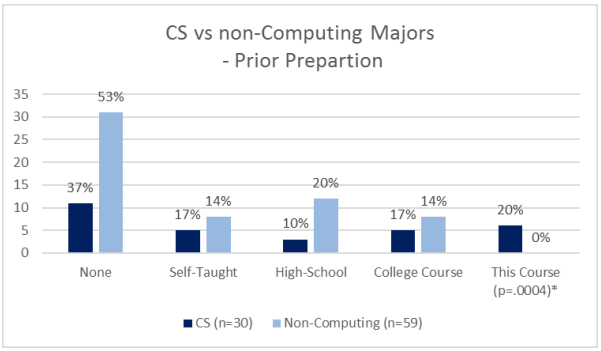

Chart 4.0 – All CS vs non-Computing

When combining all students who earned a B- or above, the fifth hypothesis is rejected for all of the categories of prior preparation except one – those who answered "None". There is a significantly higher percentage of students who earned less than a B- (57%) who had no prior programming experience.

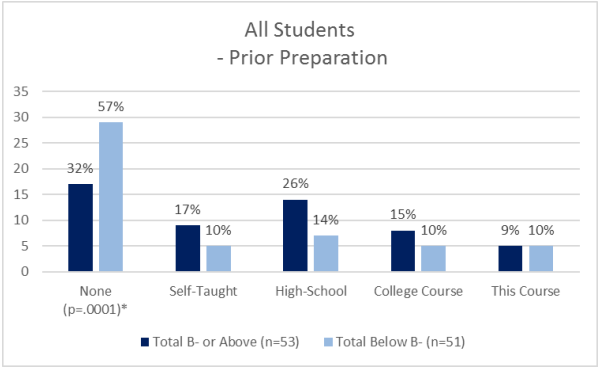

Chart 5.0 – Successful vs Unsuccessful Students

4. DISCUSSIONS AND CONCLUSIONS.

A summary of the study results is that; there was no difference in the success of students based on their declared major, and perhaps most importantly, programming experience prior to an introductory course improves the level of success. The results of this study match and confirm earlier research indicating prior programming experience is the primary predicting element for successful completion in an introductory programming course. While on its face value, this seems like a simplistic conclusion, the data show a large portion of students in an introductory programming course (CS1) have already had some exposure to programming. This creates the dilemma that instructors must find a starting point common to the majority of the class. This often leaves the minority group of students with no prior programming experience to fend for themselves. This begs the question if these "introductory" courses are truly an introduction to programming.

Anecdotal observations of curricular changes indicate that CS and IS programs have reacted differently to this challenge. Many IS programs simply reduced or eliminated programming courses, evidenced by changes in the IS2010 Model Curriculum. Introductory programming courses in CS programs often evolved to the point where prior experience was assumed. Both of these evolutionary changes may have had a negative effect on the career preparation of graduates.
The data from this study suggest that all incoming CS and IS majors should have some kind of prior programming experience, whether through self-study or through a high school or preparatory programming course. In many disciplines this is the case as math, science, and foreign languages are included in almost all high school curricula, but computing programs (e.g. AP CS) are rarely offered, much less required, in high school. Even so, these disciplines also provide remedial courses for those students who do not have the assumed background, with varying policies on if or how these courses count toward a particular degree. It could be argued that in many programs, such as MIS majors in business schools, the solution to this lack of experience led to the elimination of programming altogether, and in many computing programs, the entry point evolved to the detriment of those without experience.

At a time when industry demand for computing talent, specifically programming talent, is far outpacing the output of university level graduates, this evolution of curricular changes could have a detrimental effect on the number of computing graduates. Thus, finding a solution is imperative. From a curriculum standpoint, these findings should be incorporated into specific expectations of incoming students and that a remedial level, truly introductory course in computing concepts and programming principles be incorporated as it is critical to improving the success rate of computing students.

