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Journal Profile

The *Journal of Research in Business Information Systems* (JRBIS) is a national refereed publication published annually by the Association of Business Information Systems. This refereed journal includes articles from fields associated with business information systems focusing on theory, problems associated with information systems and information resources in education, business and industry, government, and the professions.

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All manuscripts must be submitted electronically in Microsoft Word format. Manuscripts, citations, and references must use the style format of the 2010 *Publication Manual of the American Psychological Association* (6th edition).

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- Times New Roman, 12 font-size text within article
- Bold and center primary headings, with major words capitalized
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- No footnotes or endnotes
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Tables and figures may have varying font sizes (but must adhere to APA Style). Include tables or figures formatted and placed correctly within the manuscript.

Include the References page (Works Cited only) at the end of the manuscript, followed by any appendix information, if necessary.

All submissions will be reviewed by the editor and two reviewers, using a blind-review process. Authors will receive feedback 6-8 weeks after the initial peer review. Manuscripts will be "accepted," "accepted with minor revisions," "possibly accepted after major revision and resubmission for further peer review," or "rejected."

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To ensure your manuscript is considered for publication in the 2013 *Journal of Research in Business Information Systems*, submit manuscript by *September 1, 2012*, to marcel.robles@eku.edu.

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Journal of Research in Business Information Systems

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Successful IT Management: Focus on Essential Nontechnical Skills

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Abstract

This research provides a model for designing a graduate communication course for Management Information Systems (MIS) majors. The course was designed based upon interpersonal, communication, and team skills identified by information technology (IT) managers in a specific job market as vital for successful IT management. Skills relating to interpersonal, communication, and team skills in one-on-one or small group contexts were most often identified as critical for IT management. Skills relating to communication in very technical settings were rated less important. The developed graduate communications course provided both MIS and MBA students an opportunity to experience problem solving in a business context via cross disciplinary teams.

Keywords: interpersonal skills, communication skills, IT managers

With the changing economy, evolving global delivery structure for information technology (IT), and the more competitive job market facing IT graduates, the IT curriculum must develop the skills that assure job placement and success. For graduates seeking IT management positions, the needed skill set is enlarged to include not only technical skills but also business, management, and communication skills (Bureau of Labor Statistics, 2010).

Background

For decades research studies have shown that employers seek students with superior interpersonal, written and oral communication, and team skills—often grouped as interpersonal or personal skills (Aasheim, Li, & Williams, 2009; Aasheim, Williams, & Butler, 2009; Aken & Michalisin, 2007; Bailey & Mitchell, 2006-2007; Havelka, D. & Merhout, J. 2009; Lee, 2005;

Litecky, Prabhakar, Aken, & Arnett, 2009; Yew, B. 2008). Many studies, such as the one by Downey, McMurtrey, and Zeltmann (2008), have found that the top rated and most critical skills for IT professionals are interpersonal or "soft skills." Wu, Chen, and Chang (2007) identified portfolios of critical skills and knowledge needed by varying managerial levels, noting the importance of both interpersonal and business components in the integrated skill sets. The literature concludes that technical skills are requisite for entry IT employment; however, managerial positions require well developed interpersonal skills for success. IS educators are challenged to assure technical curricula integrate the development of well-rounded skill sets of technical, business, and interpersonal skills. In quoting a practitioner, Ehie (2002) identified a common view regarding the need for developing strong soft skills in IT programs: "We can train our new MIS hire on the technical skills, but it is very difficult to teach him or her interpersonal and communication skills" (p. 154).

The 2010-11 edition of the *Occupational Outlook Handbook* projected the employment of computer and information systems managers to increase 17 percent from 2008-2018, growth faster than the average for all occupations (Bureau of Labor Statistics, 2010). The report indicated employers prefer applicants with a graduate degree for this position. In addition, employment prospects are best for graduates with good communication skills and developed understanding of business knowledge and processes. Ekimci and Ozkan (2009) found that IT employees ranked the following nontechnical skills as top requirements for senior IT managers: communication and coordination skills, leadership skills, and team working skills. Most published research focuses, however, on developing undergraduate IT curricula and does not indicate specific curricula for developing nontechnical soft skills in graduate IT programs, the

focus of this research. This paper describes the development of a graduate communications course designed to develop nontechnical skills needed by IT managers.

Purpose of the Study

The purpose of this research was to investigate the development of interpersonal and communication skills in a Master of Science in Management Information Systems program. To identify the nontechnical skills that are important, the research first investigated the following:

- What interpersonal problems/conflicts occur within IT departments?
- What type of interpersonal and communication skills are needed by IT managers?
- How do IT managers perceive their communication ability (written, oral) to impact their job performance?

Based on data collected from interviews and a survey of IT managers in phase 1 of the research, a graduate communication course was designed in phase 2 to develop written and oral communication skills in addition to applying theories of interpersonal and organizational communication in the workplace. The research study then assessed the content and delivery of the developed communication course:

- How do graduate students assess the value of a communication course designed to develop interpersonal and communication skills?

Procedures

The research was conducted in two phases.

Phase 1: Value of Nontechnical Skills Development

Based on the literature review, an interview guide was developed for face-to-face interviews with IT managers to determine their perceptions of specific interpersonal and communication skills important in IT management positions. Managers in five organizations in the following industries were interviewed: health care, insurance, IT service provider, shipping,

and utility. Participants were asked to assess the value of nontechnical skills and to provide specific examples of their job responsibilities and activities involving these skills.

Using this qualitative information, the researchers then developed a survey to distribute to IT managers to investigate the issue. The survey was pilot tested through administration to three IT managers and refined before official data collection.

IT managers in eight organizations were surveyed electronically. Usable responses were received from 22 IT managers in the following industries: insurance, 8 (36.4 percent); utility, 5 (22.7 percent); banking/finance, 4 (18.2 percent); healthcare, 2 (9.1 percent); government, 1 (4.5 percent); IT service provider, 1 (4.5 percent); and retail, 1 (4.5%). Respondents were 81.8 percent male and had an average of 13.36 subordinates. Managerial experience of the respondents was as follows: over 10 years, 13 (59.10 percent); 6 to 10 years, 3 (13.60 percent); 2 to 5 years, 4 (18.50 percent); and less than 2 years, 2 (9.15 percent). Overall data were collected from employees in varied industries in the university's market and employees having experience in IT management.

Phase 2: Development and Assessment of Graduate Communication Course

A graduate communication course was designed based on the nontechnical skills identified in phase 1. The course was delivered to graduate students during a summer session. At the conclusion of the course, the students completed a course assessment relating to course content and delivery.

The course as designed was taught to 29 students; 19 students completed a formal assessment of their reactions to and satisfaction with the course design and content. Student evaluation of the course consisted of the following:

- Rating of the value of specific course topics to personal and career development.

- Ranking of specific course activities/components based on importance to personal and career development as a business professional/manager.
- Extent to which the course changed business writing skills.
- Extent to which the course changed business speaking skills.
- Rating of invited speakers.

Data were analyzed based on students' degree programs (MS in MIS versus MBA) and years of work experience.

Eleven of the students were MBA students; seven were MS in Management Information Systems majors. The students had varied, yet substantial, years of work experience ranging as follows: less than 2 years, 2 (11%); 2-5 years, 5 (28%); 6-10 years, 6 (33%); and over 10 years, 5 (28%). The years of experience of the respondents—over 60 percent had 6 or more years of experience—added validity to their assessment of the relevance of the course content/design.

Results

Data collected from interviews with IT managers, surveys of IT managers, and surveys of students lead to the development and assessment of a graduate communication course focused on skill development for IT managers.

Phase 1: Interviews with IT Managers

Managers indicated that major interpersonal problems often involve conflict outside of the IT department. They suggest that IT managers must be effective in communicating across all areas of business: apply business knowledge to IT problem solving, differentiate between technical and nontechnical issues, and talk in business terms. Managers must be able to address and resolve areas of conflict with IT users, superiors, and peers. Varied examples provided included the following:

- Avoid finger pointing when miscommunication occurs.
- Control positive competition within IT.
- Deal effectively with controversial recommendations.
- Prioritize allocation of limited resources.
- Negotiate what issues "to tackle."

Throughout all interactions, the goal is to professionally represent the IT department and to provide superior customer service.

The managers indicated that basic writing skills are important for IT managers. Managers must assure appropriate media selection and content: letter, memo, email, IM, phone, and face to face. Issues of etiquette are important. In addition, communications must be appropriately adapted to the varied audiences: upper management, end users, and vendors, for example. Documents often written were identified: project outlines; technical specifications, reports, and analyses; RFPs; procedural documentation; staff development plans; and performance reviews and compliance reports.

Oral communication typically occurs in small group settings:

- Committee facilitation.
- Proposal presentations (with technical and nontechnical audiences).
- Techcentric demonstrations and training.
- Employee interviews and progress reviews.

Presentations are often PowerPoint supported.

Onsite team participation dominates team activities—project teams within IT and matrix teams across departments. Varied team skills and knowledge were identified:

- Develop and maintain team organization—team action plans, meeting summaries and assignments, documentation of deliverables.
- Facilitate meetings.
- Engage all team members.
- Facilitate decision making.
- Apply conflict resolution skills.
- Assure a culture of trust.

Interpersonal issues and conflicts often result from territorialism (IT versus user departments) and generational differences—differing work ethics, need for immediacy, and feelings of self-importance.

The mangers indicated that limited training is provided for IT managers to develop interpersonal skills. Training must be obtained from off-site seminars, advanced education, and/or online and corporate resources provided to staff.

Based on this qualitative data, the researchers developed a survey instrument to obtain input from a wider group of IT managers.

Phase 1: Survey of IT Managers

The survey respondents were asked to rate the importance of effectively performing specific interpersonal- and communication-related activities/functions. A rating scale of 1 to 5 was used, with 1 indicating "not important" and 5 indicating "extremely important." As shown in Table I, 80 percent of the activities/functions were rated as "important or higher"; 60 percent of the activities/functions were rated as "very important" or "extremely important"—rating of 4.0 or higher. Consistency was observed between the skill sets identified in phase 1 interviews and in the survey responses. The items rated as "somewhat important" or "not important" were

write procedural documentation, design training for nontechnical users, and present technical/demonstrations training.

When asked to rank the importance of the activities/functions, foster a positive culture of team decision making was ranked "1"; compose correspondence, memos, emails was ranked "2"; use presentation media (PowerPoint) was ranked "12"; present technical demonstrations/training was ranked "14"; and design training for nontechnical users was ranked last (see Table II). Thus traditional communication media (correspondence, memos, emails) were rated as highly important; use of PowerPoint of lesser importance. Training skills were rated less important.

The respondents identified various interpersonal and communication problems observed among employees and/or in working with other departments. As shown in Table III, the issues can be categorized as follows: macro business perspective, personal attitudes and relations with others, team issues, and micro communication issues.

Table I

Importance of Effectively Performing Specific Interpersonal- and Communication- Related Activities and Functions

Activities and Functions		Degree of Importance	Mean Rating*
1	deal with sensitive communication issues	68.2% extremely important	4.64
2.5	apply conflict resolution skills in the workplace	68.2% extremely important	4.59
2.5	foster a positive culture of team decision making	63.6% extremely important	4.59
4	interact formally one-on-one with subordinates on activities such as interviews, performance reviews	59.1% extremely important	4.55

5.5	serve in a team leadership position	54.5% extremely important	4.41
5.5	compose correspondence, memos, emails	50.0% extremely important	4.41
7.5	develop proposals/reports for nontechnical decision makers	40.9% very important 40.9% extremely important	4.23
7.5	present proposal presentations to nontechnical audiences	45.5% very important	4.23
9	facilitate small group meetings	45.5% extremely important	4.14
10	use presentation media (PowerPoint)	31.8% very important	3.55
11	present proposal presentations to technical audiences	59.1% important	3.64
12	develop request for proposals (RFPs)/technical Specifications	36.4% very important	3.59
13	write procedural documentation	40.9% important	2.95
14	present technical demonstrations/training	63.6% important	2.77
15	design training for nontechnical users	52.4% somewhat important	2.43

*(scale of 1 to 5, with 1 indicating, “not important,” 2 indicating “somewhat important,” 3 indicating “important,” 4 indicating “very important,” 5 indicating “extremely important”)

Table II

Ranked Importance of Effectively Performing Specific Interpersonal- and Communication-Related Activities and Functions

Activities and Functions	Mean Ranking*
1. foster a positive culture of team decision making	4.45
2. compose correspondence, memos, emails	4.86
3. apply conflict resolution skills in the workplace	5.45
4. deal with sensitive communication issues	5.64
5. develop proposals/reports for nontechnical decision makers	6.41
6. present proposal presentations to nontechnical audiences	6.55
7. serve in a team leadership position	6.73
8. facilitate small group meetings	7.00
9. interact formally one-on-one with subordinates on activities such as interviews and performance reviews)	7.05
10. present proposal presentations to technical audiences	8.95
11. develop request for proposals (RFPs)/technical specifications	10.00
12. use presentation media (PowerPoint)	10.64
13. write procedural documentation	11.50
14. present technical demonstrations/training	12.00
15. design training for nontechnical users	12.64

*With #1 being the most important activity/function to #15, the least important activity/function to an IT manager's success.

Table III

Interpersonal Problems Observed Among Employees and/or in Working with Other Departments

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Macro Business Perspective

- Lack of business knowledge/understanding
- Lack of enterprise focus
- Communication barriers among departments
- Difficulty working with business users to manage expectations in a constantly changing business environment
- Inability to set technical vision with business owners
- Lack of accountability/not taking ownership
- Hesitancy in making decisions
- Weak project management skills
- Poor time management
- Failure to communicate project priorities

Personal Attitudes and Interpersonal Relations

- Reliance on indirect or impersonal communication media
- Lack of appreciation for collaborating with others
- No understanding of the importance of personal work relationships and how they can improve performance, problem resolution, coordination, and job satisfaction
- Need to hold on to information, not share
- View their work and information as personal property
- Lack of appreciation for others' contributions
- No appreciation for the need to create good rapport
- Weak interpersonal relationships
- Selfish attitude
- Failure to demonstrate positive attitude
- Personality conflicts
- Lack of confidence in interacting with others
- Assertive behavior when dealing with others
- Tendency to speak in a condescending manner when users "don't know as much as they do"
- Competition for recognition
- Lack of professionalism
- Weak work ethic
- Tendency to obtain elevated permissions to perform a task
- No patience in career progression

Team Issues

- Limited team functioning—participation, coordination, and support
- Inability to treat team members and colleagues as friends rather than as strangers or subordinates
- Lack of willingness to compromise/be a team player

Micro Communication Issues

- Lack of communication skills
- Lack of/minimal interpersonal communication skills
- Poor overall written and oral communication skills
- Poor written communication skills
- Inability to write concise and meaningful technical documentation
- Poor oral communication skills
- Too much emphasis on quick as opposed to quality verbal and written communications
- Inability to discuss technical matters with nontechnical employees
- Not asking enough questions to understand what the user needs and politely explain to them that we will resolve their issue
- Tendency to interrupt others during meetings/discussions

Phase 2: Design of Graduate Communication Course with IT Focus

Using the analysis from the IT manager interviews and surveys, a graduate communication course was developed incorporating the following learning modules (Day & Mitchell, 2011):

- Communication for Business Managers

- Managerial Writing
  - Correspondence (direct, indirect, persuasive)
  - Short Reports
  - RFPs, Proposals

- Business Presentations
  - Informative Presentations
  - Persuasive Presentations
  - Small Group Facilitation
  - Interviews

- Theories of Communication
  - Communication Ethics
  - Nonverbal Communication

    - Organizational Culture
    - Crisis Management
    - Generation Issues
    - Persuasion
    - Immediacy

- Technology and Communication

- IT-Related Communication Theories
    - Media Richness Theory
    - Theory of Media Synchronicity

- Communicating with Vendors/Suppliers

Course project focus: Social Media

The course design was totally project-based, with no exams. The first day of class students were given all assignments; they were encouraged to design projects around the identified focus of social media to make use of required research in multiple projects. Individual and team research, writing, and speaking assignments were incorporated.

Individual case analyses/correspondence. Assigned analyses of cases (short reports) and correspondence were based on assigned cases and readings. These assignments were the basis for reviewing effective business writing practices and correct rules of grammar and punctuation.

Individual speech/critique. Each student developed and presented an informative presentation (8-10 minutes). A PowerPoint supplement and a full-sentence outline were required. A self-critique was submitted following the presentation (videotape of presentation available). An in-class practice session was required to receive credit for this assignment. Students were encouraged to select a topic related to social media for this research/presentation assignment.

Team case analysis/individual written report. A formal individual case analysis based on group analysis of a complex IT case was required. The case was a detailed description of the

handling/mishandling of an IT crisis; focus was on communication and managerial issues rather than technical issues. The team used multiple communication media for information sharing, discussions, and issue analysis—face-to-face discussion supplemented by at minimum three additional media types, such as email, online chat, blog, wiki, and twitter. Based on this ongoing team analysis, each team member drafted his or her own analysis of the issues and summation of needed action; this final analysis, based on prior team activity, was an individual assignment and could thus differ in approach and content among team members. Documentation of the ongoing communications of the group (use of various media) was presented by each student as an appendix to the written case analysis.

Group analysis and presentation. Each team developed a corporate training video outlining policy on the approved use of social media for meeting identified objectives within the organization. A project focus and specific audience were identified; an actual or nonidentified organization was selected. Specifics of the project were negotiated in class. The class decision was to develop a presentation to be delivered to the management team of the organization providing steps for appropriately integrating the use of social media into the organization (for identified purposes). As part of the presentation, the training video, designed for training employees on appropriate social media use, was "rolled out."

Individual analysis of varied media used as tools in business situations. Each student wrote an analysis of the team's experience in using multiple media types in analyzing the IT case. This analysis was based on Media Richness Theory and the Theory of Media Synchronicity.

Miscellaneous class components. The course consisted of many short in-class writing and speaking workshops. Corporate experts spoke to the class on these topics: Effective

Communication Skills in the Workplace; Crisis Management (the gulf oil spill), Interpersonal Communication Issues Relating to Generations, and Developing External Stakeholder Relations. Knowing all course assignments, the students could question the speakers regarding information that related to their ongoing projects.

Phase 2: Student Satisfaction Assessment

At the end of the course, students completed a written assessment of the course design and delivery.

Value of course topics. The students were asked to rate specific course content topics regarding value to their personal and career development. As shown in Table IV, presentation skills were rated highest, with written communication activities the lowest. Students did value the combination of course topics, as evidenced by the high ratings (3.5 or greater out of 5) of all topics except number 14 ("study request for proposals/technical specifications"). In many instances the skill sets valued by managers (Table II) did not parallel those identified by students (Table IV).

When asked to rank the value of the topics to their personal and career development as a business professional/manager, the rankings were similar, as show in Table V. Three items having different relational rankings were the following: (1) "present proposal presentation to nontechnical audience (social media integration)"—students may feel that managers overall do not often have this responsibility; (2) "study effective persuasion techniques"—students feel managers need this skill; (3) "compose correspondence, memos"—students may feel managers need this skill and yet their skill set is already developed.

Table IV

Value of Topics to Personal and Career Development

Topic	Mean Rating
1. design effective media (PowerPoint slide)	4.39
2.5 present informative presentation/training (individual presentation)	4.28
2.5 use presentation media (PowerPoint)	4.28
4. present proposal presentation to nontechnical audience (social media integration)	4.17
5. deal with sensitive communication issues	4.11
6. analyze choice/use of varying media types	3.89
7.5 foster a positive culture of team decision making	3.83
7.5 study effective persuasion techniques	3.83
9. review rules of grammar and punctuation	3.78
10. compose correspondence, memos	3.72
11. apply conflict resolution skills in the workplace	3.67
12. develop proposals/reports for nontechnical decision makers	3.50
13. review system of documentation (APA)	3.44
14. study request for proposals (RFPs)/technical specifications	2.89

Table V

Importance of Topics to Personal and Career Development as a Business Professional/Manager

Topic		Mean Ranking*
1	design effective media (PowerPoint slide)	5.29
2	use presentation media (PowerPoint)	5.56
3	study effective persuasion techniques	5.69
4	present informative presentation/training (individual presentation)	6.76
5	compose correspondence, memos	6.44
6	deal with sensitive communication issues	6.59
7	foster a positive culture of team decision making	6.94
8	apply conflict resolution skills in the workplace	7.25
9	analyze choice/use of varying media types	7.63
10	present proposal presentation to nontechnical audience (social media integration)	7.88
11	review rules of grammar and punctuation	7.94
12	develop proposals/reports for nontechnical decision makers	8.94
13	review system of documentation (APA)	9.69
14	study request for proposals (RFPs)/technical specifications	11.81

*With #1 being the most important topic to #14, the least important topic for personal and career success.