5. FUTURE WORK

First, this pilot study has confirmed earlier research recommending that prior programming experience is critical to the success of computing majors. Second, the research at GVSU established that this is true for all students taking a first programming course, regardless of major. This study needs to be extended with additional data from other institutions, including a variety of computing majors taking the first programming course. Furthermore, additional data is necessary to determine which type and/or amount of prior programming experience may more influential in student success. The authors are seeking collaborators to continue this research in both areas.

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Towards Improved Student Experiences in Service Learning in Information Systems Courses

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Abstract

The paper explores relevant past research on service-learning in Information Systems courses since 2000. One of the conclusions from this is that most of the publications are not founded on specific theoretical models and are mainly about sharing instructor or student experiences. Then several theoretical frameworks from Education and other disciplines and their relevance for service-learning are analyzed. As a result, several directions for future research towards improvement of service-learning in IS education are proposed.

Keywords: service-learning, IS education, experiential learning, active learning.

1. INTRODUCTION

Service-learning is an educational approach that balances formal instruction and direction with the opportunity to serve in the community in order to provide a pragmatic, progressive learning experience (Bringle & Hatcher, 1995). The recent interest in service-learning (SL) has been strengthened by the work of national organizations interested in combining service and education such as Campus Compact, American Association for Higher Education, Council of Independent Colleges, Council for Adult Experiential Learning and The National Center for Service-Learning and the Partnership for Service-Learning.

Academic programs in the Humanities like psychology, education, sociology, social work, nursing and many others have a well-established record of research and implementation of service-learning (see Welch,2002 and others). Service-learning is increasingly applied in business disciplines as well (Andrews, 2007). That paper summarizes conceptual and general business research on service learning. The author suggests that theoretical work on SL can be linked to institutional characteristics, instructional methods, personal development or learning outcomes. An overview of applications of service learning in business core areas is presented but there is no reference to any publications related to SL in Management Information Systems (see Andrews, 2007).

Several papers appearing at the start of this century pointed to the relevance of service-learning in Information Systems (IS) programs and the opportunities for practicing it (Lazar & Lidtke, 2002; Hoxmeyer & Lenk, 2003; and others). A general conclusion from them is that service-learning is applicable in the information systems discipline.

There are quite a few papers on service-learning in Information Systems published after 2003 including Preiser-Houy and Navarette (2006), Wei, Siow & Burley (2007), Petkova (2012), Chuang and Chen (2013) and others. However, they focus mostly on descriptions of experiences without attempting to systematically generalize findings and present a structured view and understanding of the process of SL. While there are considerable number of publications on SL and tradition in the use of experiential learning in the disciplines of Information Systems, Computer Science (CS) and Information Technology(IT), service-learning has not taken yet the place it

deserves in them. Part of the reasons for that are associated with the lack of a sufficiently comprehensive approach to guide the design and implementation of SL courses in IS or CS.

The *goal of this paper* is to propose a set of research directions on service -learning that can deliver improved student experiences in an IS program. Its contribution is in linking of several general theoretical concepts in education that have been applied before to SL research to possible future investigations on their application to SL in Information Systems. This work is part of a larger project on analysis and improvement of service-learning in an IS program. The paper proceeds with a brief review of past publications on service-learning in Information Systems, followed by an analysis of models and frameworks for service-learning in other disciplines and concluding with the proposed directions for research and practical work towards a comprehensive framework for design and implementation of service-learning student experience in Information Systems courses and improved student learning experience through SL.

2. BRIEF REVIEW OF PUBLISHED PAPERS ON SERVICE-LEARNING IN THE DISCIPLINE OF INFORMATION SYSTEMS

The following literature analysis is structured mainly according to the type of courses in which service learning was applied in the IS discipline. It does not aim to provide an exhaustive review of IS service learning publications but to identify relevant representative research in that area.

Rathshwohle (2000) provides some of the first accounts of service-learning in Information systems courses. In his paper the author describes the work on several web development projects with community partners as part of an introductory IS course. Another paper by the author illustrates how students in an introductory IS course at the University of San Diego serve as mentors of high school students in their computing classes which is a unique example of service-learning in IS from the literature that was studied (see Rathshwohle (2003).