Improvement of writing and speaking skills. Students were asked to indicate the extent to which their writing and speaking skills had improved in the course using a scale of 1 to 5, with 1 indicating "no improvement"; 2, "little improvement"; 3, "some improvement"; 4, "much improvement"; and 5, "extensive improvement." The mean response for the improvement of writing skills was 3.67; for speaking skills, 3.33. When asked how the course could have been improved to help further develop writing skills, a consistent response was to increase the length of the course (the course was offered over a five-week period) or offer multiple courses. Regarding improving the course speaking component, students recommended incorporation of micro speeches of one minute to provide more practice and to provide more in-class practices with class critiques.

Evaluation of other course components. Students rated the value of invited speakers on a scale of 1 to 5, with 1 indicating "no relevance"; 2, "limited relevance"; 3, "some relevance"; 4, "much relevance"; 5, "extensive relevance." The overall mean rating of speakers was 4.08. The value of the team case analysis (using various media types for communication) received a mean rating of 3.22 (3.57 for MS in Management Information Systems students alone), and the value of the study of media synchronicity to understanding how and when to use social media to accomplish business objectives received a mean rating of 3.44 (3.71 for MS in Management Information Systems students alone), both using a scale of 1 to 5, with 1 indicating "no value"; 2, "little value"; 3, "some value"; 4, "much value"; and 5, "extensive value."

Comments relating to improving the course concerned expanding the course to three nights a week rather than two and limiting the number of topics included in the course. The suggestion to give more concrete instructions and guidance for assignments was mentioned a

number of times, though the assignments were purposely vague to allow teams to move from problem to solution using a team-developed path.

Recommendation of the course. When asked if they would recommend the course to another graduate student, 11 (61%) said, "definitely"; 4 (22%) said, "maybe"; 3 (17%) said, "no." All MS in Management Information Systems students said, "definitely."

Challenges in course delivery. A number of challenges were faced in developing and delivering this course:

- The course is a requirement in a master's program in MIS; however, MBA students elect the course. Thus topics of discussion and cases purposely related to IT topics while focusing on interpersonal and communication issues rather than technical issues.
- Students varied extensively in their communication skills, considering the range of ages and cultures represented in the program.
- This offering of the course was in the summer, with only five weeks (ten 3.45 hour sessions).
- The goal of the course was to the increase knowledge base of interpersonal and organizational communication while also developing specific communication skills, content typically requiring multiple courses for sufficient delivery.
- Few teaching materials are available for a skills-based graduate communications course; they are basically nonexistent for an IT-based course.

Yet student enthusiasm in the course was extremely high; comments on the assessment included statements such as, "the course was one of the best I have had" and "the course structure was what a graduate course should be."

Discussion and Conclusions

Overall consistency was observed between interview and survey data for IT managers regarding the importance of the identified interpersonal, communication, and team skills. Skills relating to interpersonal, communication, and team skills in one-on-one or small group contexts were most often identified as critical for IT managers. These "generalists" skills can be developed within communication courses as well as integrated throughout the curriculum. Students stated that they desire more ongoing opportunities in the curriculum to refine these skills; developing these personal skills in only one course is insufficient for skill development and transfer. Accountability for developing these skills, though, must be placed in multiple points of the curricula.

Skills in communicating in very technical settings, such as technical training and writing, were rated less important by both managers and students as needed IT managerial skills. Technical training and writing responsibilities are often fulfilled by specially trained employees, not the IT managers. Thus less emphasis is usually placed on these skill areas in graduate IT programs. The developed communication course deemphasized these skill areas.

Developing a graduate communications course with an IT focus provided advantages for both MIS students and MBA students. MIS students gain experience in problem-solving with nontechnical players, similar to the corporate environment. Participating in interdisciplinary teams, all students experienced cross-functional team dynamics—differing expectations and perspectives, potential for conflict, and opportunities for team building. In addition, MBA students became increasingly aware that IT success often depends not upon technical knowledge and skill but upon behavioral and interpersonal forces impacting the work environment. In the IT-focused graduate communication course, theory taught in IT strategy (collaboration

technology acceptance, and crisis management, for example) can be experienced in a nontechnical environment.

This research was focused on designing curricula to meet the specific needs of one job market. This approach to curriculum development can be modeled by other educators in designing courses around the needs of identified employers.

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CTRL_ALT_DELETE: Information Technology Skills of Graduates Leaving Business Schools

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Introduction

College graduates are required to exhibit varying ranges of knowledge and skills after completing their degrees. Desirable knowledge and skills needed by these college graduates will be viewed differently by all stakeholders. These stakeholders include employers, graduates, faculty, universities, departments, and current students.

Review of Literature

Coll and Zegwaard (2006) reported computer literacy as recent graduates' biggest increase in perceived importance over a ten year time period with written communication being perceived the lowest. As the initial major stakeholder in this acquisition of knowledge and skills, the graduates' perceptions of the importance of these skills are paramount. This perception dramatically affects the attention given during their undergraduate preparation.

Employers are seeking a high-caliber college graduate. They seek college graduates who possess knowledge across all disciplines (breadth) and mastery of a specific discipline (depth) (Hanneman, & Gardner, 2010). As reported in a study conducted by Michigan State University (MSU) entitled "Recruiting Trends 2009-2010" (Gardner, 2010b), employers appear to be expanding opportunities across all majors with a breakdown of business disciplines comprising approximately 3% to 4%.

The rapid progression with technology accentuates the ever changing knowledge and skills required to effectively perform job duties successfully. Hanneman and Gardner (2010) surveyed business and industry stakeholders to identify knowledge and skills needed by college graduates. From the data collection, the following skills were identified: the ability to use higher-order thinking, ability to communicate ideas, ability to function as a member and leader of teams, and ability to utilize technology to make or save the company money. Companies were asked to list the desired qualities and skills needed by applicants. Listed among the top eight desired skills and qualities were computer skills, communication skills, and leadership skills. (CollegeGrad.com, 2009) For business (other), finance, and accounting majors, Hanneman and Gardner (2010) reported that employers identified the following desired skills and qualities as needed by graduates: engage in continuous learning; analyze, evaluate, and interpret data; and build professional relationships. The executive summary of the MSU study (Gardner, 2010a) reports a business shift in the demand for business majors to possess the technology skills aligned with companies repositioning for more Internet business and to seek candidates with acumen in these areas. Adding to the demands for extensive skills and training is the increasing attention given to social media by those involved in the hiring process (Gardner, 2010b).

Lai and Nurul Hidayah (2010) focused their 2010 study on the necessary formation of communication technologies needed by an accounting graduate when joining a tax firm. The survey listed eight major computing and ICT skills: spreadsheet software, word-processing software, presentation software, accounting information systems, commercial tax software, file and directory management, Internet skills, and email. Their study found that familiarity with spreadsheet software, word processing software, and email were the most important three skills for fresh graduates. Senior partners in the tax firms surveyed also stated that these skills along

with tax preparation software skills should be included in tax courses provided at higher education institutions. The same study also stated that a substantial majority of the junior tax practitioners had used some type of e-filing for the clients' tax returns, but this item was not included in the aforementioned skills set.

London (2011) reported critical thinking, problem-solving (as the number 1 skill), ethical behavior, accounting technical knowledge, technology knowledge [which include the use of advanced Excel, QuickBooks, and MYOB AccountEdge], and attention to detail as being essential assets for accountants.

In accounting, as well, Jones (2011) stated that basic writing mechanics (the combination of correct grammar, punctuation, spelling, and word usage) was rated very important to extremely important by employers. In terms of information technology skills, the only computer mediated communication skill that was highly ranked by the employers was the effective use of email.

Adhering to accreditation standards, the colleges of business or schools of business are required to provide documentation of student learning experiences in the areas of communication, ethics, information technology (computer skills), and domestic and global environments (global skills). AACSBI does not require a specific course for each area; however, all of the business courses are required to include these vital areas. (AACSBI, 2010)

Statement of the Problem

To adhere to the accreditation standards, one small rural southern university (public four-year) School of Business integrates these skills beginning with freshman level courses. For example, all majors are required to take two computer-specific courses-- one at the freshman level and one at the junior level where technology-related knowledge and skills are stressed.

Other courses integrate technology-related knowledge and skills through assignments and projects. This being said, the authors wanted to measure the actual skill levels acquired and the students' perceptions of their skills abilities.

Therefore, the purpose of this study was to determine students' perceptions of their business technology knowledge and skills and to determine whether students are as competent in business technology knowledge and skills as they perceive themselves to be.

Design of the Study

Population and Data Collection

During spring 2010, 73 students were enrolled in MGT 4300--Management Policy (capstone course). This course is a required course in the accounting degree, the business administration degree, and the computer information systems degree at a small rural southern university. Students enrolled in this course must be graduating at the end of the semester in which they are taking this course.

Of the 73 enrolled students, a total of six were eliminated due to various reasons: one student withdrew from the course; one student was located in Florida; and one student became ill receiving an incomplete; and three students failed to complete all three assessments. Sixty-seven students completed all three instruments

Instrument and Methodology

For this study three instruments were utilized. First, permission was received to use and modify an existing instrument to measure students' perceptions of their technology abilities (Grant, Malloy & Murphy, 2009). The survey was presented as part of the MGT 4300-Management Policy course and made available to the students via the Blackboard Internet delivery system.

Part one of the survey asked the students for demographic information--gender, age, major, mother's highest education level earned, father's highest education level earned, type of high school attended (public school, private school, or home school), hometown, and state. Part two asked the students to rate from *1-High Skill* to *5-No Skill* their overall computer application skills. Students were asked if they owned or their family had access to a computer and how long they owned or had access to a family computer. Students were asked if their high school required a course in basic computer skills and if they chose a course in basic computer skills as an elective in high school. Part three asked the students to indicate all software that they had used in their courses or for personal purposes. Part 4 asked the students to rate their proficiency from *1- High Skill* to 5- *Little or No Skill* in file operations, MS Word, MS Excel, MS PowerPoint, E-mail, MS Access, Web Page Development, and Application programming. Part 5 asked the students to indicate ALL tasks that they were familiar with as it relates to the following applications--MS Word Processing, Excel Spreadsheets, MS PowerPoint, and MS Access.

After the initial survey was collected, a second instrument was administered via computer as an undergraduate computer skills assessment pre-test originally developed by Creighton, Kilcoyne, Tarver, and Wright (2006) to assess skills in the CIS 1800 course. This assessment test was modified for the current study using preloaded databases, documents, and various other items for the students to use in completing the required tasks.

After completion of the application skills assessment, a post assessment was given to the students. The students were asked to rate their proficiency from *1- High Skill* to 5- *Little or No Skill* in the following areas: Word, Excel, Access, PowerPoint, computer file operations, and overall skill in computer applications.

Data Analysis

Descriptive statistics and statistical data analysis were performed. A Pearson product-moment correlation coefficient, measuring the strength of the relationship between two continuous variables (Pearson, 1896), was computed to assess the relationship between the students' perceptions and their actual performance.

Findings

Demographics

Out of the 73 enrolled students, only 67 completed all of the required parts of the study. Students from three different majors were included in the sample, Business, Accounting, and Computer Information Systems (CIS). In terms of percentages, Accounting students comprised 19.69% of the sample; 15.15% of the sample were CIS students; and finally, 65.15% of the sample included the Business students. In terms of gender, females were represented a little bit higher with 58% of the sample. Participant students were for the most part, 20 to 25 years old (85%).

Differences by Major

As stated previously, step 1 of the study involved a pre-test of students' perceptions of their own computer skills; step 2 involved a skills test assessment, and in step 3, after students completed the skills assessment test, they were asked to rate their skills again. Pearson correlations were calculated to observe the relationship between these three steps. A Paired T-test was conducted to observe the difference between the pre-students' perceptions of their skills and the post perceptions.

Pearson correlations between the students' perceptions and the graded skill test did not provide any significant relationships when all the students were included in the sample.

However, when the sample was divided by Major, only one correlation was significant. The EXCEL skills perceptions of CIS students were significantly correlated with the grade they received in the Email skill test (see Table 1 for results).

Performance skills were then compared with the students' perceptions of their skills after they took the assessment test. Results from this comparison increased the number of significant relationships. When all majors were included in the analysis, we found significant relationships between students' perceptions of their EXCEL skill and the actual performance, their perceptions of ACCESS skills and EXCEL performance, and finally, their perceptions of ACCESS skills and ACCESS performance (See table 2 for results).

When the sample was divided by major, no significant relationships were found for the Accounting group. However, for the CIS group, we found significant relationships between the students' perceptions of their skill level in WORD and their actual performance in ACCESS; as well as the students' perceptions of their skill level in PowerPoint and their actual performance in PowerPoint and ACCESS (see Table 3).

Results from the Business Administration group were significant between the students' perceptions of their skill level in ACCESS and their actual performance in EXCEL and ACCESS; as well as students' perceptions of their skill level in PowerPoint and their actual PowerPoint performance (see Table 4).

Finally, Paired T-Tests were conducted for all observations matching both the pre and post students' perception skills. Results from this analysis showed that the means were significantly different for all the pairs at the .05 level of analysis (see Table 5 for results).

Discussion and Conclusions

An important objective of this study is to provide insight into how computer skills are being acquired by students graduating from business schools. The technology component is now a very important part of AACSB accreditation, and as such, it has to be measured and monitored over different periods of time and multiple graduating classes. This study was developed to monitor part of this AACSB required technology component. We believe that students' perceptions of their acquired skills are important since they are major stakeholders in their education. We wanted to know if students perceived that they had sufficient computer skills after reaching their last year. We also believe that their perceptions may or may not match the required needs of a secondary group of stakeholders—faculty. Hence, this study examined self-ratings of computer skills ability and actual performance of computer skill tasks as measured by faculty using the four most commonly used application packages: Word, Excel, PowerPoint, and Access. According to these results, students perceive their computer skills to be medium to high as evidenced by the means obtained in both the pre- and post-test perceptions; however, these averages changed significantly after the performance skills test was administered. Students modified the scores on their perceived computer skills as evidenced by a significant change in the means. Students scored themselves lower in their computer skills after the performance test was completed.

The relationship between their actual, graded performance and the self-rating of their skills appeared significant only after the skills test was performed. Results suggest that students do think that they have the knowledge needed to complete any task with the specific software package tested; however, the correlations between their performance and their ratings only hold significance for Excel and Access when all majors were included in the sample; for Access and

PowerPoint for BUAD majors; and PowerPoint for CIS majors. The ultimate goal for any business school would be to produce a graduate whose perception of computer skills and actual performance rated equally. If this match does not happen, it raises issues that require attention not only from faculty in terms of instruction but also by the administration in terms of curriculum requirements. It is important to mention that this group of students—the sample used for this study—started their degree before the technology component was modified to be reflective of technology changes based on business and industry recommendations as well as provide support documentation for accreditation agencies. For this reason, the students may not have been exposed to the knowledge and skills tested in this study since the knowledge and skills tested may not have yet been integrated throughout the courses included in the curriculum.

Therefore, it is imperative that we keep testing and monitoring these students, not only at the capstone-class level, but also at the sophomore- and/or junior-level to make sure that they are receiving the required computer skills instruction and that their perceptions of those skills are being modified along the same lines. Testing students at lower levels would give faculty and administrators a chance to modify curriculum and/or instruction to better meet the student needs and remedy shortcomings before graduating underprepared students.

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TABLE 1 – Performance vs. Perception – CIS Majors PRETEST

Performance vs. Perception Pre-test		WORD Perception	EXCEL Perception	PPT Perception	Email Perception	ACCESS Perception
Word Performance	Pearson Correlation	.327	.756	.982	.982	.982
	Sig. (2-tailed)	.788	.454	.121	.121	.121
EMAIL Performance	Pearson Correlation	-.221	-.144	.000	.000	.000
	Sig. (2-tailed)	.721	.817	1.000	1.000	1.000
EXCEL Performance	Pearson Correlation	-.360	-.394	-.466	**-.766***	-.350
	Sig. (2-tailed)	.341	.294	.207	**.016**	.355
Power Point Performance	Pearson Correlation	-.562	-.206	.275	.275	.000
	Sig. (2-tailed)	.324	.739	.654	.654	1.000
ACCESS Performance	Pearson Correlation	-.152	-.322	.440	.[a]	.088
	Sig. (2-tailed)	.718	.437	.275	.000	.836

*. Correlation is significant at the 0.05 level (2-tailed).

a. Cannot be computed because at least one of the variables is constant.

TABLE 2 – Performance vs. Perception – ALL Majors POST-TEST

		WORD Perception	EXCEL Perception	ACCESS Perception	PPT Perception
Word Performance	Pearson Correlation	-.258	-.162	-.209	-.011
	Sig. (2-tailed)	.067	.256	.141	.939
EXCEL Performance	Pearson Correlation	-.083	**-.325***	**-.533****	-.189
	Sig. (2-tailed)	.561	**.020**	**.000**	.183
Power Point Performance	Pearson Correlation	-.211	-.206	.108	-.238
	Sig. (2-tailed)	.125	.134	.436	.083
ACCESS Performance	Pearson Correlation	.277	-.240	**-.688****	.027
	Sig. (2-tailed)	.237	.309	**.001**	.911

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

TABLE 3 – Performance vs. Perception – CIS POST-TEST

		WORD Perception	EXCEL Perception	ACCESS Perception	PPT Perception
Word Performance	Pearson Correlation	-.327	.756	.756	.655
	Sig. (2-tailed)	.788	.454	.454	.546
EXCEL Performance	Pearson Correlation	.655	-.425	-.425	.102
	Sig. (2-tailed)	.056	.254	.254	.794
Power Point Performance	Pearson Correlation	.562	.074	-.074	**.963****
	Sig. (2-tailed)	.324	.906	.906	**.008**
ACCESS Performance	Pearson Correlation	**.762***	.000	.000	**.792***
	Sig. (2-tailed)	**.028**	1.000	1.000	**.019**

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

TABLE 4 – Performance vs. Perception – BUAD POST-TEST

		WORD Perception	EXCEL Perception	ACCESS Perception	PPT Perception
Word Performance	Pearson Correlation	-.142	-.084	-.054	.084
	Sig. (2-tailed)	.402	.622	.750	.620
EXCEL Performance	Pearson Correlation	-.146	-.152	**-.571****	-.008
	Sig. (2-tailed)	.442	.421	**.001**	.967
Power Point Performance	Pearson Correlation	-.183	-.291	.150	**-.347***
	Sig. (2-tailed)	.279	.081	.376	**.035**
ACCESS Performance	Pearson Correlation	.462	-.053	**-.790***	.448
	Sig. (2-tailed)	.249	.900	**.020**	.266

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

TABLE 5 – PAIRED T-TEST PRE/POST PERCEPTIONS

		POST-WORD Perception
PRE - Word Perception	T -TEST	-5.212
	Sig. (2-tailed)	.000
PRE - EXCEL Perception	T -TEST	-2.928
	Sig. (2-tailed)	.005
PRE - Power Point Perception	T -TEST	-2.529
	Sig. (2-tailed)	.014
PRE - ACCESS Perception	T -TEST	-3.559
	Sig. (2-tailed)	.001

A Qualitative Assessment Model for Business Information Systems Programs for Accreditation Efforts

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Abstract

This paper describes the implementation of a course that is a requirement for graduating seniors in an undergraduate Business Information Systems (BIS) program at a regional university. The description provides a model which includes the culmination of students' academic training in Information Systems (IS) curriculum which is part of a Bachelor of Business Administration (BBA) program in an accredited college of business. The course has been used to fulfill the assessment requirements for the Association to Advance Collegiate Schools of Business (AACSB). The requirements include an application of technical and business skills, as well as systems development and project management skills—altogether working towards completing an actual information technology project for an external sponsoring organization. Motivation for implementing this type of course includes the benefits of practical experience that provides the students the opportunity to build relationships with project sponsors who participate in the projects. As a result of their involvement, the sponsors receive a usable system from the project. The IS department providing the training also gains needed information which may be used for program effectiveness. Feedback from the course is also used as an integral part of the curriculum assessment process used for accreditation purposes.