A similar type of service learning experiences of students in an introductory IS course at a Jesuit university based on the Ignatian Pedagogical Paradigm of context, experience, reflection, action and evaluation is presented by Tellis and Campbell (2004). In some cases students taught high school students or other members of a local community including large percentage of immigrants or simply helped them gain more confidence with the use of computers.

Preiser-Houy and Navarette (2006) analyze student learning and transformation of the students into engaged and active learners through a community-based research project in a web-based systems development course. Their work is valuable for the identification of the student learning outcomes at various stages of the project and for the formulation of ways in which SL complements the technical aspects of software development technical skills.

The development of a web portal for a non-profit organization is the focus of the custom designed interdisciplinary course "Community Empowering through Information Systems and Technology", described by Lawler and Joseph (2009). Lessons learned from SL in IS are presented in Lawler & Li (2005). In both cases the findings of the authors indicated improved student engagement, better results for non- IS students and higher learning. In addition, there was improvement in the pedagogy of instructors in information systems initiating interesting projects in service learning.

Further examples of undergraduate pre-capstone service-learning experiences in web development and database classes are provided in Citurs (2009). That paper provides also well researched argument for the alignment of service learning components in IS classes with the goals of liberal arts education and discusses issues of improving student engagement through SL.

Saulnier (2003) shares his students' SL experiences in a Systems Analysis and Design course. He concludes that the students in such a course should have not only the professional skill sets but also they should understand the civic responsibility associated with being educated corporate and community citizens as those factors contribute to significant learning that provides lasting change. Those ideas are further developed in Saulnier (2004) and are enhanced with some strategies for involving faculty in service learning teaching. Saulnier (2004) discusses also the theoretical background of service-learning, its applicability to the discipline of Information Systems and the suitability of different Information Systems courses to service-learning projects.

Student SL experiences in systems analysis and design and software engineering are also studied in Lennox (2009) and Chuang & Chen (2013). In both papers are provided reflections on how SL affects the course structure, what is the response of the university community partners and on

student learning. The lessons learned from applying SL for over 10 years in Database design, systems development, accounting information systems and e-commerce are summarized in Hoxmeyer & Lenk, 2003.

The instructor and student experiences in project management courses are discussed by McCoy & Wimer (2010) and Petkova (2012). The nature of projects in the first paper is diverse, ranging from web development to implementation of databases and networks. Petkova (2012) combines elements of the approaches suggested in Wilcox & Zigurs (2003) and Wei, Siow & Burley (2007) in a pre-capstone project management course with projects for non-profit organizations and small businesses.

The need to include SL in Information Systems courses and especially in the capstone integrative projects and the problems related to them are analyzed in Reinicke and Janicki, 2007. The paper provides useful insights in the concerns of the clients including difficulty in formulating requirements and lack of funding as well as the management of the client-developer relationship in SL projects.

A conclusion from the above analysis is that while some authors relate their service-learning experiences to particular pedagogical principles and frameworks (e.g. Saulnier, 2004; Citurs, 2009; Abrahams & Singh, 2010), most of the papers on service-learning in Information Systems simply aim to share educational experiences and to promote interest toward community engaged service- learning in the academic community. Hence the need for a more detailed analysis of different models, frameworks and approaches to service-learning that is going to be presented in the next section.

3. ANALYSIS OF MODELS, FRAMES AND APPROACHES RELATED TO SERVICE-LEARNING AND THEIR RELEVANCE FOR IMPROVEMENT OF SERVICE LEARNING

Most of the following models related to SL are from education and other disciplines and one is from the IS field (Wilcox and Zigurs (2003).

On Models/Types of Service-Learning

According to Heffernan (2001), there are six models for Service-Learning: (1) "Pure" Service-Learning, (2) Discipline-Based Service-Learning, (3) Problem-Based Service-Learning (PBSL), (4) Capstone Courses, (5) Service Internships and (6) Undergraduate Community-Based Action Research.