Keywords: AASCB accreditation, business information systems project management, service-learning, capstone course, evaluation, assessment and qualitative assessment of learning.

Statement of the Problem

The Association to Advance Collegiate Schools of Business AACSB is an association of educational institutions, businesses, and other organizations devoted to the advancement of

management education. It is also the premier accrediting agency of business schools and collegiate accounting programs worldwide.

In 2003, AACSB International started an impetus toward program-level outcomes assessment. Major revisions to their standards during 2009 and 2010 expanded their program-level assessment orientation. AACSB Standard 16 now requires that programs,

> *"adapting expectations to the school's mission and cultural circumstances, the school specifies learning goals and demonstrates achievement of learning goals for key general, management-specific, and/or appropriate discipline-specific knowledge and skills that its students achieve in each undergraduate degree program*" (AACSB 2010)

Because of the demands for academic programs to adhere to accreditation efforts to meet assessment of learning outcomes, it has become apparent that academic programs that offer business information systems as a discipline must provide a confident measure to provide qualitative feedback to answer questions regarding the assurance of learning for the accreditation efforts.

Review of Literature

Project management (PM) is one of the fastest growing career fields in business today, and many universities currently include a senior projects class as part of their Information Systems (IS) curricula (Olson, 2001). The role of projects in organizations is receiving increasing attention, and projects are becoming a major learning emphasis as a result (Gray & Larson, 2003). There is a national consensus among information systems (IS) educators that project management should be an integral part of an IS curriculum (ACM/AIS Curriculum Committee, 2010). Although some schools present project management as a case-focused course,

the course described in this paper presents a client-service based model which provides exposure to "real-world" experiences.

In the case presented, business degree students with a BIS option area were required to take a standard senior-level capstone course in the management discipline. The IS faculty did not feel that the required management capstone course properly represented the specific coursework that the IS students are required to take; therefore, an IS specific capstone was developed to help students better integrate their IS coursework, and to help them prepare for a work experience in IS. From a curricular perspective, this class includes two major objectives:

1) To give the students experience in applying IS training on real world problems while still providing them with the security of the academic environment.

2) To help the students learn proper project management and report writing through guided experience in a simulated work environment as an acting project manager.

Description of Methodology

When a client-based model of learning is imposed, the capstone project management course becomes a critical component of IS curriculum for the benefit of the students involved and for the fulfillment of the educational objectives of the program. The value students may gain from such a course is more than just the project management concepts taught in the course content. Students may also obtain experience in a real-world work environment doing original projects designed to meet the needs of the sponsoring organization for which they are working.

The students are not the only beneficiaries of this course; the businesses that they work for can benefit greatly, and the IS department at the training institution/university establishes better relationships with these respective businesses. These businesses or organizations in turn may provide input into the overall curriculum by taking part in the advisory council/committee

meetings. Also, the department faculty directly benefits by evaluating certain components of this course for assessment recording and accreditation efforts. Every IS faculty member is invited to evaluate a portfolio and a summative presentation given by the students. They volunteer time with students who need help with projects which relate to the faculty member's expertise. Some schools use these methods for constructing a more effective curriculum (Brewer, 2002; Schwieger, & Surendran, 2009).

For many of the senior students in the projects course, they receive the first opportunity in which they might become involved to apply their skills in a professional IS-related work environment. Also, the course and associated project provides a reassuring learning environment because of the presence and involvement of the instructor as a facilitator. Since some students may experience the natural lack of confidence during the first application of their skills, the circumstances create an environment in which students feel more confident to take risks through trial and correction of errors, because they know they have the support structure of IS faculty. Also, the required student reports, both oral and written, discuss the status and functioning of the projects to the course instructor on a regular basis. This helps to alleviate small problems as they arise. Therefore, students get assistance with learning how to find problems, and they receive assistance with solving the problems. This process allows students to build confidence in their skills and abilities so they may experience the reality of functioning in a work environment that is supportive of the learning outcomes of the program.

During the course meeting times and lecture, the instructor is also delivering content about both project management concepts and best practices. The content is structured specifically to build concepts and skills as the students need them for their project during the course. Thus, initial content in the course focuses on interviewing techniques along with

effective communication, defining user requirements, building schedules, and planning projects. As the student projects progress, the course content moves toward discussing issues of managing projects, managing groups, managing sponsor communications, and project execution with delivery. This direct tie between the course's PM concepts and students' project schedules helps them to become aware of the relevance of the concepts and skills being taught. Students often struggle to understand the relevance of the content of a primarily lecture-based course, and how this content relates to their lives and work after they graduate. With this integrative content approach, students are able to apply discussed concepts and learn immediately how it can benefit or applies to project management work.

Other obvious advantages for students taking this course include the real work they complete in a sponsoring organization, which they can include on their resumes. Also, since students generally take this as one of their last classes at the university, they have the opportunity to do valuable networking with employers and organizations in the region for future job possibilities.

The participation of the managers of the sponsoring organizations, who receive the value of the students' labors and the instructor's mentoring experience in the form of deliverables from the completed IS projects, is a vital component of the success of the PM course. The sponsors usually choose to use the project to meet an important need for a system in their respective organization, and the students receive "real-world" experience in return. These small projects also help build relationships between the university and regional businesses which can lead to further opportunities such as student cooperative educational experience, internships, and even collaborative case-based research opportunities. The best result is that many students have received full-time employment with the sponsors after graduation.

Procedures

IS students in the project's class are formed into groups of two to four students and the groups are assigned a project during the third week of a 16 week semester course. Student groups are formed on the basis of the student skills necessary to complete sponsor projects. Student skills are assessed through a self-skills assessment survey which students take the first week of class.

The self-skills survey focuses primarily on three areas:

1) Programming experience
2) Web development experience
3) Experience with database design and management

This survey also includes a section asking students for the topic they would feel least comfortable working with and the topic with which they would most like to work. For demonstrating a more realistic work experience, students do not accept projects individually; however, it is acceptable for them to work on an existing project management team in the organization. A large part of project management is dealing with people who work in different aspects of a project team; therefore, there is a definite proponent of acquiring a subject matter expert (even if that includes or excludes an IS faculty member or the instructor of the course). The size of student groups is based upon the estimated hours to complete the project and upon the need to get an adequate collection of skills necessary to complete a given project. Sometimes the team may even work on a particular phase of a project, and then forward their work to the next semester for another team to take the subsequent phase.

Student projects are derived from the needs of the organizations that agree to sponsor the students to do work for them. Sponsoring organizations can be local businesses or local nonprofit

organizations. Sometimes projects include various departments within the university that have a need that fulfills the student learning outcomes. All these organizations have a need that can be met through the IS deliverables produced by the project assigned to the student team(s). The standard size for a project is approximately 50-70 hours of work per student per semester. Therefore, a minimal requirement for the average group of three students for a project requires approximately 175 man-hours of work. If the team (or project) is adjusted, the required student learning objective is adjusted for the needs required for the project(s) provided by the clients. Projects are minimally scoped by the instructor in discussions with sponsoring organizations. Most of the instructor's efforts to ascertain the scope of the projects are done to assure that they can be completed within the allocated hours and the 12 to 13 weeks that students have to work during a semester. Projects are also limited to those students who have the skills necessary to complete the coursework required in the IS program, and who should be able to complete the required work. Table 1 shows a breakdown of the types of projects that students have participated in during the last four years.

Table 1. Student Groups and Assignments

Project Type	**Number**	**% of all projects**
Business web site	27	47
Informational web site	2	3
Networking project	4	7
Database Development	22	38
Application Development (Programming)	3	5

When student groups are formed, they are immediately given contact information for their sponsoring organization and their sponsor. Student groups are then responsible to meet with project sponsors within the sponsoring organization, and the groups begin the process of gathering the requirements to begin formulating a definition of the scope of the project. Students are fully responsible for all contact with the sponsor from this point forward, and they are expected to make all necessary arrangements for future communications throughout the remaining 12 to 13 weeks of the project. From the perspective of the student projects, the instructor's role is that of a facilitator, and the students are expected to interact with the instructor as if the instructor were a senior project manager responsible for the project in terms of the students reporting on project status operations.

The instructor interviews potential sponsors to assure that the project is suitable in terms of required expertise and the amount of required work to complete. One of the important aspects of this course is for students to get experience in completing information systems analysis and design. The instructor should spend significant time interviewing the sponsor to fully scope the project prior to assigning it; therefore, during the initial interview of students with the sponsor, the sponsor will be more thoughtful and educated about the project. Limiting the initial discussions between the instructor and sponsor will give students a more realistic experience in working with details of the projects themselves.

Scope problems of this method might include:

1) Students could miss significant aspects of the project's scope or deliverables when initially setting up the project.

2) Students may not fully understand the scale and requirements of the project, and thus they have the risk losing sufficient time to complete the scope of the project.

3) Students may end up with a project that is not what was initially expected from the project description. Usually, due to miscommunication, this is because the instructor was not able to properly ascertain the sponsor's exact requirements for the project description.

During the twelve to thirteen weeks when students are working on their projects, they are required to give a number of both oral and written reports on the project's status. Students are expected to maintain and monitor the status of the project through the use of project management software. The students are expected to demonstrate their functional ability to use the software in their oral and written reports. Students are expected to maintain regular and adequate contact with project sponsors to assure project quality and timeliness.

Instructor contact with sponsors is kept to a minimum to allow the students free interaction so that they may learn about proper communication with the project sponsor. Instructor contact with sponsors is limited to two to four follow-up calls during the semester to assure that students are:

1) Maintaining adequate communication lines with the sponsor.
2) Doing the work reported.
3) Ensuring that the sponsor has no serious reservations about the status of the project or the student's competencies in being able to achieve the project's goals.

(Appendix A shows the reporting that students are required to provide during the project. Appendix B includes a common evaluation rubric used by faculty during developmental oral and written reporting.)

To help contribute to the technical success of the project, the PM instructor encourages students to get consulting help with technical issues from faculty in the IS Department. This contact with faculty is, for the students, an opportunity to refine, confirm, and improve the

technical skills they need to complete the project. These consultations are also good for the faculty member because they provide an opportunity to observe students practicing the skills that are taught in the IS curriculum program. This provides a valuable form of program assessment, which gives holistic feedback to faculty for/with/about students and subjects presented to the student during the educational program.

All of the IS faculty should participate in this consultative process with various student groups. Such consultative relationships are most often arranged informally by students seeking the advice of faculty they have learned from during the educational program. Sometimes the PM course instructor will arrange such a relationship if students are in need of technical help to complete a project.

Findings and Conclusions

Many indicators have shown that students consider this course a very valuable part of the IS curriculum. Feedback from exit surveys of BIS seniors has consistently rated the capstone class as very valuable. Also, another indicator of the value of this course is that many BIS alumni who have completed this course, and have become employed in IS positions in the region, have approached the instructor and offered to act as sponsors. These alumni have found great value in the class with the opportunity to learn project management through a real-world project, and they wish to provide similar opportunities for other students. Feedback from other faculty in the IS program and from sponsors, taken for program assessment purposes, also shows a great deal of positive support for this class.

Currently efforts are underway to provide a cost/benefit analysis report of the value of this class to the project sponsors and sponsoring organizations. This effort is being conducted through the development of a survey to be given to sponsoring organizations that have sponsored

a project in the last four years. The survey will look at the financial value of previously completed student projects to the sponsoring organizations in an attempt to assess whether these projects have met the beneficial need for which they were developed, and whether the project deliverables are still in use.

Current efforts toward improving the class include:

1) Improving student understanding of requirements and learning outcomes in the prerequisite course which encompasses information systems analysis and design.

2) Improving students' interviewing skills through better coordination with their required oral business communications class.

3) Seeking better samples of corporate project report templates currently in use in industry in order to give students a better understanding of reporting requirements currently used in project management.

4) Including emphasis on industry certification for project manager and helping students understand the value of taking the class to gain project management certification.

Capstone courses in MIS (Management Information Systems), BIS (Business Information Systems), CIS (Computer Information Systems) and CS (Computer Science) programs are commonly incorporated into this type of curriculum as they can be used effectively to assess several major student learning outcomes. This format provides considerable opportunity for collaborative learning, serves as an instrument for assessing the respective program objectives relating to both technical and professional (soft) skills, and meets the learning outcomes of general educational requirements for higher education/professional accreditation agencies.

To achieve the goal of assuring that students achieve objectives presented throughout the program of learning, the participants are groups working on a client-sponsored project who apply the systems they have learned about while they are exposed to recent developments in the field. Appendix C illustrates a common evaluation instrument that could be used by faculty to assess a presentation by students who have finished the process of such a capstone course. Appendix D provides a common summative evaluation instrument that could be used by faculty to evaluate student written portfolios at the completion of the projects. The faculty involved in this particular model had the ability to convey a paradigm of qualitative information when they were asked by AACSB to provide supporting evidence in achieving student learning outcomes for the IS program. The IS program using this model received a written commendation from the AACSB peer review team, commenting that the model presents an "exemplary model for" qualitative assessment methodology as opposed to a common discipline-related, quantitative examination which is often associated with most business disciplines.

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Appendix A
Student Reporting.

Report	Type	Number Required	When Required	Description and purpose
Interview and Business Systems Report	Written	1 per individual student	1 week after first sponsor contact	- Describes the information gained from initial contact interview - Describes the organizational system in which the students' project deliverables will function
Feasibility and Planning Report (FPR)	Written	1 per group	3 weeks after first sponsor contact	Initial planning documents focusing on: Scope Definition Planning of project control structures for scope and communication Initial Work Breakdown Structure Signed by Sponsor to show approval
Design Report (DR)	Written	1 per group	4 weeks after FPR	Final Planning documents with: Full design specifications for project implementation Full Work Break Down Structure Full Gantt Chart showing project schedule
Status Reports	Written	3 per group	At 2 week intervals starting one week after FPR	To keep instructor informed as to the status of the project schedule and any developing problems.
Project Manager's Report	Oral	2 per individual student	At 2 week intervals – alternating weeks with written status reports	To keep instructor informed as to the status of the project schedule and any developing problems.

Appendix B
Student Formative Reporting for Project Management

(Used with developmental written and oral reports when meeting with faculty members.)

Faculty Name: _____

Student Names: _____

_____

_____

CATEGORY (points)	4	3	2	1
IS Group Project	Students have developed a clear plan for organizing the information as it is gathered for the final project product. All students can independently explain the planned organization of formative work.	Students have developed a clear plan for organizing the information in the final product. All students can independently explain this plan.	Students have developed a clear plan for organizing the information as it is gathered. All students can independently explain most of this plan.	Students have no clear plan for organizing the information AND/OR students in the group cannot explain their organizational plan.
Ideas/ Questions	Students independently identify at least 4 reasonable, insightful, creative ideas/questions to pursue when doing the project.	Students independently identify at least 4 reasonable ideas/questions to pursue when doing the project.	Students identify, with some instructional help, from faculty, at least 4 reasonable ideas/questions to pursue when doing the project.	Students identify, with considerable faculty help, 4 reasonable questions to pursue when doing the project.
Written Documentation	The written documentation for the final portfolio is timely, well organized, and provides evidence in the form of individual journals is presented that all students have contributed to the group work and plan.	The written documentation for the final portfolio is timely, and provides evidence in the form of individual journals is presented that most students in the group contributed to the group work and plan.	Students have written documentation but need some instructional assistance to provide demonstrating contributions to the work.	The documentation does not include one or more students in the group contribution to the work they are responsible for completing.
Delegation of Responsibility	Each student in the group can clearly explain what information is needed by the group, what work s/he is responsible for completing, and when the information is needed.	Each student in the group can clearly explain what work s/he is responsible for completing.	Each student in the group can, with minimal prompting from peers, clearly explain what work s/he is responsible for completing.	One or more students in the group cannot clearly explain what work they are responsible for completing.

Total: _____

Appendix C

IS Faculty Curriculum Assessment Observation Form
Student Project Presentations

Semester: _____ **Project Title**: _____ _____

Using the scale shown below, please assess to what extent the students giving this presentation demonstrate mastery of the 14 objectives listed in the table. This scale is relative to the skills and training that our students should receive within our BIS curriculum. "Expected level" therefore would indicate that students demonstrate the level of competence that you feel our BIS graduates should have upon completion of our program. (Please note that further information on how details of these projects demonstrate competencies of our graduates will be assessed by review of written project portfolios.)

N/A	1	2	3	4	5
Objective cannot be assessed from the work presented	Minimal or no evidence of the objective was observed	Lower than expected competency in this objective observed	Expected level of competency in this objective observed	Higher than expected level of competency in this objective observed	Exceptional competency in this objective observed

Objective being assessed	Score
Communication Abilities	
1. Good speaking and presentation skills appropriate for a business report	
2. Understanding of audience for presentation	
Accurate and appropriate use of professional language: 3. Technical Terminology 4. Business Terminology	
5. Ability to function as a group, specifically to organize and present a group report in a coherent manner	
6. Ability to explain project work clearly and concisely	
Understanding and management of project	
7. Professional commitment to the project, sponsor and sponsoring organization	
8. Understanding of system in which the project's deliverables will function.	
9. Adequate and proper use of Project Management methods and practices	
10. Proper and adequate scoping and planning of project	
Project Design and Solution	
11. Adequate and proper use of systems design methodology used in business	
12. Ability to do original design and problem-solving.	
13. Are the project and its deliverables an appropriate solution (for novices in the profession) to the problem addressed?	
14. Extent to which this project challenged students to learn new skills outside those directly taught within the BIS curriculum.	
Other (please write in):	

Additional Comments: (Please include other comments relevant to how this presentation conveys valuable assessment information about our curriculum. Continue comments on back if necessary.) (Also, feel free to comment about this assessment tool itself and its validity, effectiveness, and make suggestions for improvement.)

Appendix D

IS Faculty Curriculum Assessment Jurying Form
Student Project Portfolios

Semester: _____ **Project Title**: _____

Using the scale shown below, please assess to what extent the students' work as presented in the portfolio report demonstrates mastery of the objectives listed in the table below. Please keep in mind that this scale is relative to the skills and training that our students should receive within our IS curriculum. "Expected level" therefore would indicate that students demonstrate the level of competence that you feel our IS graduates should have for the given area upon completion of our program. This is your opportunity to see whether students have the understanding and skills they should be acquiring.

N/A	1	2	3	4	5
Objective cannot be assessed from the work presented	Minimal or no evidence of the objective was observed	Lower than expected competency in this objective observed	Expected level of competency in this objective observed	Higher than expected level of competency in this objective observed	Exceptional competency in this objective observed

Objective being assessed	Score
Written Communication Abilities	
1. Writing and format appropriate for a business report.	
Accurate and appropriate use of professional language:	
2. Technical terminology used effectively	
3. Business Terminology used effectively	
4. Ability to function as a group, specifically to organize and provide a group report for a business problem.	
5. Ability to explain project work clearly and concisely	
Understanding and management of project	
6. Understanding of system and organization in which the project's deliverables will function.	
7. Adequate reporting included properly defining and describing the project.	
8. Adequate and proper use of Project Management methods and practices.	
Project Design and Solution	
9. Adequate and proper use of systems design methodology	
10. Ability to do original design and problem-solving	
11. Are the project and its deliverables an appropriate solution (for novices in the profession) to the problem addressed for this system?	
12. Extent to which this project challenged students to learn new skills outside those directly taught within the CIS curriculum.	
Technical Skills and Understanding	
13. Please write in this line the IS technical area(s) that this project focuses on (e.g. Database Design, Web Development, Networking, Programming, etc.): _____	
For the technical area specified above please assess the following points:	
14. Understanding of the technical area	
15. Technical skills needed to properly implement a solution in this technical area	
Other (please write in):	

Strategically Integrating Technology into Instruction

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Abstract

The use of technology in education has had a profound impact on education. As instructors have adapted technology integration into their classrooms, learning theories and teaching styles have also had to adapt. Instructional design strategies have changed to accommodate student learning needs. Effective integration of technology into the curriculum requires a departure from traditional means so that a technology-mediated learning environment becomes pedagogically effective for teaching and learning.

Keywords: Instructional Technology, Student Learning, Paper-and-Pencil Method

Introduction

Technology has always lent itself to progressive education. In the past 30 years, education has evolved from typewriters, calculators, and overhead projectors in the college classroom to computers, digital presentations, and touchscreens. Calculators replaced slide rules in the early 1970s. Microcomputers in the 1980s immersed higher education as a personal tool for several types of applications, from writing to computations, analysis, graphics, presentations, digital imaging and other new technologies that impact teaching and learning (Green & Gilbert, 1995). The 1990s brought more technology to higher education, shifting from the computer as a desktop tool to the computer as a communications interface among students and faculty. The new generation of college student, who was born in the early 1990s, has a lifestyle of e-mail, cell phones, and the Internet. They do not remember the days before computers. They have always been able to communicate with anyone, anywhere, anytime.

Integrating Technology into the Curricular Framework

Before handheld calculators, paper-and-pencil was the fastest way to find a mathematical answer; today the calculator is quicker to do a computation that might have taken students many hours of instruction and practice to master. But, one must ask if this technological influence advances the development of the students' basic reasoning skills (McCauliff, 2004). Over the past 25 years, technology has changed the way teachers teach and students learn. Both the subject matter and the educational process are essential components of the instructional strategy. Several national commissions and scholarly reports on the status of contemporary higher education have criticized the college experience, citing undue emphasis on transmitting fixed bodies of information and failure to develop students' critical thinking and problem solving skills as particularly troubling weaknesses. Even a decade ago, the need for lifelong learning as a result of quickly changing and ubiquitous technology became more of a factor than ever before (Dumestre, 1999). A strategic plan for how to use technology in the classroom and in the curriculum is critical; not only to help achieve goals, but also to maximize the positive impact of instructional technology.

As technology continues to provide increased access to information via the Internet, computer literacy has evolved into "information literacy." Students are developing and perfecting skills to search, retrieve, analyze, evaluate, and use information (Ehrmann, 2004). Technology has revolutionized how we teach in today's classroom (Price & Kirkwood, 2011). Therefore, business teachers need to know how to use the technologies and how to use them for strategic instruction. Bartholomew (2004) suggests that we need to analyze what we are really trying to accomplish through the use of technology. Just as handheld calculators were introduced in the elementary classroom in the early 1980s with some controversy that they would take away

from the students' ability to think and reason through problems (McCauliff, 2004); as technology use increases in the classroom, teaching strategies need to include pedagogical instructional methods that focus on student learning (Ringstaff & Kelley, 2002). The evolution of technologies continues and will further reshape quantitative memorization and influence the way we teach and learn knowledge and skills in business courses.

The incorporation of technology into the business information systems class is not simply a matter of giving a computer and Internet access to teachers and students. For example, as teaching strategies include more visual media, assignments and assessments should also include visual media (University of California, 2009). Visual media allows students to process information better; but because it is real-time, it does not allow time for reflection, analysis, or imagination. Therefore, technology is not a cure-all in education because of those particular skills being lost. The National Council of Teachers of Mathematics (NCTM) made the statement in 2000: "Technology should not be used as a replacement for basic understanding and intuitions; rather, it can and should be used to foster those understandings and intuitions" (McCauliff, 2004, p. 1). Teachers cannot just substitute technology from chalkboard to whiteboard from overhead to smart board. Learning theory must be tied with student learning outcomes. Integration of technology must consider instructional strategies and student learning outcomes, and incorporate student learning, educational theory, and instructional methodology (Johnson et al, 2009; Muniandy, Mohammad, & Fong, 2007; Rakes, Fields, & Cox, 2006).

To use technology effectively, instructors must know how the technology can be incorporated into the larger curricular and instructional framework (Price & Kirkwood, 2011; Ringstaff & Kelley, 2002). The technology must not drive the curriculum, but should be integrated into the curriculum. The integration of technology into the curriculum should make

sense and promote cognition, computation, problem solving, analysis, critical thinking, and decision making skills (which are the higher order thinking skills of Bloom's Taxonomy).

Advocates of technology use in the classroom sometimes cite the importance of developing students' job skills, and teachers often respond by "teaching technology," such as keyboarding or word processing, rather than using it as a tool to teach the curriculum. However, research suggests that when technology is integrated into the larger instructional framework, students will not only learn how to use the equipment and software, but also will gain content knowledge (Price & Kirkwood, 2011). Moreover, using technology within the curriculum framework can enhance important skills that will be valued in the workplace, such as locating and accessing information, organizing and displaying data, and creating persuasive arguments (Ringstaff & Kelley, 2002). When technology is used strategically and appropriately in the classroom, it can increase overall achievement and conceptual understanding, without adversely affecting procedural knowledge. Just like everything else, moderation of technology use in teaching is important. To develop a variety of skills, students should have a balance in their use of instructional media to enhance their skills (University of California, 2009).

Baker, Shi, and Stock (2006) found that college teachers need to teach both technology and traditional paper-and-pencil fundamentals as they prepare well-rounded students for a successful career in business. Students should be placed in scenarios that give undue emphasis to the basics in learning new information that leads to rigidity in decision making and scenarios that emphasize that decision makers "know how to know" (Brody & Coulter, 2002). They need to learn to be flexible and to use their own judgment because no two businesses are exactly the same. Brody and Coulter (2002) discuss the concept of "mindfulness" in an effort to prepare graduating seniors for the real world. "Mindfulness" is the overarching ability to be open and

aware of new information and categories, as well as being approachable to the acceptance of more than one view while focusing on process before outcome.

Reeves defines the use of learning with technology (1994, as cited in Ringstaff & Kelley, 2002), whereby students use technology to gather, organize, and analyze information, using this information to solve problems. The teacher and the students control the curriculum and instruction. The technology is used only as a tool and can be used in a variety of applications and curricular areas.

Adequate Instructor Preparation

Teachers who report feeling prepared to teach using technology use it more frequently and in a greater variety of ways, and are more likely to have their students use technology as a tool in tasks that require higher-order thinking. In a report that examined the results of over 300 studies of technology use, authors concluded that teacher training was the most significant factor influencing the effective use of educational technology to improve student achievement (Ringstaff & Kelley, 2002). A variety of studies indicates that technology will have little effect unless teachers are adequately and appropriately trained (Judson, 2006; Koh & Frick, 2009; McCauliff, 2004; Ringstaff & Kelley, 2002; Silverstein et al., 2000). Teacher attitudes and perceptions also impact the use of technology in their instructional design. If teachers have a positive attitude about using computers, they are more apt to integrate technology effectively in their classes (Christenson, 2009; Teo, 2008). Further, if pre-service teachers were taught using educational technology, they are more likely to apply and integrate technology into their own teaching, as their computer self-efficacy improves (Koh & Frick, 2009). Additionally, as teachers regularly use computer applications outside of the classroom, in their personal life, their use in the classroom increases (Wozney, Venkatesh, & Abrami, 2006).

Applying Bloom's Taxonomy

Bloom's lower-order thinking skills of memorizing, understanding, and application of knowledge are necessary for students to grasp the basic skills for foundational knowledge (McCauliff, 2004), after which teachers need to instill higher-level thinking skills and include critical thinking. For example, students comment that the best way they learn the fundamentals in their accounting classes, is to do the mundane tasks of posting accounts in a general ledger at the beginning of the semester for a few weeks. Then later in the semester, they see how quickly they are able to use the software for efficiency instead of having to write all of the numbers and calculations (Wyer, 1993). Ultimately, students understand where the accounts came from and why the financial statements look the way they do.

Teachers who use the constructivist approach incorporate technology into their instruction more than non-constructivists. Additionally, student-centered teachers tend to use and integrate technology effectively to enhance student learning. Therefore, constructivism has been shown to promote technology as a learning tool in the student-centered classroom (Judson, 2006; Rakes, Fields, & Cox, 2006).

Computers and other forms of technology in education can help students improve their performance on tests of basic skills and also be used as a tool for problem solving, conceptual development, and critical thinking (Means, 1994; Ringstaff & Kelley, 2002). The technology should be used as a supplement to learning, not as a replacement for learning (McCauliff, 2004). Teachers also see that implementation of technology into the classroom is beneficial to student learning if teachers feel they can implement technology successfully (Wozney et al, 2006). Students can spend less time doing calculations and more time creating strategies for solving

complex problems and developing a deep understanding of the subject matter (Ringstaff & Kelley, 2002).

Students need to know a variety of strategies for problem solving and decision making. Instructional technologies allow visual demonstration to higher-order concepts, using graphics and simulations to link mathematical concepts to real-world applications, providing tools for data analysis that can disclose understated patterns in data, and supply contextual information through interactive dictionaries, encyclopedias, and similar resources (Ringstaff & Kelley, 2002). Using the technology allows them to think more abstractly, allowing them to solve problems whose solutions are within theoretical grasp—beyond the lower levels of Bloom's Taxonomy. Using real-world scenarios to connect the quantitative data promotes higher levels of thinking.

Advantages and Disadvantages of Classroom Technology

Technology can be used as an effective tool for attaining student learning outcomes to achieve instructional goals; but technology must be used strategically in instruction. Otherwise, it can and has brought both advantages and disadvantages to teaching and learning.

Much research indicates that technology integration and ubiquitous computing have a positive effect in college courses and does facilitate both faculty-student and peer interaction and increases student engagement and active learning (Fried, 2007; Rakes, Fields, & Cox, 2006; Stephens, 2005). Further, technology use enhances student satisfaction and exploratory learning, increases motivation, promotes the ability to apply content-based knowledge, and increases overall academic achievement (Fried, 2007; McCauliff, 2004). Technology also encourages student collaboration, project-based learning, and higher-order thinking (Ringstaff & Kelley, 2002). Students are more willing to help and share with one another. Teachers also note that students who work diligently on research projects and reference information are developing

analytical and research skills. With the enormous amount of information, the student must determine relevance and choose that information that complements the projects. Students develop research skills and are exposed to many ideas and creative ways to work that can have a positive effect on their note taking, multitasking, and keyboarding skills. Technology supports exactly the kinds of changes in content, roles, and organizational climate that define the constructivist approach.

On the other hand, instructional technology can be negative if introduced too early into the curriculum. Allowing the use of technology to solve basic skills before they are acquired can be detrimental to the learning process; for example, students should not use calculators before they know how to do the operations mentally (McCauliff, 2004). Additionally, students need to read their textbook chapters. Reading develops critical thinking, creative thinking, induction, reflection, and vocabulary (University of California, 2009). Writing with paper-and-pencil, as opposed to typing on a computer, is also important to enhance creativity (Pescovitz, 2008). Furthermore, if students are accessing the Internet during class lectures, they do not process the teacher's content as well as if they were not using their computers (University of California, 2009). Another disadvantage to the technology revolution is current employees who have been in the field for several years, but do not have the necessary computer skills to use the ever changing technology; and they may not have a will to learn it.

Employer Perspectives of Business Graduate Qualifications

The question then becomes are companies hiring employees based more on fundamentals of technology use compared to the traditional paper-and-pencil knowledge or not. While qualifications for jobs in fields like management are constantly changing, the foundational concepts and theories remain the same. The change comes from the amount of technology that is

required as the years pass. McFadden and Gabric (2001) conducted a study to determine significant differences between employer and employee beliefs as to the most important skills to have for entry-level jobs, examining general skills and technical skills. The results indicated that both employers and employees valued general skills more than technical skills when hiring job applicants. The overall results of the numerous experiments performed showed that today's employer values general management skill and positive personality traits more than technical skills. Research shows over and over, year after year, that the quality that employers want from new employees is their ability to communicate effectively and have interpersonal skills, whether they are using traditional or technology means (Baugh, Davis, Kovacs, Scarpino, & Wood, 2010; Stevens, 2005).

Business schools face the challenge of revising their curricula to be more competitive, global, and technology oriented. Although developing skill sets that enable the graduates to perform the basic duties of their job is important, the development of skills that involves communicating, computer knowledge, problem solving, and critical thinking are essential. Business schools must incorporate the use of technology along with the building and applying of competencies into their curriculum. Tanyel (1999) found that both employers and university faculty agree on the types of skill sets that are essential. They arrived at the understanding that the traditional pencil-and-paper methods of performing job tasks may be necessary in some cases, but are not typically required to be able to effectively use software applications that improve the quality of work and reduce the amount of time required. In college coursework, teachers sometimes focus more on the specific knowledge gained rather than the skills employers are looking for in a prospective employee. Coursework knowledge is important, but employers require much more.

Research shows that in today's job market a Computer Information Systems (CIS) professional must be able to provide excellent oral and written communication to convey user information properly in computer programming. Research of 100 different CIS online job opportunities posted on the job site Monster.com showed criteria that included "computer related, entry level positions, requiring a four year degree." The results from the job postings showed that employers are emphasizing the need for employees who can provide comprehension of technical documentation, in addition to being a team player, and being able to communicate with all levels of management. While knowledge of programming language was considered important, the interpersonal and communication skills surpassed the technical skills in the job market (Baugh, Davis, Kovacs, Scarpino, and Wood, 2010).

Conversely, many management, accounting, and other business positions want employees to enter the workforce with an understanding of the basics of financial concepts, managerial theories, and fundamentals of the field (Bellamy & Mativo, 2010). Oftentimes, students do not realize the importance of a subject. They think they will never use those concepts--until they get into a job that has them using a ruler and figuring dimensions and calculating orders. At that point, the former student realizes the importance of math and theorems. Employers want to hire college graduates who have computer competency and the necessary technology skills for solving real-world problems, but those potential employees also need to know their field of study to achieve success on the job (Bartholomew, 2004).

Businesses in society today are moving away from the traditional method of pencil-and-paper to heavier use of computer software in their accounting and financial practices. The traditional method and the use of software are both effective and accurate, but neither is perfect nor flawless. However, most of the time, using software is more efficient, less time-consuming,

and virtually error-free. Accordingly, some jobs will require more technical skills than others. Businesses who offer products online, reaching current and potential customers, may want job applicants with computer skills in addition to marketing skills. E-commerce businesses may require new call-center employees who are computer savvy and need to communicate with people on the telephone to fix technology problems. These employees will be using computers and telephones, rather than the traditional method of pencil-and-paper. These businesses will want to hire people who already have the computer skills so they can easily learn the necessary software of the business. This type of move towards technology increases a business' demand for hiring business students who already have the computer skills and software knowledge to learn new technology (Leiber, 2010).

Conclusions and Recommendations

Challenges from evolving technology transition into the college classroom. Teachers must not only focus on teaching with the technology, but also on achieving the student learning outcomes. Technology provides opportunities to address learning styles, teaching strategies, critical and creative thinking, and student-centered instruction. Today's society asks more of college graduates than it ever has in the past. With the rising competition within and between corporations, businesses are no longer searching for graduates who have a specialty in one area. Technology is part of the instructional systems design, and additionally needs to be part of the student learning theory, methodology framework, and teaching strategy. Just using technology to teach does not automatically lead to successful learning. Using technology without instructional strategy will not be effective. The instructor must have a pedagogical strategy. Learning theory, instructional strategies, teaching models, and technology integration must be blended for successful student learning outcomes. Students today need to know how to use computers; but

more importantly, they need to know how to use technology effectively and efficiently as a tool for communication, research, operations, scheduling, problem-solving, and decision-making.

As many businesses change, computers are a mandatory advancement from the traditional pencil-and-paper; but prospective employees should have already learned the fundamentals, using the traditional method (pencil-and-paper) earlier in life, and now be able to merge what they already know with the changing software and technology. Accounting, statistics, and math students should be able to solve a problem with pencil-and-paper; and they should be able to explain the method for solving problems, evaluating alternatives, arriving at conclusions, and making decisions. Many students can do this "critical thinking" process with the assistance of a computer or even a calculator, but not with only a pencil-and-paper. They do not understand the concept and/or the theory behind the solution. Ideally, students will be exposed to business classes that have a balance of teaching fundamentals using the traditional methods of pencil-and-paper and of using technology to teach the software necessary to stay abreast of business functions.

Technology is a tool and should be used as a tool; it is not a panacea for decision-making and everything else that needs to be accomplished in the business setting. Future business executives must be prepared for a changing job market that requires adaptable styles of lifelong learning. If professors want to do their students justice, they should begin with the paper-and-pencil method to find the solution. Once the student has had the basic fundamentals of each class, he or she should be able to think critically about the problem and arrive at a conclusion. After the student has struggled through finding a solution manually, then the professor can demonstrate the technology that will solve the problem. Students develop an appreciation for both their own fundamental knowledge as well as the technology that is available to help them be

more productive. Technology is a wonderful teaching tool, but first students must be able to know the fundamentals to find the answers themselves.

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Using Social Network Analysis to Leverage the Industrial Advisory Board for Continuous Program Improvement

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Abstract

In this paper we take the position that the Industrial Advisory Board (IAB) for undergraduate programs in Computer Information Systems (and other IT-related disciplines) is a key and vital ingredient for a program's long-term viability. We propose a Social Network Analysis (Cross & Parker, 2004) framework and an Actor-Network theoretical framework (Callon, 1986a; Latour, 1986, 2005) that can be used to understand, manage, and sustain the IAB. Social network analysis is presented as a visual and statistical tool for understanding the centrality and betweenness of advisory actors in the social network comprised of a program's constituents, influences, dependencies, and stakeholders. Actor-Network Theory is discussed as a theoretical basis for understanding the unique qualities of the Computer Information Systems discipline, which is concerned with the emergent phenomenon that arise from the interaction between technical and organizational systems. Actor-Network Theory is also used to understand why skills, techniques, resources, and knowledge can serve as actors in the social network. A brief demonstration of the solution approach is given and future research directions which utilize the analytical and theoretical framework are discussed.

Keywords: Industrial Advisory Board, Continuous Improvement, Social Network, CIS Programs

Introduction

In a dynamic discipline such as Computer Information Systems (CIS), higher education programs must routinely undertake processes of continuous assessment, evaluation, and improvement. This is of particular importance as CIS programs must impart vital knowledge, skills and techniques to their undergraduates as a measure of program success. We deliberately equate attainment of knowledge, skills and techniques, as these will be what our students are judged on in the marketplace. That is, we place

significance on students' achievement of student learning objectives as measure of program success largely via our measurement of their performance in industry. This is because most measures of program educational objectives focus on the characteristics of the graduate in the marketplace; often one to five years after graduation.

Of the elements required to sustain an effective CIS program – qualified faculty, educational facilities and technology, procedures for regular program assessment, etc. – one of the more important elements, and often over-looked, is an industrial advisory board (IAB). CIS programs need an IAB's input as a means of reflecting on and assessing the program's attainment of its educational objectives. In this paper, we are concerned with attaining and sustaining effective engagement with the IAB as the board represents an important gauge of the quality of a program (Rooney & Puerzer, 2002).

One means by which we can understand the IAB's role is to consider the process of ensuring high-quality educational objectives – typically the successful entry of graduates into the profession – from a systems perspective. In this case, we propose that the IAB is a key conduit by which the faculty in a CIS program understand how their activities in the academy are co-created with those in the marketplace of industry (Prahalad & Ramaswamy, 2004). This mutually-constructive process is illustrated in Figure 1.

Figure 1 Relationship Driving the Need for a Healthy IAB

For a skills- and technique-heavy discipline, such as CIS, the demand for graduates creates a marketplace which the academy helps to facilitate. As CIS programs engage in processes of continuous program improvement, a strong IAB becomes a key factor which can be used to ensure that the CIS program truly and effectively understands the symbiotic relationship between the marketplace and the academy.

This paper examines several issues related to the importance of the IAB: the need to establish, account for, account to, understand, manage, and sustain a strong, effective, and helpful industrial

advisory board (IAB). Essentially, these are tasks which seek to maximize the effectiveness of the IAB in facilitating program success. We propose that Social Network Analysis (SNA) (Cross & Parker, 2004) is a compelling tool available by which a CIS program might better understand and sustain the association between the marketplace and the academy.