Adhering to this classification, only two of the examples listed in the previous section, namely the ones by Ratshwohl (2003) and Lawler and Joseph (2009) represent "pure" service-learning. The model of "pure" service-learning is rather suitable for interdisciplinary courses and courses within the humanitarian disciplines.

Most of the service-learning experiences reported in the IS literature are a mixture of Discipline-Based-Service-Learning, where "students are expected to have a presence in the community throughout the semester and reflect on their experiences on a regular basis throughout the semester using course content as a basis for their analysis and understanding" (Heffernan, 2001) or Problem- Based Service-Learning, in which the students' role is explained by Heffernan (2001) as "consultants" working for a "client". When offered in the final year of a program and drawing upon knowledge and skills obtained from all other courses in this program, combined with relevant community service work, the service-learning experience is classified as a "capstone" experience.

Although very relevant to information systems education, and widely represented in the literature, Service Internship as a model of service-learning is outside the focus of this paper and will not be discussed here. The last model of service-learning, Undergraduate Community-Based Action Research, which is somewhat similar to an independent study if it involves active engagement of a student with the subjects of his/her study, is a relatively new approach for IS education and to the best knowledge of the author there are no published examples in IS or CS of this type of service-learning.

The influence of Bloom's Taxonomy of Learning and Kolb's Experiential Learning Model

The widely popular Bloom's taxonomy of learning (Bloom et al., 1956) in its original form is shown in Fig.1. It is used by many educators today to promote active learning, to set up learning objectives and to assess the learning achievements of their students.

In the subsequent improved version of Bloom's taxonomy (see Krathwohl, 2002), the six hierarchical levels of learning-knowledge, comprehension, application, analysis, synthesis, and evaluation are transformed into Remembering, Understanding, Applying, Analyzing, Evaluating and Creating (see Fig.2).

Fig.1. Bloom's Taxonomy- original version (based on Bloom et al., 1956)

The modified naming of the levels of student learning in Krathwohl (2002) is probably more suitable for reflecting on the sophisticated learning processes taking place in the information systems classroom. More empirical evidence is needed however to justify that conclusion.

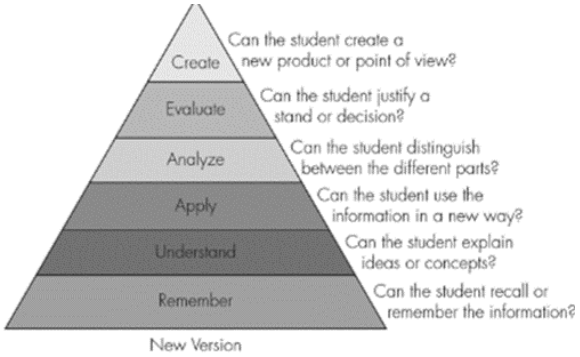

Fig.2. Bloom's Taxonomy- new version (after Krathwohl, 2002)

Since service-learning is a subset of experiential learning, it is not possible to understand the processes of service-learning without considering Kolb's experiential learning model (Kolb, 1984). In this model, students obtain real, concrete knowledge (defined also as learning by feeling), observe and reflect on their experience (learning by thinking about what was observed), generalize what they learned through abstract conceptualization (learning by thinking), and actively experiment in new situations (learning by doing) (see Fig.3).

By following Kolb's experiential learning model instructors can design service-learning projects that could help the information systems students to move successfully into handling tasks at the highest advanced levels of Bloom's taxonomy and to be ready for employment in the real world.

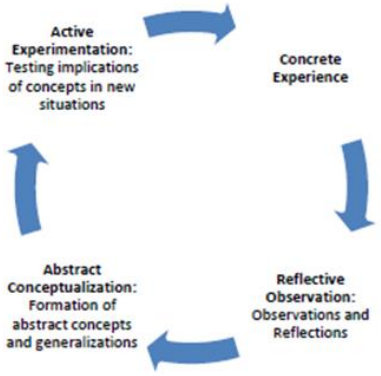

Fig. 3. Kolb's Experiential Learning Model (after Kolb, 1984)

Some of the authors mentioned in the second section of the paper position their theoretical understanding of service-learning pedagogy on Bloom's Taxonomy and Kolb's Experiential Learning Model (Citurs, 2009; Abrahams &Singh, 2010; Petkova, 2012; Chuang & Chen, 2013) and roughly follow the four steps (phases) of Kolb's model in their analysis.

In a few cases authors move a step beyond following the original model and modify it in order to make it more suitable for the purpose of designing service-learning courses. For example, borrowing ideas from Kolb (1984), and based on their e-Commerce service-learning course, Abrahams and Singh (2010) propose a replicable model for experiential learning (see Fig.4).

Fig.4. A Replicable Experiential Learning Cycle for Information Technology Students (after Abrahams & Singh, 2010)

The model facilitates attainment of the learning levels defined in Bloom's Taxonomy and consists of six steps: Identify, Assess, Deploy, Implement, Evaluate and Revise. Documentation and Project

Management are important in every step and they are also included in Abrahams &Singh (2010) model.

Although good for understanding of the basic pedagogical principles of service- learning, Kolb's model of experiential learning and Bloom's Taxonomy are not sufficient to be used on their own as tools for design of service-learning projects. The complexity of the learning environment requires the inclusion of additional elements in the models explaining student learning through SL.

Inclusion of Roles, Techniques and Deliverables

Wilcox and Zigurs (2003) borrow concepts from agile methodologies for systems development projects and apply them to the field of service-learning in order to create a new service-learning method. Their method includes phases, techniques, deliverables, roles, and an underlying philosophy.

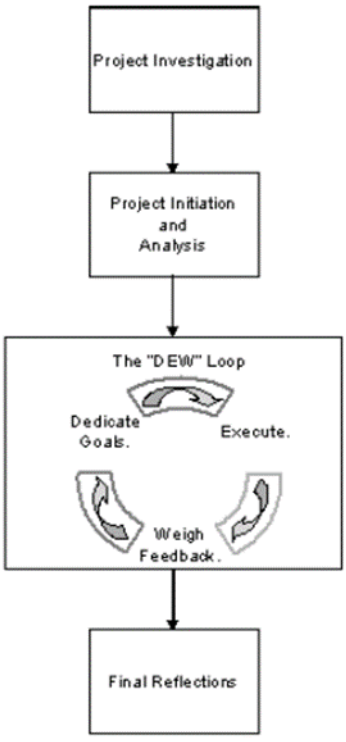

Fig. 5 Phases of a Method for Service-Learning Projects (after Wilcox & Zigurs, 2003)

The Wilcox and Zigurs method consists of four phases: Project investigation, Project initiation and analysis, "DEW" loop (dedicate goals, execute and weigh feedback) and Final reflections. In any educational situation stakeholders are very important, but in service-learning apart from students and instructors, the community has also a significant role. This is why the explicit underlying philosophy of the proposed method for service-learning is that the stakeholders drive the process and success of the project.

Wilcox & Zigurs (2003) provide also examples of possible techniques and templates to be used in the different phases of SL projects and their deliverables (the results of carrying out of various techniques). They point however that their work which is based on established processes in the field of Information Systems, it is not tested in practical projects.

Inclusion of Communication Flows

Wei et al. (2007) improve on the Wilcox & Zigurs method of service-learning by including communication channels and information interchange between the students, educators and clients' community (see Fig. 6). The authors of this paper identify the following information and communication channels:

1. Educators design content and provide structured reflection opportunities
2. Students think and conceptualize knowledge
3. Educators contact clients for feedback
4. Clients send feedback to educators about students' performance
5. Students work with the community/clients
6. Clients provide requirements details and feedback to students
7. Educators coordinate students and clients

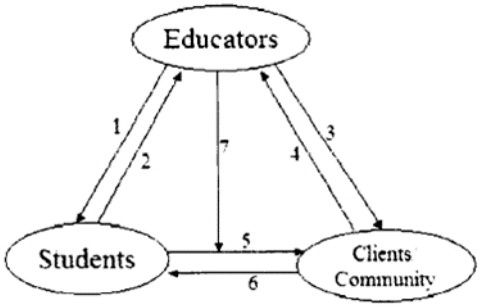

Fig. 6 Information and communication channels between students, educators and community (after Wei et al., 2007)

Critical success factors for service-learning in IS courses have been identified by Wilcox & Zigurs (2003) and Lawler (2011). There is an opportunity to explore further how these are manifested in different educational projects.