Towards these ends, the paper proceeds in the following manner. First (1), we discuss the historical context and importance of the industrial advisory board (IAB). Second (2), we focus on the needs of the regional institution versus the metropolitan institution. Third (3), we discuss the expectations of the advisory board and the desirable/key attributes that an IAB advisor should meet. Fourth (4), the importance of finding a good mix of intra- and extra-regional advisors is stressed. Fifth (5), we then discuss issues related to maintaining the focus and sustainability of the IAB. Sixth (6), we describe the use of social network analysis (SNA) as a tool to maintain and sustain the effectiveness of the IAB. Seventh (7), we then propose that an analysis of the IAB promotes continuous program improvement, which in turn leads to a reflective and learning-oriented program assessment and evaluation approach. And, eighth (8), we close the paper with a short demonstration of the solution approach, a discussion of the outcomes, and conclude by discussing future directions for the use of proposed analytical and theoretical approach.

The Importance of the Industrial Advisory Board

The IAB should consist of a number of leading professionals, dispersed endogenously and exogenously to the institution, who are able to represent trends and sentiment in the discipline's practitioner and industrial component (Marshal, 1999; Rooney & Puerzer, 2002; Strauss et al., 2001). Furthermore, the endogeny and exogeny of the IAB would also extend to concerns of intra- and extra-regionality. The need for, and characteristics of, this dispersion of characteristics is presented in Table 1.

Table 1 Regionality, Exogeny, and Endogeny of IAB Members

	Exogeny	**Endogeny**
Intra-regional	CIO, CTO, CSO for local companies, typically SMEs.	CIO, CTO, CSO or lead staff in IT for the institution
Extra-regional	CIO, CTO, CSO for local companies, typically SMEs.	CIO, CTO, CSO or lead staff in IT for the system of institutions to which the home institution belongs (not always applicable)

Accordingly, the IAB is important to an institution for the value it provides to the academic programs that they serve. These provisions of value added by the IAB are listed in Table 2.

Table 2 Focusing the Values, Benefits and Provisions of the IAB

Value-Added by the IAB	**Benefits and Provisions**
Leadership	For the program, curriculum, practicum, internships, etc.
Promotion	Liaison and advocacy at the intra- and extra-regional level
Resource Development and Support	Funding, equipment, opportunities, access, donations, scholarships and grants, technology funding, and human capital
Professionalization	Aiding and guiding in students' transition towards a professional career
Curriculum Development	Suggests what currency in relevant skills and competencies are required
Public Relations	Institution and program promotion; graduate mentorship, development and promotion; networking

In this paper, our primary concern with an IAB is in regards to our ability, as educators, to understand whether the match between the skills, techniques, and knowledge that we teach in our programs are (a) relevant to practice and; (b) meet the standards of rigor necessary to provide value to practice. Of particular importance and interest is capacity of the IAB to attune a CIS program to the needs of industry, particularly those firms in the immediate constituency of the program. Thus, a faculty that engages and enlists the support of an effective IAB is a faculty that forestalls the irrelevance of

outdated and unwanted skills and training. In this sense, the IAB grounds and focuses the discipline. In these pursuits, we undertake the vital necessity of human capital refreshment and replenishment by engaging the IAB in an integral manner.

Regional vs. Metropolitan Institutional Concerns

With respect to IAB design and strategy, it is not likely that a one-size-fits-all approach will suffice the needs of all institutions. One variable of concern is the geographic nature of the institution: is this a regional or metropolitan school? For the purposes of our discussion, we distinguish between a regional school, one that is far from major population and employment hubs, and the metropolitan school, characterized by abundant access to employers, population, and industry. The importance of this question is not to focus on the cultural and demographic variety between regions, but rather focus on where the imperative lies in the relationship between academic programs and the IAB. We propose that the imperative lies with the institutions in the case of regional schools and with industry in the case of metropolitan schools. We hold this position as regional institutions: a) are faced with sparse opportunities for industrial interaction; b) typically have a more pedagogical focus in their mission; and c) are remote to the typical power centers of industry. We make these assertions based both on our own observations over many years spent in a variety of institutions and also by support from the literature whereupon the strengths, weaknesses, opportunities, and threats perceptibly different between metropolitan and regional institutions (Drucker & Goldstein, 2007; Huggins, Johnston, & Steffenson, 2008; Warrena, Hankeb, & Trotzerc, 2008; Winters, 2011). Additionally, other voices in the literature on program assessment and management for small programs in regional schools largely corroborate our observations on the challenges faced by a small and regional institution (Rooney & Puerzer, 2002). As we speculate on different motivations for developing an IAB, we turn our focus on the qualities of and expectations of the IAB members.

Expectations and Desirable Attributes of the IAB Member

As the IAB accords their advisee institution and programs multiple roles, it is beneficial to determine nature and criticality of these roles. Foremost, the IAB serves as an intermediary between the market and the academy (Rooney & Puerzer, 2002) such that the IAB may advocate in both directions (see Figure 1). However, in the case of a regional school, the advisee institution must develop key expectations from the IAB in order to derive maximum benefit from the association. We continue by focusing on three of these expectations: accountability, focus, and strategic direction.

Accountability

The advisee institution and programs should seek mechanisms for accountability through the IAB's oversight. The accountability we are concerned with relates to the efficacy of program learning outcomes and program objectives in so far as they meet the needs of industry. Ideally, this accountability is bi-directional in that the IAB is also consistently engaged to provide vital feedback. In this sense, the ideal relationship is mutually reinforcing and symbiotic.

Focus

Accountability affords both parties the focus required to both maintain and sustain the program and IAB oversight of program outcomes. Toward this end, the IAB becomes an important conduit in a feedback loop where students' skills, technical competency, and knowledge are set against the real needs of practice and industry. This also helps to establish regional influence in the need for skills and also corrects excessive interest in trends which may be irrelevant to industry. This is not to say that the academy should not lead through experimentation; rather, this is to say that such endeavors should be accorded in appropriate proportion and measure. This last point is critical as it is also possible that both the academy and industry are susceptible to the push and pull of fads and fashion in the computing disciplines (Baskerville & Myers, 2009).

Strategic Direction

With accountability and focus, the IAB and the institution are positioned to shape the strategic course of the program in order to differentiate and distinguish the program from others. Thus, the IAB's

oversight may lead to the discovery of appropriate niche areas in which specialization is desirable to local industry and practice. We have both anecdotal evidence and evidence from the literature (Wenger, 2001) that suggest that, some areas sustain seemingly dead technologies, such as COBOL, due to regionalized demand. It is also possible to refer to a distinguishing niche as a program theme: an overarching set of concerns which provide cohesion in the curriculum (Landry, Pardue, Longenecker, & Feinstein, 2003).

Desirable Attributes

In addition to the obvious desire for IAB members who are leaders and experts in their field, there are other individual qualities that are also important (Fleischer et al., 1998). Influence is certainly important as influential individuals provide access to other stakeholders and resources and, thus, broaden the network. This influence can be manifested through inter-personal traits such as: involvement, excitement, spirited and unflappable commitment, and motivation in general. Concomitant to influence are experience and prestige. In our experience, those with experience and prestige are those who are typically able to wield influence. Thus, through renowned, knowledge, and expertise, these individuals enjoy and wield influence. However, perhaps above all else, this influence needs to be made relevant and applicable via representation and expertise within the field. Thus, the influential IAB member is most effective when their influence lies within the sanction of discipline-specific and recognized bodies and outlets.

Sourcing the IAB

Standing up an effective IAB in a small and regional institution is a potentially difficult endeavor at first as it is likely that the department is small, or that the faculty in the department may not originally be from the area. However, there are general concerns in sourcing the IAB regardless of the endemism of the faculty to the region or the department's size.

Working the Network

Generally speaking, the development of a professional network is vital for all: students, educators, practitioners, administrators, the community at large, etc. Therefore, an institution must

remain vigilant and persistent in the utilization of the social networks which are vital to professional life (Hall, Hogan, McQuade, O'Brien, & Sherry, 2007). The graduates, associates, and boosters of the institution are an obvious starting point, such that many extant relationships might be leveraged.

Compel, Persist, and Initiate

We have previously posited that the imperative to develop a strong IAB lies with the regional institution. In the case of a program in a regional institution, there are a number of concerns (Rooney & Puerzer, 2002). First, the regional institution must determine what compelling arguments and incentives will motivate a prospective IAB member. As with any relationship-building challenge, the regional institution must remain persistent with the prospective IAB member by engaging in frequent follow-up. Lastly, the regional institution will want to hold a first meeting where they project the highest possible impression for their prospects. Additionally, there are concerns related to the intra- and extra-regional challenges inherent in developing the networks necessary to cultivate prospective IAB members. Table 3 examines the intra-regional and extra-regional concerns related to developing a prospective IAB advisor.

Table 3 Concerns for Finding IAB Advisor Prospects across Social Networks

Intra-Regional	Extra-Regional
• Face to face relationships • Word-of-mouth • Community leaders • Ties to institution • Business and organizations who can benefit from your program's expertise • Onsite activities at businesses • On campus	• Rely on networks • Rely on graduates • Rely on reputation • Rely on perceived unique and distinctive qualities of your program

Inherent Sustainability of the IAB

While the task of finding and commissioning the IAB has been presented here as a challenge, we propose that sustaining the IAB is an even greater problem. We have observed this to be so as the IAB may lack the goal-oriented purposing which typically accompanies single projects. However, to ensure the greatest success, the IAB's oversight should be ongoing. Furthermore, IAB membership and member participation is not likely to be static: IAB advisors will come and go for a variety of reasons. Thus we

describe two challenges to IAB sustainability: (1) the challenge of ongoing engagement; and, (2) the challenge of attrition. We propose a model of IAB advisor participation and interest in Figure 2, which is not based on empirical data, but rather based on our impressions in our personal experience with our own IAB from 2003 to 2009. Therefore, the values in Figure 2 are offered to illustrate a notional sense of our collective experience – whether these experiences are unique to our particular situation, or universal, is unknown and is not tested here. However, we do broadly borrow from Roger's (2003) diffusion of innovation and ideas perspective for our thinking and analysis. We do so as the sustainability of the IAB reaches a saturation point beyond which the initial excitement of the innovative idea is no longer sufficient to sustain the endeavor (Rogers & Shoemaker, 1971). We also draw from Bower and Christiansen's (1995) disruptive technologies perspective in that, as an innovative idea, the IAB must be at least maintained as a sustaining innovation. Furthermore, we would hope that we can introduce techniques that challenge the IAB to continue a positive feedback loop for the advisee CIS program.

Based on our model in Figure 2, we propose that the innate qualities of individuals who most likely fulfill our optimal requirements for ideal IAB advisors are perhaps those who welcome challenge. In this sense, the IAB's charge is seen as fresh and innovative; and thereby attractive to advisers. Thus, rapid enthusiasm is likely in the run-up to developing a successful IAB. However, our experience has shown that the oversight and maintenance required to sustain the IAB are often not as appealing and interest wanes. Our concern here is that, as an important stakeholder and constituent group for an institution's programs, the waning, dormancy, and dissolution of an IAB is a threat to the viability of a program's efforts towards sustainable and continuous improvement (Maxim, 2004).

A succession of short IAB life-cycles, such as presented in Figure 2, are detrimental to an institution and its programs as the effort to stand up a new IAB is considerable. Furthermore, a wealth of longitudinal and institutional knowledge likely evaporates each time an IAB is allowed to dissolve. We acknowledge the existence of "symbolic" IABs, which may appear to function over a long duration, but are actually dormant, for practical purposes, at later stages. In this light, our concern is how an institution

might ensure sustainable input from and engagement with the IAB. We propose that what is necessary is a means of both understanding and managing the IAB as a social network. For this we move to the next section where we propose an SNA approach to the problem of managing a sustainable IAB.

Monitoring and Managing with Social Network Analysis

We propose that the networks used to commission an IAB are dynamic: candidate advisers are selected to further connect the institution, the program, the faculty, and the students to a much wider network of social connections. Thus, the "pull" of those networks may influence the efficacy and reliability of any given adviser and by extension, the cohesion of the IAB. Thus, by joining the institution, program, the faculty, and the students to the collective network of the IAB, the complexity of the entire topology increases. In order to manage this complex task, we propose that the tools associated and facilitating social network analysis constitute an appropriate IAB management approach.

Social Network Analysis Explained

Social network analysis is a visual measuring, graphing, and analysis toolset designed to measure the interdependency and centrality between nodes in a social network (Cross & Parker, 2004; Scott, 1988; Streeter & Gillespie, 1993). Our interest in an SNA solution approach lies within our need to track, monitor, and influence the perceived and actual value that our IAB advisors derive from their social network and how our advisors networks extend to the institution, and our program.

There is a long and engaged history of social network analysis in the humanities (Cross, Borgatti, & Parker, 2002; Cross & Parker, 2004; Tichy, Tushman, & Fombrun, 1979; Wasserman & Faust, 1994). In early uses, social network analysis was applied in a manner less concerned with mathematics and graph theory, and simply served as a theoretical basis for genealogical and kinship studies (Barnes, 1954). Over time, social network analysis has also been seen as a means of examining the increasing inter-connectedness that modern technology has afforded to humans – a basis and pre-cursor for the popular notion of "six degrees of separation." (Milgram, 1967; D. Watts, 1999; D. J. Watts & Strogatz, 1998) Accordingly, SNA became a lens through which many concerns of human interaction could be reviewed

(Burt, 1992; Freeley & Barnett, 1996; Ibarra & Andrews, 1993). Recently, with the advent of more powerful computing and software, SNA has been transformed to a concern of the graphing, statistical, and visual analysis of networks of human connection and interactivity (Freeman, 1979; Freeman, White, & Romney, 1992; Rice & Richards, 1985). Increasingly, SNA has become compelling as a means of visual and statistical reasoning in a number of social/human problem spaces.

Specifically to the CIS discipline, SNA is an important approach by which we might understand the organizational problems endemic to the discipline (Burkhardt & Brass, 1990; Constant, Sproull, & Keisler, 1996; Cross, et al., 2002; Haythornthwaite, 2000; Haythornthwaite, Kazmer, Robins, & Shoemaker, 2000; Sproull & Kiesler, 1986). Furthermore, we can conceive of the complexity of IAB network management as a boundary problem: how do we manage the influence of the IAB advisors' networks where they extend beyond the boundary of our own concerns? Towards these ends, the power and allure of SNA is the ability to perform both visual and statistical analysis in pursuit of answers to questions pertaining to "who knows who and why?" Figure 3 shows a wide-view of a social network analysis graph wherein visual associations and clustering is immediately revealed, merely through visual analysis.

Beyond the compelling results obtained from simple visual analysis, there are other statistical and graph metrics available in SNA. Using tools such as *UCINet*, *Pajek*, *ORA*, *GraphViz*, *COSBILab Graph*, *R*, *SocioMetrica*, and others, the social network analyst is concerned with measures of centrality, which determine the relative importance of a node to the integrity and function of the network (Borgatti, Mehra, Brass, & Labianca, 2009). SNA borrows from graph theory and network theory for its logical and mathematical constructs. Our interest in centrality is the degree to which it can tell us about the following concerns listed in Table 4 (Cross & Parker, 2004). These are not the only centrality measures used in SNA, however they are fairly representative.

Table 4 Descriptions of Centrality Measures in Social Networks

Centrality Measure	Description
Betweenness	A node's situation between centers of influence in the network
Bridge	The criticality of a node such that removing the node severs one or more connected networks
Proximity	For a given node, what is its power and information distance relative to other nodes or branches/sub-networks in the network?
Degree	For a given node, what is the sum total of ties to other nodes? We consider these ties as being strong, weak, or absent.
Cohesion	For a given node, do other adjacent nodes cluster on, or gravitate towards, this node?

Process and Procedure

Cross and Parker (2004) provide a general outline and procedure for how a social network analysis is typically conducted which we adopt for our SNA solution approach. We summarize this process here to illustrate how to go about using SNA to build, monitor, and manage the IAB. The premise of the Cross and Parker (2004) procedure holds that the revelations of a social network analysis provide palpable benefits: informal relationships between actors (nodes) exert critical influence on work and innovation; the appropriate level of connectivity in well-managed networks has a substantial impact on an actor's performance, learning, and innovation; and, the ties between actors in the network are made explicit. Table 5 provides a summary of the Cross and Parker (2004) procedure.

Theoretical Basis of the Solution Approach

We must consider that SNA, based on graph and network theory, is meant to measure and visualize centrality in a network of nodes. However, we must also revisit our motivations for using SNA to better understand centrality. If we reconsider Figure 1, we must ask, what exists, if anything, between "marketplace" and "academy?" Whereas our IAB advisors represent the profession and discipline, we, as

educators who run the programs which produce graduates, must measure the success of these programs with respect to their goals. Generally, these goals are related to the disposition and "state" of the graduate in their initial years of matriculation from the program and into industry (Starr, Manaris, & Stalvey, 2008). Thus, our measure of success is the degree to which the graduate was able to successfully, gainfully, and remuneratively, enter into the marketplace of employment. Therefore, we, as the educators who facilitate our programs, must involve the IAB into the network with actors that are not human: the program, the curriculum, skills, techniques, knowledge, etc. These concepts and artifacts are actors in the network in that they exert influence on the human actors in the network. By its nature, SNA does not address these non-human nodes in the network; this is where Actor-Network Theory (Callon, 1986a, 1986b; Latour, 1986, 1987, 2005; Law, 1992) can help to understand and assess non-human actors in the IAB social network.

Table 5 Cross and Parker (2004) SNA Procedure

Step	Actions	Remarks	Outputs
1	Identify a strategically important group (the IAB, extant or prospective)	Typically, the limit would be 250 individuals	List
2	Assess meaningful and actionable relationships	This is obtained by using a confidential survey	Relationships revealing collaboration, information-sharing potential, rigidity, supportiveness, etc.
3	Visually analyze the results	The spatial distributions of nodes and arcs/edges is revealing	A graph of the network
4	Quantitatively analyze the result	Centrality measures	Degree, between-ness, etc.
5	Create meaningful feedback sessions	Interviews and workshops	Documentation
6	Assess progress and effectiveness	Follow-up 6-9 months subsequent to SNA	Develop propositions, hypotheses, interventions, treatments, etc.

Considering Actor-Network Theory

What is remarkable about Actor-Network Theory (ANT), from an ethical, ontological, and epistemological standpoint, is the agency it affords to non-human nodes in a network (Law, 1992). We adopt this perspective as we see the exchange between actors in the network centralized on the IAB as containing concepts, knowledge, and skills. Moreover, ANT suggests that these "things" we surround our discipline with partake in an active role in shaping how we, as people, interact within our discipline. In a manner similar to the socio-technical theory of structuration (Jones & Karsten, 2008): we are shaped by, and in turn shape, the non-human "objects" in our network. It is the heterogeneity between actors in the network, both human and non-human, which represents ANT's distinction – and its applicability to the problem of SNA for IAB management.

If we accept that managing the IAB requires the consideration and inclusion of concepts and artifacts into the network, then we may also consider Actor Network Theory (Callon, 1986a; Latour, 1986) as a means of enhancing SNA. As there is a marketplace for our graduates' skills, and one important measure of the success of our programs is the ability for our graduates to "sell" in that marketplace, then we may accept that these skills, and their contributories and antecedents, exert influence within the network. Thus, in our use of SNA, we may also consider the useful distinctions available in Actor-Network Theory (ANT): the concept of the heterogeneous network; it's composition of both social and technical parts; and the cognitive equality of the social and technical actors (Law, 1992). The enhancements afforded by ANT are compelling given the emergent and inter-disciplinary history of the CIS discipline; a social network model that considers that both technical and social actors mutually construct a system is attractive, useful and appropriate. It is for these reasons that we include both human and non-human actors in our own social network analysis solution approach.

Explicating with an Example

We will now briefly illustrate the proposed solution approach by demonstrating with a social network analysis of our own advisory board, as it existed in the period of 2003 to 2009, which also

includes non-human actors: knowledge, organizations, and resources. By examining the non-human influences in the network, we can ascertain the efficacy of our advisory board and postulate regarding the adjustments that might be needed. This example is a post-hoc study of our advisory board which utilizes the Cross and Parker (2004) technique for SNA. While we feel that the Cross and Parker (2004) approach would be best used during the ongoing life-cycle of the IAB, we availed ourselves of the technique as a "post mortem" tool for reflection and retrospective. While our program-level IAB was subsequently absorbed into a college-level IAB, we feel our retroactive application of Cross and Parker (2004) still illuminates the efficacy of their SNA approach coupled with the ANT "lens."