The above overview of several relevant frameworks from education and IS and their application to SL research in Information Systems can be used for the generation of research directions to improve student experiences in service-learning in Information Systems discussed in the next section.

4. ON POSSSIBLE RESEARCH DIRECTIONS ON SERVICE-LEARNING IN INFORMATION SYSTEMS PROGRAMS

The previous analysis of service-learning in IS education was mainly concerned with course level evaluation of SL. It seems that dedicating to service-learning just one or two courses in an academic program will not provide the needed transformation of IS education towards greater role of service-learning in improving student engagement and learning. Another conclusion is that a single experiment of a new idea on service-learning in IS at a particular university is not sufficient to transform SL in an academic program or the discipline of Information Systems. Hence the motivation for the following possible directions for research on service-learning in IS education and practical steps towards improved student experience:

- What kind of model/type of service learning in Heffernan's (2001) typology is better suited to different IS courses on the basis of delivered improvement of the measured quality of student learning?
- Drawing on the interactive nature of the relationship between software developers and clients, there is potential to study service learning in IS projects through the action research model (see Baskerville and Wood-Harper, 1996). This requires the careful archiving of cases and gathered evidence on the usefulness of applying Action Research in SL in IT educational projects.
- Gather evidence on the effectiveness of the new form of Bloom's taxonomy of learning (see Krathwohl, 2002) for promoting better service-learning in IS courses.
- Analyze empirical evidence on various forms of documentation of students' concrete experiences in SL courses related to the stages of Kolb's learning cycle (see Kolb, 1984).
- Gather and analyze empirical evidence on the effectiveness to SL in IS courses of any modifications of Kolb's learning cycle, including the replicable experiential learning cycle of Abraham & Singh (2010).
- Compare the effectiveness in IS education of the replicable experiential learning cycle of Abraham & Singh (2010) and Kolb's learning cycle.
- Explore and propose ways for documentation of evidence on student learning in IS education not just in single courses but at program level as well through appropriate assessment methods for student-learning at program level.
- Gather empirical evidence on the effectiveness of applying the SL method proposed by Wilcox & Zigurs (2003).
- Develop ways that extend any approaches for measuring the impact of SL in individual IS courses to the broader problem of assessing the impact of SL on IS programs.
- Test further the knowledge on critical success factors for service-learning in IS courses as formulated by Wilcox & Zigurs (2003) and Lawler (2011) in new courses exploring various stakeholder characteristics and technologies.
- Encourage the conducting and reporting of results of confirmatory studies replicating the findings of published works in SL in IS education.
    - Archive in an online accessible repository reference details on published research on service learning in IS/IT education.
- Organize special streams on service-learning in IS education at specialized IT conferences and seek further ways for institutionalizing research on SL in IS education within the IS and related computing disciplines.

The above research directions are quite broad in nature but they can be flexibly modified within the environment of a particular academic program if necessary and through the cooperative efforts of communities of IS educators across different existing professional societies.

5. CONCLUSION

The paper was motivated by the lack of comprehensive frameworks guiding the design and implementation of service-learning courses in an Information Systems program. It provided an overview of the relatively scarce previous published research on SL in IS education and on relevant theoretical models or frameworks from Education that were proposed in the past to support service-learning. As a result a set of

research directions on SL in information systems was proposed. They are probably too ambitious for a single researcher or a small group of IS educators in an academic department but they require cooperation through professional societies and beyond. That may not be impossible given the noble goal that is pursued – improved student experiential learning in Information Systems. The proposed research directions require coordinated effort by many individuals in small realistic steps towards the improvement of SL in Information Systems education.

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