For this retrospective exercise, we utilized *COSBILab Graph*, from Microsoft Research and the University of Trento Centre for Computational Systems and Biology Lab. *COSBILab Graph* is an easy-to-use software tool that allows a researcher to quickly establish a graph based on a visual interface to the DOT plain-text graph description language (Ellson et al., 2002). In a manner consistent with our solution approach (incorporating ANT and SNA), we described a graph in DOT, using *COSBILab Graph*, which includes nodes representing: human advisors, the organizations they are connected to, the knowledge they are associated with, and the resources they provided (Table 6). While it would be possible to place scalar attribute values upon the edges which link these nodes, and thus form the network, we did not place any attribute upon edges in the graph. This is so as measures of degree and centrality are adequate for the task of illustrating the basic benefits of a social network analysis. The actors comprising the nodes in the IAB social network are listed in Table 6.

We have abbreviated and obfuscated the names of the advisory actors, and some of the organizations, in order to maintain their privacy. While the associations between actors in the network were well-known to all, it is not likely that each advisory actor had a full picture of the connectedness within the group that the SNA tools afford.

Table 6 Actors in the Advisory Board Social Network

Advisors	Organizations	Knowledge	Resources
AL, BP, DB, DF, DP, GA, HS, JA, KS, KSa, LH, MS, PG, PS, RD, RM, ST	Aetna, Air Force Academy, Alphaville National Bank, Alphaville National Foundation, American Fidelity Insurance, AngelLMS, Bank of America, Blue Cross Blue Shield, Chevron, Cisco, City of Alphaville, Computer Associates, Corporate Systems, Datatel, Dell, DoD, EcoStar, FedEx, Foundary, G and Associates, H State Bank, Hewlett Packard, IBM, Intel, Juniper, Lawrence Livermore Labs, McCoy Meyers, McKesson, Microsoft, Northwest State Hospital, Northwestern Hospital, Oppenheimer Funds, Oracle, Phillips, Region 16, Sandia Labs, Siemens, Texas A&M University	Database, IT Management, Networking, Security, Software Development	Donor, Employment, IT Resources, Professional Network

Once the nodes were entered into *COSBILab Graph*, using the DOT graph description language, the edges connecting the nodes were expressed according to descriptions and data provided by archival departmental and IAB meeting minutes and by general recollection from tenured faculty and the department chair. Additionally, we called upon the Dean of the college and an Associate Dean when we were doubtful of certain connections in the graph. We used this data to establish edges and nodes in the graph such that the basic centrality measures could be established. Again, as no attributes were collected for the edges, we describe a simple non-directed graph of the actors in our advisory board. For a presentation layout of the graph, we adopted the assumptions of force-directed placement as described by Fruchterman and Reingold (1991). Generally speaking, the force-directed placement approach "…attempts to produced aesthetically-pleasing, two-dimensional picture of graphs…" (Fruchterman &

Reingold, 1991: 1129) This is accomplished by 1) distributing vertices evenly; 2) minimizing edge crossings; 3) uniform edge lengths; 4) favoring symmetry; and, 5) conforming to the display frame. This layout, depicted in Figure 3, presents a reasonable approximation of the sum of relationships that would exist if attribute values were ascribed to the edges. Moreover, the force-directed placement technique is quite random in its representation. Thus, Figure 4 reasonably visualizes key sub-graphs found toward the center of the layout and which are consistent with our statistical analysis of the graph.

There are many measures and operations possible with a graph constructed for social network analysis, all of which should talk about the nature of connections within the network. However, for this exercise, we have elected to show the following measures of relationships between nodes in the graph: degree, betweenness centrality, clustering coefficient, and a general binary centrality measure called topological importance (TI). We have selected these centrality measures as they provide a decent overview of the relationships between nodes with respect to centrality. We will now briefly explain how each of these measures is calculated.

Degree

Degree is a measure of the number of links that each node has to the neighboring nodes it is connected to (West, 2001). In a directed graph, it would be necessary to distinguish between incoming and outgoing connections, but for the undirected graph constructed for our analysis, we simply count the number of adjacent edges.

Betweenness Centrality

A betweenness coefficient quantifies the centrality of a node by accounting for the ratio between the number of shortest paths passing through a given node and the total number of shortest paths in the network (West, 2001). In *COSBILab Graph*, this is performed according to a technique described by Brandes (2001).

Equation 1 Betweenness Centrality (Valentini & Jordan, 2010)

$$C_B(v) = \sum_{s \neq v \neq t \in V} \frac{\sigma_{st}(v)}{\sigma_{st}}$$

Equation 1 expresses the Brandes (2001) algorithm for calculating betweenness centrality in the graph where σ_{st} is the number of shortest paths between node *s* and *t* and $\sigma_{st}(v)$ is the shortest path between nodes *s* and *t* that also passes through *v* (Valentini & Jordan, 2010).

Clustering Coefficient

This coefficient describes how densely a node's neighbors are connected. This is established by dividing the number of links between a given node's neighbors by the maximum number of links between them. This coefficient provides insight about which advisory actors or non-human actors would tend to cluster within the global network of the graph (D. J. Watts & Strogatz, 1998).

Topological Importance

There are other index measures available which provide a relative position within the graph in terms of centrality. Since our network is unweighted and undirected, where link effects can propagate in either direction, a binary measure such as topological importance can be useful (Jordán, Liu, & Veen, 2003). For this technique, we establish how many steps are required to fully propagate through the network to account for the effects governing centrality. Therefore, we define $A_{n,ij}$ as the effect of *i* on *j* when *i* can be reached from *j* in *n* steps. The number of steps can be established upfront when calculating this measure. This can also be simplified when the degree (*Di*) of a node is known: $A_{n;ij} = n/Di$. For additional steps, the process is repeated and the results are summed. This process then yields a topological importance measure of centrality of a given node (*i*) when node effects up to *n* steps are considered:

Equation 2 Calculating Topological Importance (Valentini & Jordan, 2010)

$$TI_i^n = \frac{\sum_{m=1}^{n} \sigma_{m,i}}{n} = \frac{\sum_{m=1}^{n} \sum_{j=i}^{N} a_{m,ji}}{n}$$

Review of SNA Procedure

We now summarize the example Cross and Parker (2004) post-hoc procedure we conducted on our IAB board from 2003-2009 in Table 7.

Table 7 Summary of Cross and Parker (2004) Procedure Steps for this Study

Step	Actions	Actions Taken in this Study and Deviations from Cross and Parker (2004)	Outcomes/Outputs
1	Identify a strategically important group (the IAB, extant or prospective)	17 advisors, 41 organizations, 5 discipline knowledge areas, and 4 resource areas were identified from historical data.	List was confirmed by those with historical knowledge of the CIS program IAB
2	Assess meaningful and actionable relationships	Unlike the Cross and Parker (2004) method, these relationships were reconstructed from historical data	Relationships were confirmed by those with historical knowledge of the CIS program IAB
3	Visually analyze the results	The Fruchterman and Reingold (1991)force-directed placement technique provides a reasonable representation of the graph using *COSBILab Graph*.	A graph of the network is show in full in Figure 3 and partially in Figure 4.
4	Quantitatively analyze the result	Centrality measures for degree (Table 8), betweenness centrality (Table 9), clustering coefficient (Table 10), and topological importance (Table 11) were computed using *COSBILab Grap.*	Results reveal the same actors (DP, PG, and JA) demonstrated a high degree of centrality. These results were corroborated by senior program faculty and administrators in the college
5	Create meaningful feedback sessions	To be completed/implemented moving forward with the college-level IAB	To be completed/implemented moving forward with the college-level IAB
6	Assess progress and effectiveness	To be completed/implemented moving forward with the college-level IAB	To be completed/implemented moving forward with the college-level IAB

Results from the Example

We now share the results from the SNA exercise describing the various actors present in our IAB social network. The following tables show the top ten scores on measures of degree (Table 8), betweenness centrality (Table 9), clustering coefficient (Table 10), and topological importance (Table 11).

Table 8 Top Degree Scores

Actor	Degree
DP	23
PG	20
JA	17
MS	16
KS	15
KSa	15
ST	15
BP	14
PS	14
DB	11

Table 8 shows that the top ten most connected actors in the network are human advisory actors. From this data the department may realize that professional networks remain a key success factor for IAB effectiveness. Furthermore, the department would know that DP, PG, and JA are very connected advisors within the network.

Table 9 Top Betweenness Centrality Scores

Actor	Degree
DP	959.5272616
JA	731.5759796
PG	663.2472971
BP	643.8068931
KSa	537.0256188
MS	471.9209124
ST	402.6452658
DB	317.7132756
KS	290.7251415
PS	287.5698413

The scores on measures of betweenness centrality (Table 9) reveal a picture similar to the simpler measure of degree and suggest that the same three advisory actors are critical in connecting the network.

Table 10 Clustering Coefficient Scores

Actor	Clustering Coefficient
Air Force Academy	2
Bank of America	2
Corporate Systems	2
FedEx	2
Hewlett Packard	2
Microsoft	2
American Insurance Fidelity	1
Alphaville National Foundation	1
Graham and Associates	1
Networking	1

The clustering scores are potentially confusing, but present a preponderance of organizational actors with at least one knowledge area (Networking) represented (Table 10). Clustering suggest that these actors are closely associated with more than one advisory actor per node and gives a sense of what many of the advisory actors share commonly in close proximity. Also striking is that both extra-regional and exogenous actors feature prominently. This may represent that these important clusters are present as the result of good IAB advisor selection on the part of the department.

Table 11 Three-Step Topological Importance Scores

Actor	Topological Importance
DP	5.173288398
JA	4.384650067
BP	4.028324426
PG	3.916257836
KSa	3.606136116
MS	3.473877362
PS	3.098404998
ST	2.774598837
KS	2.72882447
DB	2.480480732

The scores on a three-step measure of topological importance suggest (Table 11), as do scores on betweenness and degree, that many of the same advisory actors are critical to the centrality of this network. However, it is arguably the visual presentation of the SNA graph that is most useful as it tends to reflect the scores on these centrality measures, particularly when the force-directed Fruchterman & Reingold (1991) technique is used for layout (see Figure 4). Overall, this simple exercise shows that much can be revealed and discovered about the actors in an advisory network through very simple social

network analysis techniques. In our particular case, we can corroborate the importance of those actors shown to be the most central and between in the network.

Discussion

In our example, the results of each centrality measure reinforced that DP, PG, and JA are very connected within the network. Visually, *COSBILab Graph* would then allow the department faculty insight into which firms and industrial partners they were connected to (Advisors and Organizations in Table 6), what industries they represent (Organizations and Knowledge in Table 6), and what skills and facilities they are most connected to (Knowledge and Resources in Table 6). The utility of our solution approach, which utilizes the mechanics of SNA with the theoretical assumptions of ANT, is that we are able to treat all actors – advisors, organizations, knowledge, and resources – as equals in a heterogeneous network. In terms of evaluation and continuous improvement for the CIS program, running an SNA analysis similar to the techniques described by Cross and Parker (2004) affords the faculty an additional factor for their own continuous improvement planning. The faculty would want to engage DP, GP, and JA on a more regular basis and with an additional level of care. As actors, DP, GP, and JA are resources for input on matters pertaining to how curriculum is affecting local firms. Also, these central actors would be in the best position to provide feedback concerning which up-and-coming skills are of interest.

While there are certainly more rigorous applications and treatments of SNA in the literature, the aim of this research is to educate faculty in CIS, IS, and IT programs on how to regularly monitor their IAB such that the extended social network and be best utilized to the benefit of the program. In general, it is imperative that we are teaching the right topics, making the right career placement connections, and obtaining a wide constituent representation such that it is known whether we are meeting our program educational objectives. Obtaining and visualizing measures of centrality via an SNA technique represents yet another tool in our toolkit for maintaining CIS programs that meet the needs of their stakeholders.

Directions for Future Research

In this paper, we have proposed and demonstrated that SNA is a useful tool for IAB management, which itself is also a useful "tool" to facilitate ongoing processes of continuous program improvement. With this theoretical and analytical framework – ANT and SNA – in place, we propose the Cross and Parker (2004) procedure as a process for IAB renewal. As a next step, we would subsequently develop a collection of SNA case studies of IABs at other institutions (both regional and metropolitan). Using this SNA/ANT solution approach, we can not only continue to history our own profile of IAB utilization, but we can discover wider patterns about the nature and disposition of our discipline at large. Based on our initial experience, we are convinced that our SNA/ANT solution approach, utilizing the Cross and Parker (2004) procedure, is the best path forward for our own IAB renewal and sustainability efforts; either at the program level or at the college level.

Another important goal for future research is to test the validity of tying the ethical, ontological, and epistemology properties of ANT to SNA in a broader sense when examining questions pertaining to technology. It may seem counter-intuitive to explore the agency of non-humans in a network designed to manage human members of the IAB, but the IAB is meant to act as a fulcrum in the industry/academy continuum. For this reason, we have to understand how the industry exerts its influence on the IAB, the program, the faculty, and the students. Consider, for instance, relatively recent phenomenon of social networking websites such as Twitter and Facebook. To what degree have members on the IAB been influenced by these technological innovations, and how will these technologies impact the selection process for new IAB advisors? In a situation such as this, we must ask where agency lies. We hope that taking an ANT perspective during the course of our SNA analyses will help to understand the agency of technology and to perhaps add to the body of knowledge concerning both SNA and ANT.

Conclusion

In this paper, we have proposed that the utilization and management of the IAB, with the ultimate aim of managing its sustainability, is of paramount importance. In our own experience, we have found

that many IABs are not sustainable as they haven't been managed properly with sustainability in mind. While this may not be the case universally, we suspect that the ephemerality we have observed in our own IAB experiences may be a widespread phenomenon worthy of additional study. We have proposed, and explicated with an example, that SNA is an appropriate analysis approach used to understand, manage, and sustain the IAB.

Utilizing the Cross and Parker (2004) procedure, we propose to use the theoretical propositions of ANT and the analytical framework of SNA in order to renew and sustain our IAB's social network as well as that of a representative sample of other regional and metropolitan institutions. We are interested in the geographical aspect of institutions, as we have found that the impetus for action in regional institutions lies with the institutions and not with the influential, experienced, and prestigious candidates whom we desire to be our IAB advisors. While the use of SNA as a means to understand and address problems of a socio-technical nature is not a new idea, we do not know of other studies that have used our proposed theoretical and analytical framework in order to study the sustainability of the IAB. Therefore, we anticipate that findings from our future research endeavors will provide an analytical context that will assist us in our primary goal: to build a viable and sustainable IAB that allows our programs, and the students we graduate from these programs, to flourish.

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Figure 2 Sustaining IAB Interest

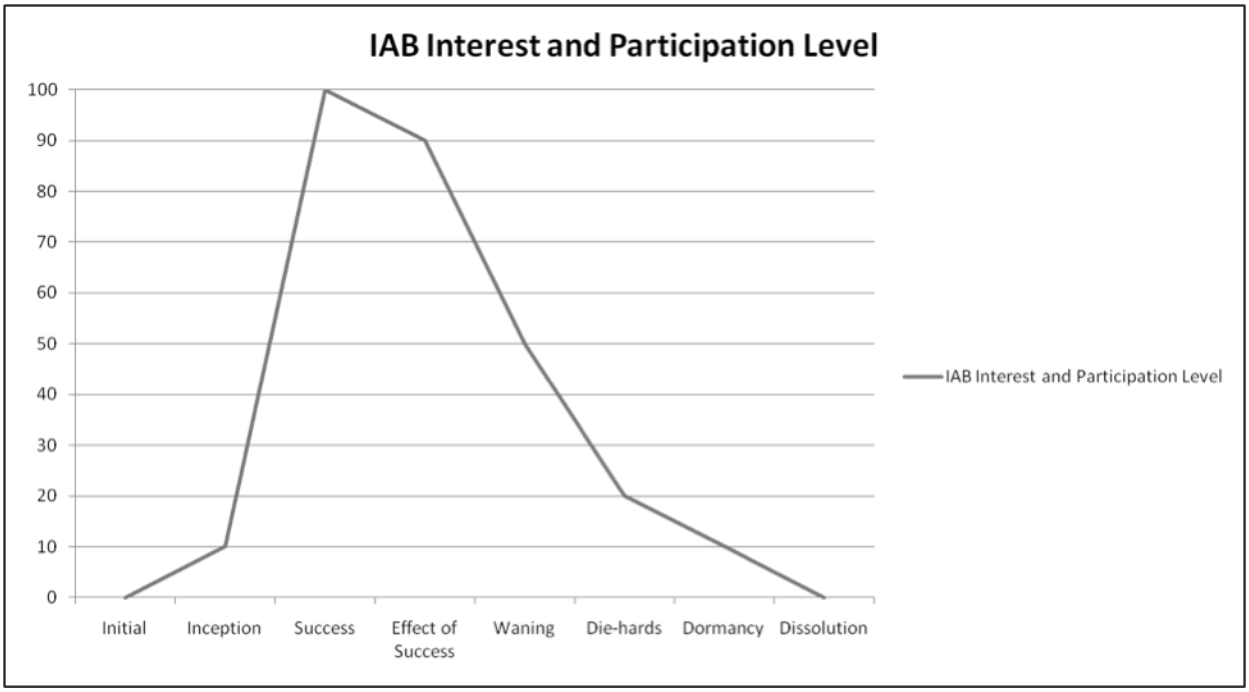


Figure 3 Visualizing the Social Network (FMS Advanced Systems Group – Sentinel Visualizer)

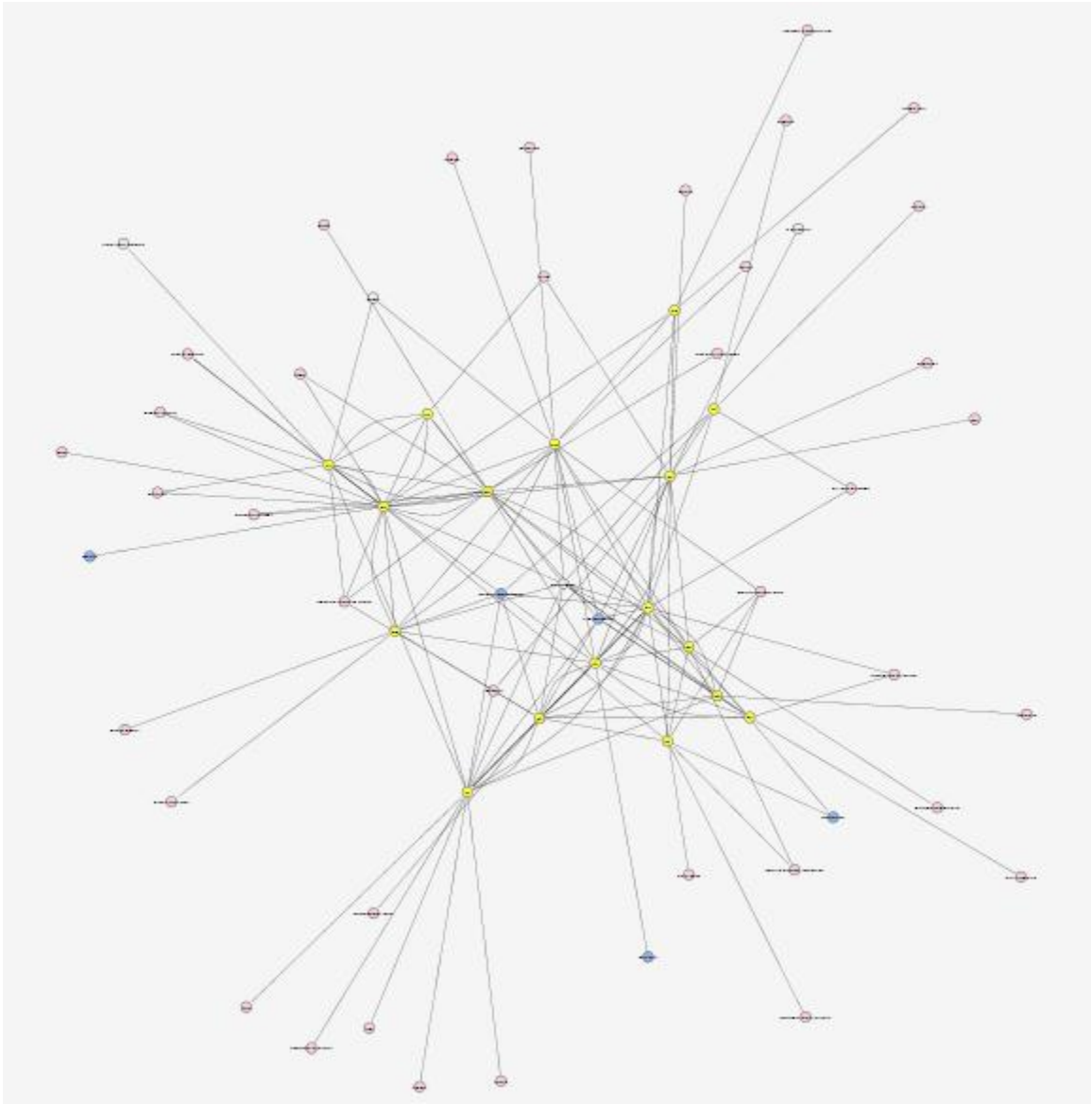
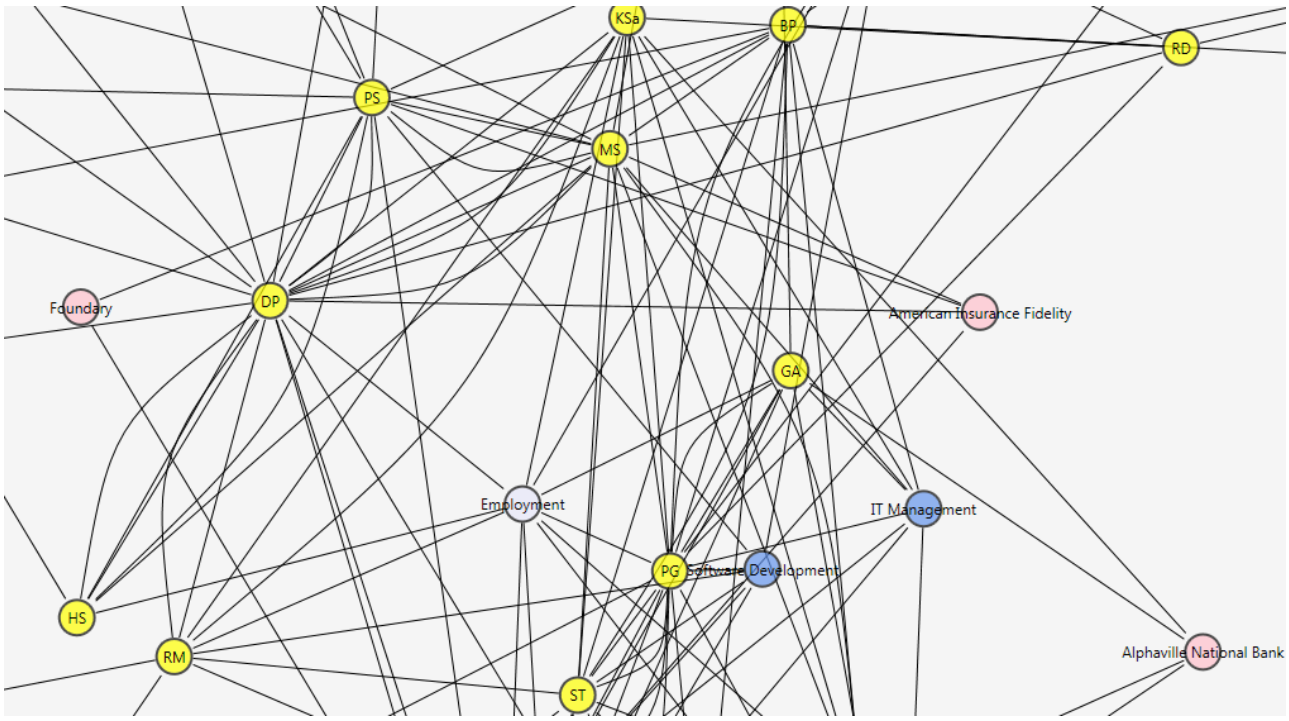


Figure 4 Important and Central Nodes in the IAB SNA Graph



Critical Thinking in Business Information Systems Courses

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Abstract

Critical thinking has become a major emphasis at many universities across the United States. At the same time, identifying effective teaching methodology for critical thinking remains an elusive concept for many educators. This research included an instructional design for teaching critical thinking about scholarly works. The design focused on a scaffolding methodology that guides students to apply the Paul and Elder (2007) identified Elements of Thought and Intellectual Standards to sentences, paragraphs, and finally to articles. Findings in this research indicated that the instructional design in this study resulted in significantly greater increases in student's critically thinking skills, as measured by the Eniss and Millman's (2005) CCTT-X critical thinking assessment instrument, then the critical thinking instructional design that has been the approved method at the site university.

Keywords: Critical Thinking, Paul and Elder Elements of Thought and Intellectual Standards, SEE-I Instructional model, Cornell Critical Thinking Test Level X

Critical Thinking Literature Review

The intellectual roots of critical thinking (Paul, Elder, & Bartell, 2009) are traceable to the teaching practice and vision of Socrates 2,500 years ago. Socratic discussion guides students to develop and evaluate their thinking with a sense of intellectual discipline and thoroughness. Paul and Elder (2007) regard Socratic questioning as the heart of critical thinking. Even though some researchers believe that the roots of critical thinking go back as far as 2,500 years, a review of the literature reveals that there remains a lack of agreement among researchers regarding characteristics of critical thinking and definitions of critical thinking.

Critical thinking – opinions among researchers. Lack of agreement among researchers regarding critical thinking includes a lack of consensus regarding what critical thinking skills can and should be taught and disagreement on what methodology should be used to teach critical thinking. Further, critical thinking researchers have differing opinions on terminology. For example, while some scholars consider critical thinking a subset of higher order thinking (Cuseo, Fecas, & Thompson, 2007), others use the terms interchangeably (Halpern, 2001), and still others make a sharp distinction between the terms. Another major difference researchers have in describing critical thinking, states Reed (1998), is whether critical thinking is subject specific or not. In addition, definitions of critical thinking abound.

Despite differences in opinions regarding not only the construct of critical thinking but also the terms, psychologists, philosophers, and content specialists have developed numerous definitions of critical thinking over the last several decades (Huitt, 1998). Pascarella and Terenzini (2005) relate that most attempts to define critical thinking operationally focus on an individual's capability to accomplish some or all of several dimensions of critical thinking. Those dimensions include (a) identify central issues and assumptions in an argument, (b) recognize important relationships, (c) make correct inferences from the data, (d) deduce conclusions from information or data provided, (e) interpret whether conclusions are warranted based on given data, (f) evaluate evidence or authority, (g) make self-corrections, and (h) solve problems.

Definitions of critical thinking. Numerous researchers have proposed definitions of critical thinking, and some have developed instruments that may reflect their definition. Dewey, the American philosopher, psychologist, and educator who is widely regarded as the developer of the modern critical thinking tradition, proposed one early definition of critical thinking.

However, the concept we commonly refer to today as critical thinking, Dewey referred to as reflective thinking. Dewey defined reflective thinking as "active, persistent, and careful consideration of a belief or supposed form of knowledge in the light of the grounds which support it and the further conclusions to which it tends" (Fisher, 2001, p. 2).

Gabbitas (2009) reports that as the concept of critical thinking began to become more popular in the late 1930s and early 1940s, a definition of critical thinking began to emerge that represented critical thinking as a procedural kind of thought that uses method and logic to come to conclusions. Glaser developed one of those early definitions as he built on Dewey's work. Glaser (1941) defined critical thinking as:

> (1) an attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one's experience, (2) knowledge of the methods of logical enquiry and reasoning, and (3) some skill in applying those methods. Critical thinking calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusions to which it tends. (p. 5)

Subsequently, Watson and Glaser's 1942 test of critical thinking revealed a common perception of critical thinking in its early days. The test focused on reasoning strategies such as making inferences, generalizations, and applied logical reasoning.

Ennis (1985) defined critical thinking as reflective and reasonable thinking that is focused on the decision what to believe or do. Further, Ennis and Millman (2005) developed the Cornell Critical Thinking Test level X and level Z in 1985 and revised the tests in 2005. The Cornell Critical Thinking Test Level X (CCTT-X) is the critical thinking assessment instrument used in this study. Ennis and Millman indicate that the CCTT-X assesses five aspects of critical thinking.

Those aspects include (a) induction, (b) deduction, (c) observation, (d) credibility, and (e) assumptions. The aspects of critical thinking are assessed through 72 items.

The challenge in developing a definition of critical thinking that most researchers could agree upon is reflected in an effort by the American Philosophical Association in 1987. Through its committee on Pre-College Philosophy, Facione was asked to serve as the lead investigator to coordinate an international effort to determine the extent to which experts agreed on the definition of critical thinking for purposes of college level teaching and assessment. The report of the results of the investigation became known as the Delphi Report because the research employed the qualitative research methodology known as the Delphi Method. The Delphi Method incorporates a panel of experts who participate in several rounds of questions as they work toward a consensus as they offer and reconsider opinions.

The consensus statement in the Delphi Report (Facione, 1990) regarding the definition of critical thinking is reported in the Executive Summary. The Executive Summary reports the consensus definition of critical thinking as the purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. At the same time as the American Philosophical Association committee was working to determine a consensus on the definition of critical thinking, Facione (1990) developed the California Critical Thinking Skills Test (CCTST). Skills test scales on the CCTST include Analysis and Interpretation, Inference, Evaluation and Explanation, Inductive Reasoning, Deductive Reasoning, and a Total Critical Thinking Skill score.

According to Gabbitas (2009), Paul, Director of Research and Professional Development at the Center for Critical Thinking, deliberately tried to maintain an open definition of critical

thinking in order to avoid the limitations of an overly precise or overly narrow conception. Paul (1990) defined critical thinking as that mode of thinking about any subject, content, or problem in which the thinker improves the quality of his or her thinking by skillfully taking charge of the schema inherent in thinking and imposing intellectual standards upon them. Paul and his colleague Elder (Paul & Elder, 2006) advocate critical thinking based on eight elements of thought that are used with sensitivity to intellectual standards that they have identified.

The elements of thought identified by Paul and Elder (2006) include (a) purpose, (b) question at issue, (c) information, (d) interpretation and inference, (e) concepts, (f) assumptions, (g) implications and consequences, and (h) point of view. Paul and Elder recommend using the elements of thought with sensitivity to intellectual standards including (a) clarity, (b) accuracy, (c) precision, (d) relevance, (e) depth, (f) logic, (g) significance, and (h) fairness.

Research Focus

The focus of this research was to investigate the effects that an instructional design strategy that includes a scaffolding methodology has on critical thinking scores. The dependent measure was participants' critical thinking scores derived from the Cornell Critical Thinking Test Level X (CCTT-X).

Hypotheses

1. Critical thinking gain scores will be significantly greater for the participants in the treatment group than the critical thinking gain scores of the participants in the traditional group.
2. Participants ACT composite scores will be positively correlated with their respective critical thinking pretest scores.

Participants

Participants in the treatment and traditional groups in this research were incoming freshmen students matriculating at a southeastern American regional university. They were enrolled in the Foundations of Learning orientation course.

Instrumentation

Participants' critical thinking skills were assessed with the Cornell Critical Thinking Test Level X (Ennis & Millman, 2005). An analysis of data collected by pre and post testing in the treatment and traditional groups was conducted. Participants' demographics are reported from a demographics instrument.

Critical thinking instrument. Participants' critical thinking was assessed by pre and post testing with the Cornell Critical Thinking Test, Level X. Ennis, Millman, and Tomko (1985) initially developed the Cornell Critical Thinking Test, Level X (CCTT-X). This study used the current version of the CCTT-X (Ennis & Millman, 2005).

The CCTT-X assesses ability to think critically in five aspects of critical thinking including Induction, Deduction, Observation, Credibility, and Identification of Assumptions. The five aspects of critical thinking that are assessed by the CCTT-X are the subscales of the instrument, and they are assessed through 71 multiple-choice items. For each item, participants are requested to select one of three possible responses.

The interdependence among the aspects of critical thinking is reflected in the CCTT-X by the rough assignment (Ennis, Millman, & Tomko, 2005) of many instrument items to more than one aspect as illustrated in Table 1. For example, the assumption identification items are listed under both assumption identification and deduction because deduction is useful in identifying

likely candidates for an assumption in a given line of reasoning (Ennis, Millman, & Tomko, 2005).

Table 1

Aspects of Critical Thinking and Rough Assignment of Items

Aspects of Critical Thinking	Item numbers of CCTT-X
Induction	3-25, 48, 50
Deduction	52-65, 67-76
Observation	27-50
Credibility	27-50
Assumptions Identification	67-76

Note. Adapted from "Cornell Critical Thinking Tests: Administration Manual" by R. Ennis, J. Millman, and T. Tomko, 2005, p. 2.

Because of the interdependence of the items, it was very difficult for Ennis, Millman, and Tomko (2005) to secure totally independent part scores and strong independent factors in the factor analysis. At the same time, based on Spearman-Brown split halves analysis, the reliability of the CCTT-X is good with a range from .76 to .86. After participants completed the CCTT-X critical thinking instrument, they completed a demographics instrument.

Demographics instrument. A demographics instrument was used to collect data in eight categories. The demographic categories included first generation college status, gender, major declared status, age, two-year or four-year degree sought, and previous formal instruction in critical thinking. In addition, participants were asked if they consider themselves good critical thinkers, and they were asked to report their composite ACT score. During the class meeting

following the administration of the pretest instrument and the demographic instrument, the instructional treatment began.

Study Design

This study assesses the development of two groups (Treatment and Traditional) of participants' critical thinking skills pre and post of critical thinking instruction. Both groups' experienced critical thinking instruction based on Elements of thought and Intellectual Standards identified by Paul and Elder (2007). However, each group experienced a different instructional methodology.

Treatment group instruction. The treatment group instructional design incorporates the Paul and Elder Elements of Thought and Intellectual Standards and researcher modified related guiding questions as illustrated in the Critical Thinking Elements of Thought and Intellectual Standards handout (Appendix A). In addition, the treatment group participants experienced the researcher-developed Critical Thinking Assignment Template (Appendix B) that, with faculty supervision, guided them through a critically thinking process for sentences, paragraphs, and articles. Initially, faculty assigned one sentence and a related Element of Thought, and participants were guided to think critically using the Critical Thinking Assignment Template. Students use the assignment template as a guide through a systematic process of identifying and applying the Intellectual Standards to Elements of thought identified by the professor. This process directs students to refer to the Critical Thinking Elements of Thought and Intellectual Standards handout.

After students completed the critical thinking assignment template for three sentences, they were guided to apply the Critical Thinking Assignment Template, and therefore the Paul and Elder Elements of thought and Intellectual Standards to paragraphs and then to articles.

As students progressed from critically thinking about sentences, to paragraphs, to articles, the professor assigned more Elements of thought, assigned Intellectual Standards for students to consider, had students progress to identifying Elements and Standards, and had students work as individuals and in groups. The progression through the critical thinking unit was based on the Coordination of Critical Thinking Exercises table (Appendix C). Student's critical thinking work was assessed based on the Critical Thinking Scoring Rubric as illustrated in Appendix D.

Traditional group instruction. The traditional group instructional design strategy included the State Elaborate Exemplify Illustrate (SEE-I) instructional model developed by Nosich (2009). The SEE-I model (Figure 1) was introduced to site university faculty through multiple workshops conducted by Nosich. The SEE-I model was used to help students clarify, understand, and communicate a topic or concept.

The acronym SEE-I stands for four steps (Nosich, 2009) that may help make whatever topic or concept a student is working on clearer. Following are the four steps of the SEE-I model:

S - State the Main Topic or Concept

E - Elaborate on the Main Topic or Concept (explain it more fully in your own words)

E - Exemplify the Main Topic or Concept (give a good example)

I - Illustrate the Main Topic or Concept (give a metaphor, a simile, an analogy, a diagram, a concept map, etc.)

The first step in applying the SEE-I model is to state the main topic or concept.

State the main topic or concept. The statement of the main topic or concept (Nosich, 2009) is an identification of the problem, the main idea, the principal concept, etc. to which the SEE-I model is being applied. Statements should be brief, clear, and as precise as possible. After

stating the main idea or concept, the model guides the student to elaborate on the main topic or concept.

Elaborate on the main topic or concept. To elaborate using the SEE-I model is to explain something in greater depth or detail to help the student better identify and understand the topic or concept. The elaboration should expand on the information in the student's own words and not be taken from resource information. After elaborating on the main topic or concept, Nosich (2009) suggests identifying an example.

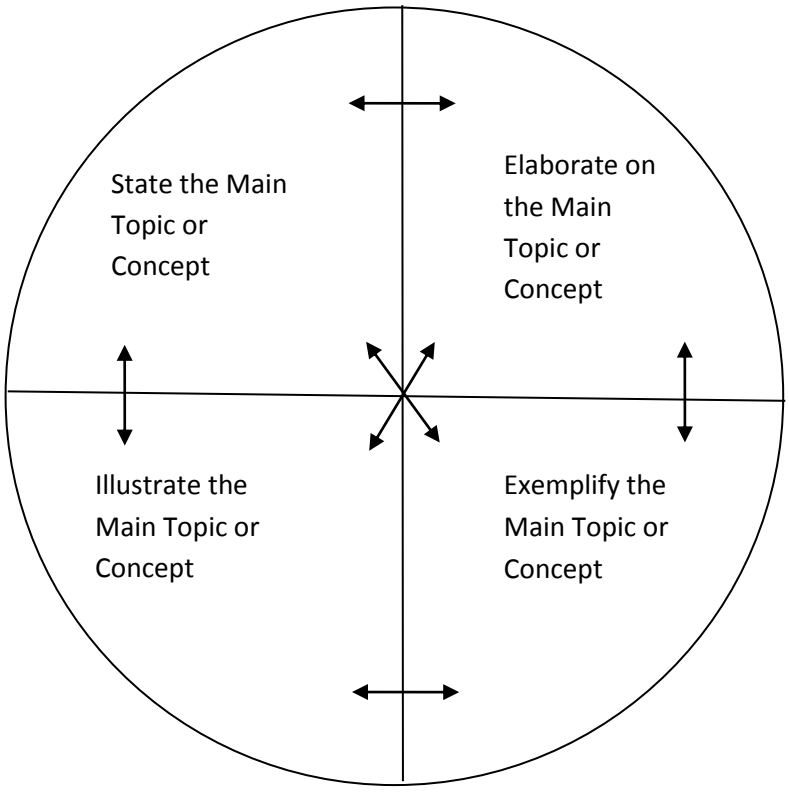


Figure 1 SEE-I Model

Exemplify the main topic or concept. To exemplify in the model is to give an example that will help to clarify the student's focus on the main topic or concept. The example should be concrete and should fit well with the statement and the elaboration. After identifying an example, students using the SEE-I model will develop an illustration.

Illustrate the main topic or concept. According to Nosich (2009), when the student using the SEE-I model develops an illustration, (s)he forms a mental image. The image could be an illustration of a process, a graph, or a diagram. Usually, however, the illustration will be a verbal description, an analogy, a simile, or a metaphor that captures the meaning. The illustration is frequently the final step in applying the SEE-I model, but Nosich emphasizes that the model can be applied in any order as necessary for students to develop a deeper understanding.

Applying the SEE-I model. Typically, (Nosich, 2009) a student who uses SEE-I will apply the model starting with *state*, followed with *elaborate, exemplify,* and *illustrate*. However, the student can revisit any of the steps in the model if revision of one or more of the completed steps becomes necessary. For example, as a student is applying the elaboration step, it may become evident that the statement needs revision. While participants in the traditional group will experience and apply the SEE-I model, participants in the control group will experience a didactic lecture strategy without a critical thinking unit of instruction.

Quasi-Experimental Design

There were two research groups in this study including the treatment and the traditional groups in this quasi-experimental design. The treatment group and the traditional group were each composed of one Foundations of Learning course section with a maximum of 25 qualified students per section.

The independent variable was group membership. The dependent variable was critical thinking as measured by the CCTT-X. The unit of measurement of the critical thinking dependent variable was the critical thinking score that is the total number of right answers minus one-half the number of wrong responses on each respondent's CCTT-X instrument (Ennis, Millman, & Tomko, 2005).

Participants in the treatment and traditional groups completed the CCTT-X instrument both pre and post of the Critical Thinking unit of instruction. Significance testing was conducted on the data to derive possible changes in students' critical thinking skills. Demographic data were collected, including first-generation college status, gender, major declared status, age, two-year or four-year degree sought, and previous formal instruction in critical thinking. In addition, participants were asked if they consider themselves good critical thinkers, and they were asked to report their composite ACT score. During the class meeting following the administration of the pretest instruments and the demographic instrument, the instructional treatment began as illustrated in the procedures figure, Figure 2.

Findings

The effects of the instructional design of a critical thinking unit delivered to incoming freshmen at a Southeastern American university were investigated in this study. Data are presented on demographics and critical thinking. Descriptive statistics are presented first, followed by the primary analysis. The section concludes with a summary analysis of the data.

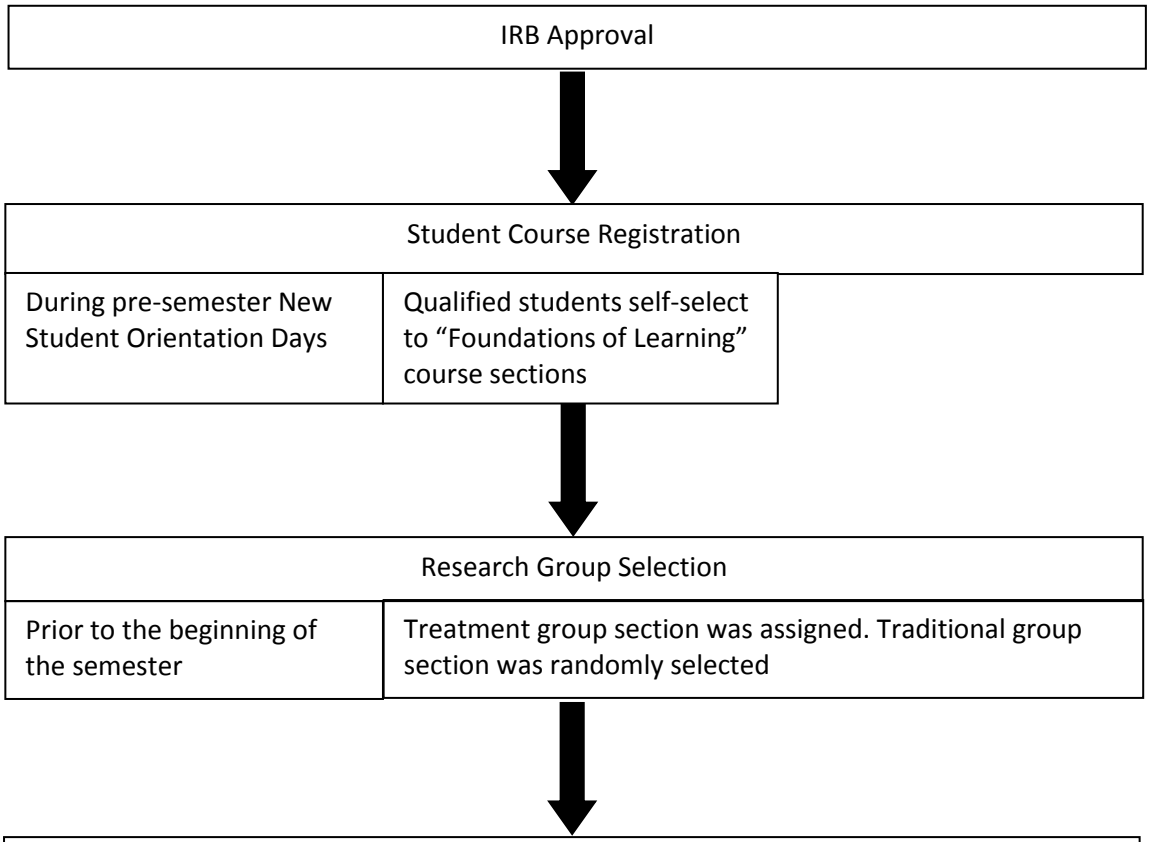
ACT composite scores and standard deviations. The research participants had an average ACT score of 22.62 with a standard deviation of 3.35 as illustrated in Table 2.

Table 2

Mean ACT Composite Scores and Standard Deviation by Group

Group	Mean	SD	n
Treatment	23.17	3.67	18
Traditional	22.06	3.03	17
Overall	22.62	3.35	35

Analysis of CCTT-X Data for ANOVA Assumptions. Participant's baseline CCTT-X scores were obtained by administering the CCTT-X pretest at the beginning of the study. To satisfy assumptions of normality of distribution of the pretest data, box plots, the Ryan-Joiner test, and skewness and kurtosis Z scores were run. Then, the results of those tests were checked for agreement.



Instrument Completion and Experimental Treatment	
Week#	Action
9	Students received introduction to the research and student materials.
9	Participants read, signed, and returned IRB consent form.
9	Participants completed the Cornell Critical Thinking Test Online.
9	Participants completed and returned demographics instrument.
9 - 13	Treatment and traditional groups instructional delivery.
14	Participants completed the CCTT-X post-test online.

Figure 2 Procedures for Treatment, Traditional Groups

The Z scores and related data are illustrated in Table 3. A Z score above absolute 1.96 would indicate a distribution that does not approximate a normal distribution. None of the Z scores were greater than absolute 1.96. Therefore, the Z scores agree with the Ryan-Joiner tests and indicate that the CCTT-X pretest data approximate a normal distribution. After the tests for normality were conducted on the CCTT-X pretest data, an ANOVA was run on the data from the three groups to see if there is a significant difference in the mean scores among the groups.

Table 3

CCTT-X Descriptive Statistics for Pretest Skewness and Kurtosis Scores by Group

Test	Group	n	Item	Statistic	Std. Error	Z Score*
CCTT-X Pretest						
	Treatment	18	Mean	34.472	3.058	
	5% Trimmed Mean			35.108		
			Median	33.500		
			Std. Deviation	12.972		
			Skewness	-.426	.536	-.795
			Kurtosis	.158	1.038	.152
	Traditional	17	Mean	23.053	3.460	
			5% Trimmed Mean	23.698		
			Median	23.000		
			Std. Deviation	14.264		
			Skewness	-.682	.550	-1.240
			Kurtosis	.155	1.063	.146

Note. Test statistic and Standard Error calculated by SPSS
[a]Skew Z Score calculation: Z_{Skew}=Skew/Std. $Error_{Skew}$
[b]Kurtosis Z Score calculation: $Z_{Kurtosis}$=Kurtosis/Std.$Error_{Kurtosis}$
*Significant when greater than absolute 1.96

CCTT-X Pretest ANOVA

The baseline measurement of the participant's critical thinking scores was collected by administering the CCTT-X pretest before the beginning of the instructional treatment. The overall CCTT-X pretest mean for all participants (N=35) is 27.55 and the pooled standard deviation is 14.08. An analysis of variance indicated that there is a significant difference among

at least two of the CCTT-X pretest group means, $F(1,33) = 3.67$, $p = 0.032$. A post-hoc Tukey procedure was performed in conjunction with the ANOVA. The Tukey grouping showed that there is a significant difference in CCTT-X pretest scores between the Treatment and the Traditional groups.

Results of Primary Analysis

There were two primary hypotheses in this research. Following is a summary of the hypotheses testing.

Hypothesis 1. The first hypothesis is that critical thinking gain scores will be significantly greater for the participants in the treatment group than the critical thinking gain scores of the participants in the traditional group. The data from the study does support hypothesis one.

The CCTT-X gain scores were determined by calculating the difference between each participant's pretest score and his/her posttest scores. The overall mean of the CCTT-X gain scores is 2.81 and the pooled standard deviation is 6.54.

An ANOVA on the CCTT-X gain scores revealed that there is a significant difference among the two group's gain scores, $F(1,33) = 7.28$, $p = .002$.

Hypothesis 2. Hypothesis two is that participants ACT composite scores will be positively correlated with their respective critical thinking pretest scores. Earlier studies have shown that students who have higher ACT composite scores also have stronger critical thinking skills (Kahn and Nauta, 2001; Gore, 2006), this research did support hypothesis two. The resulting test for correlation yielded a Pearson correlation of ACT Scores and CCTT-X Pretest = 0.453, P-Value = 0.000. As Table 4 indicates, the Treatment group had the higher ACT

composite score and the higher CCTT-X mean pretest score while the Traditional group had the lower ACT composite score and the lower CCTT-X mean pretest score.

Results of Analysis of Gain Scores by Demographics

Participant demographics were reported in this research. The remainder of this section is a discussion of CCTT-X gain scores by demographics.

Table 4

ACT Mean Composite Scores and Standard deviations and CCTT-X Mean Pretest Scores and Standard Deviations (n=60)

Group	Mean ACT Composite Scores	ACT Composite Score SD	Mean CCTT-X Pretest Scores	CCTT-X Pretest Score SD
Treatment	23.17	3.67	48.55	11.16
Traditional	22.06	3.03	32.47	13.21

Analysis of CCTT-X Gain Scores by Gender

The CCTT-X mean gain score for males was 4.239 and the CCTT-X mean gain score for females was .542 as illustrated in Table 5. An ANOVA on the difference between male's and female's gain scores and a post-hoc Tukey analysis both indicated that there is no significant difference in male's CCTT-X gain scores from female's gain scores, $F(1,33) = 3.87$, $p = 0.054$.

Table 5

Gender Based CCTT-X Gain score Means, Standard Deviations, Tukey Grouping, and p Value

Gender	n	Mean	SD	Tukey[a,b] Grouping	p
Male	22	4.239	8.602	A	0.054
Female	13	.542	3.956	A	

Note. Pooled Standard Deviation = 7.132.
[a]Statistic Means sharing a common letter variable are not significantly different according to the Tukey procedure. [b]Individual confidence level = 95.00%

Summary of Findings

The critical thinking CCTT-X gain scores for the Treatment group proved to be significantly higher than the gain scores for the Traditional group. Even though the Traditional group and the Treatment group experienced the same instructional unit on critical thinking through the treatment period, the Traditional group's CCTT-X gain score decreased from pretest to posttest. Analysis of other variables within the demographics revealed that there is not a significant correlation between CCTT-X gain scores and age $r(58) = 0.072$, $p(\text{two tailed}) = 0.586$. Whether students intend to earn a two-year degree or a four-year degree had no significant correlation with CCTT-X gain scores $r(58) = 0.010$, $p = .942$.

Participants reported if they have ever received any formal classroom critical thinking instruction. There is no significant correlation between participants experience with formal classroom critical thinking instruction and CCTT-X gain scores, $r(58) = -.080$, $p = .545$. Participants also reported if they perceive themselves as good critical thinkers. Participant's perception of their critical thinking ability did not have a significant correlation with CCTT-X gain score, $r(58) = -0.078$, $p = 0.553$.

Discussion

The purpose of this study was to examine the effects of an instructional design strategy on research participants' critical thinking skills through the instructional treatment in a college freshmen orientation course.

The Treatment and Traditional groups experienced instructional units on critical thinking. The critical thinking content in the instructional design for both the Treatment group and the Traditional group was based on the Paul and Elder (2006) critical thinking elements and

standards model as described in Appendix A. However, the instructional design for the Treatment group instruction was different from the instructional design for Traditional group.

The instructional design developed for the Treatment group includes the researcher developed Instructional Strategies Treatment Template. The instructional design experienced by the Traditional group is an existing design that included Nosich's (2009) SEE-I model.

Participants in both groups completed the critical thinking instrument developed by Ennis and Millman (2005), and a demographics instrument. The study was conducted over a five-week period including four weeks (8 class periods) of instructional treatment and one week (one class period pre and one class period post treatment) in which participants completed data collection instruments.

The research in this study focused on participants' change in critical thinking as measured by the CCTT-X. This research revealed that students who experienced the researcher-developed instructional design developed stronger critical thinking skills than research participants who did not experience that instructional design.

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Appendix A

Critical Thinking Elements of Thought and Intellectual Standards (Adapted from the Models of the Critical Thinking Institute, Richard Paul, Linda Elder, and Gerald Nosich.)

Elements of Thought

*Use for a Critical Thinking Analysis of Writing (yours or others') or to Analyze Problems. (Apply as Appropriate!)

1. What is the **purpose** of the message?
   a. How is the purpose stated clearly?
   b. How is the purpose significant, relevant, and realistic?
   c. Check periodically to be sure the writing is still on target with the purpose.
2. What is the **question** or **problem?**
   a. How is the question or problem stated clearly and precisely?
   b. Explain how the question or problem is expressed in several ways to clarify its meaning.
   c. State the type of answer needed; e.g., opinion, fact.
   d. Give stated sub-questions of the question or problem.
3. What are the **assumptions** and their justifications?
4. What is the writer's **point(s) of view** as well as other points of view?
   a. What is the basis for the writer's point of view?
   b. What are some strengths and weaknesses of the writer's point of view?
5. What are the **information, data,** and **evidence** upon which the reasoning is based?
   a. State data, information, or evidence the writer gives that supports and opposes the point of view, inference, conclusion, etc.
   b. How is the information the writer presents clear, accurate, and relevant to the question or problem?
   c. How and why (or why not) did the writer give sufficient information?
6. What are the key **concepts** and **ideas?**
   a. How are each of the key concepts and ideas explained clearly and precisely?
   b. What are the stated alternative concepts and ideas?
7. What **conclusions** did the writer draw, and what evidence did the writer use to draw each conclusion?
   a. What **inferences** did the writer draw, and what **assumptions** did the writer use to draw each of them?
   b. How are the inferences, interpretations, and conclusions consistent with each other?
8. What are the positive and negative **implications** and **consequences**?
   a. How do each of the implications, consequences, inferences, and assumptions follow logically from the reasoning?
   - (Elder & Paul, 2007)

Intellectual Standards

*Use for a Critical Thinking Evaluation of the Information from the Elements of Thought. (Apply as Appropriate!)

- **Clarity**
  - Could you elaborate further?
  - Could you give me an example?
  - Could you illustrate what you mean?
- **Accuracy**
  - How could we check on that?
  - How could we find out if that is true?
  - How could we verify or test that?
- **Precision**
  - Could you be more specific?
  - Could you give me more details?
  - Could you be more exact?
- **Relevance**
  - How does that relate to the problem?
  - How does that bear on the question?
  - How does that help us with the issue?
- **Depth**
  - What factors make this a difficult problem?
  - What are some of the complexities of this question?
  - What are some of the difficulties we need to deal with?
- **Breadth**
  - Do we need to look at this from another perspective?
  - Do we need to consider another point of view?
  - Do we need to look at this in other ways?
- **Logic**
  - Does all this make sense together?
  - Does your first paragraph fit with your last?
  - Does what you say follow from the evidence?
- **Significance**
  - Is this the most important problem to consider?
  - Is this the central idea to focus on?
  - Which of these facts are most important?
- **Fairness**
  - Do I have any vested interest in this issue?
  - Am I sympathetically representing the viewpoints of others?
  - Have I thoroughly examined both points of view? (Elder & Paul, 2007)
- **Sufficiency**
  - Have I said enough?
  - Is my information (given or received) complete enough? (Nosich, 2005)

Appendix B

Critical Thinking Assignment (Template)

Name _____

1. Read **(Faculty: Put the title of your paragraph, article, case study, etc. here).**

2. On a separate sheet of paper, for each element of thought below,

   - Answer every sub-question for that element from the Elements of Thought and Intellectual Standards handout.
   - Put the letter of the sub-question in front of your answer.
   - Your answer should be in similar language to that sub-question.
   - **See "Here is How" below** for an example of identifying and elaborating on the *purpose* element of thought**.**

Elements of thought that you must identify and elaborate about:
(Faculty: Put the Elements of Thought that are applicable to your assignment here.)

Here is How:

Purpose:

The purpose of this (*paragraph, article, case study, etc.*) is (*put your text here)*. **(Use wording similar to the element main question!)**

a. The purpose of this article is stated clearly and precisely because the author said (*put your text here)*.

b. The purpose of this article is significant because (*put your text here).*

c. The author gets somewhat off target because he/she concludes with (*put your text here)*.

Put the sub-question letter in front of your answer for that sub-question, and use wording similar to the sub-question!

Notice: This assignment must be typed and stapled (if multiple pages) or it will not be accepted!

Appendix C

Coordination of Critical Thinking Exercises

Writing Structure	Writing Selected by	Location Exercise Completed	Elements & Standards Selected by	No. Elements Selected	No. Standards Selected	Group Work or Individual
Sentence	Instructor	Classroom	Instructor	1	1 or 2	Individual
Sentence	Instructor	Classroom	Instructor	1	1 or 2	Individual
Sentence	Instructor	Classroom	Instructor	1	1 or 2	Individual
Paragraph	Instructor	Classroom	Instructor	2	3 or More	Individual
Paragraph	Instructor	Classroom	Learners	Minimum 2	As Applicable	Group[a]
Paragraph	Learners	Out of Class	Learners	Minimum 2	As Applicable	Individual
Article	Instructor	Out of Class	Instructor	4	As Applicable	Group[b]
Article	Learners	Out of Class	Learners	Minimum 4	As Applicable	Group[b]
Article	Learners	Out of Class	Learners	Minimum 4	As Applicable	Individual

Note. Class discussion follows the completion of each critical thinking exercise that includes instructor-selected writing.

[a]Learners self-select into groups of two. [b]Learners assigned into groups of three.

Appendix D

Critical Thinking Scoring Rubric

Student Name _____ Assignment Title _____

Were each of the Elements of Thought and Intellectual Standards in the assignment addressed sufficiently, including the use of language similar to the Critical Thinking Elements of Thought and Intellectual Standards document?

Scoring: 0 = not addressed; 1 = addressed, but not with similar language to model;
2 = addressed correctly

(Faculty: Complete the scoring rubric for each exercise and therefore determine the point value of the assignment! Of course, not all elements and standards apply to all sentences or paragraphs.)

1. What is the **purpose** of the message? _____
   a. How is the purpose stated clearly? _____
   b. How is the purpose significant, relevant, and realistic? _____
   c. Check periodically to be sure the writing is still on target with the purpose. _____

2. What is the **question** or **problem?** _____
   a. How is the question or problem stated clearly and precisely? _____
   b. Explain how the question or problem is expressed in several ways to clarify its meaning. _____
   c. State the type of answer needed; e.g., opinion, fact. _____
   d. Give stated sub-questions of the question or problem. _____

3. What are the **assumptions** and their justifications? _____

4. What is the writer's **point(s) of view** as well as other points of view? _____
   a. What is the basis for the writer's point of view? _____
   b. What are some strengths and weaknesses of the writer's point of view? _____

5. What are the **information, data,** and **evidence** upon which the reasoning is based? _____
   a. State data, information, or evidence the writer gives that supports and opposes the point of view, inference, conclusion, etc. _____
   b. How is the information the writer presents clear, accurate, and relevant to the question or problem? _____

   c. How and why (or why not) did the writer give sufficient information? _____

6. What are the key **concepts** and **ideas?** _____
   a. How are each of the key concepts and ideas explained clearly and precisely? _____
   b. What are the stated alternative concepts and ideas? _____

7. What **conclusions** did the writer draw and what evidence did the writer use to draw each conclusion? _____

   a. What **inferences** did the writer draw and what **assumptions** did the writer use to draw each of them? _____

   b. How are the inferences, interpretations, and conclusions consistent with each other? _____

8. What are the positive and negative **implications** and **consequences**? _____
   a. How do each of the implications, consequences, inferences, and assumptions follow logically from the reasoning? _____