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Moving Beyond Integrating Ubiquitous Undergraduate Research Skills in Undergraduate Information Systems Degree Programs

Submitted to the: Innovative Education, Pedagogy, and Experiential Learning track

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ABSTRACT

Information systems professionals must be able to recognize and adapt to changing technologies to support evolving business needs. While it is impossible to accurately envision tomorrow's technologies and business needs, it is possible to develop students' ability to constantly survey the changing business and technology landscapes and apply critical thinking skills to draw appropriate conclusions regarding which potential trends are worth following and which are less viable. This paper makes the case for preparing undergraduate students with problem-solving and research skills and describes a successful methodology for developing these skills in an undergraduate information systems course.

BACKGROUND

Increased attention has focused on developing undergraduate students' problem solving skills. "Changes in IS technologies, applications, and personnel require us to reconsider the skills for tomorrow's IS professionals" (Trauth, Farwell, & Lee 1993). Employers seek graduates who can apply their knowledge to solve business problems. This requires combining technical, business, and problem solving skills. Librarians have long recognized the importance of teaching 'library skills' to undergraduate students; many institutions have variations of information literacy programs in place.

In many cases, the teaching of in-depth research skills has been reserved for graduate level courses. This training can also occur in Research Methods courses and in specific subject area courses such as Marketing Research.

If undergraduate students are expected to leave the university prepared to seek, evaluate, and apply information to create knowledge and solve complex problems for their employers, an obvious question is how can universities can best prepare them to do so? Some might argue that the basic information literacy skills that we provide through generic library training are sufficient. Given these skills, students should be able to research solutions and solve problems in their chosen discipline. Perhaps this is true.

But, if it is possible to provide students with additional expertise and experience while meeting the learning goals of an undergraduate course, why not provide students with a competitive edge? This is possible through the integration of an applied problem-solving research experience in students' undergraduate coursework.

LITERATURE REVIEW

Significant research has concluded that today's IS graduates require skills that will not only get them through the hiring phase but also skills that will promote their success throughout their careers (Cappel, 2001-2). Most information systems degree programs recognize that students must have certain requisite technical skills. Educators are increasingly cognizant that technical skills, while a necessary ingredient for success, are not the only skills needed to sustain graduates beyond the initial interview stage. Employers lament that many technically-oriented graduates do not exhibit appropriate soft skills, where soft skills are described as interpersonal communication skills, personal motivation, an independent work ethic and critical and creative thinking skills (Litecky, Arnett, & Prabhakar, 2004). Furthermore, universities generally and business colleges specifically, cannot develop curriculums around technical job skills when the likelihood that the technical skills required are likely to change before the student completes the program. Other literature suggests that IS students need a fundamental understanding of business functional systems in order to succeed in a business environment (Peslak, 2005).

In the early 1980's, Trauth began a conversation distinguishing between what employers wanted from Information Systems graduates and what Information Systems graduates had learned from university programs. Her later research noted that "industry will demand a cadre of IS professionals with knowledge and skills in technology, management **and** (emphasis ours) interpersonal skills to effectively lead integration and process re-engineering activities." (Lee, Trauth, & Farwell, 1995). Other studies indicate that employers typically rate non-technical skills (soft skills) **higher** than programming or technical skills. (Cappel, 2001-2) One study noted the distinction between hiring practices. Technical skills tended to move a candidate past the "filtration process" and into the interview process; but soft skills were a key factor in making choices between similarly technically-qualified applicants. (Litecky et al., 2004).

Accreditation body recommendations are consistent with these findings and emphasize employer demands for graduates with soft skill competencies. The IS2002 Model Information Systems Curriculum, developed with guidance from the Association of Computing Machinery (ACM), the Association for Information Systems (AIS), and the Association for Information Technology Professionals (AITP), lists four required characteristics of the IS professional that have "been relatively constant over time."(IS2002):

1. IS professionals must have a broad business and real world perspective
2. IS professionals must have strong analytical and critical thinking skills
3. IS professionals must have interpersonal and team skills and have strong ethical principles

4. IS professionals must design and implement information technology solutions that enhance organizational performance. (Joint IS2002 Curriculum Co-Chairs).

Our work focuses attention on characteristics #2 and 3 above. Analytical and critical thinking skills are not unique to information systems programs, but are integral components of most general education curricula. The same is true regarding the need for interpersonal skills, team skills, and strong ethical principles. At JMU these are incorporated into the mission for the General Education Program:

“to graduate students who will be informed citizens, well prepared to participate in public life and public decision-making” and “to provide students with critical skills in reasoning, communication, and technology that build a strong foundation for course work at JMU as well as for their lives and careers after college.”
(General Education, James Madison University).

Librarians and libraries are natural partners in developing research skills also referred to as information literacy competencies. According to Association of College and Research Libraries; Students should;

1. know when information is needed
2. be able efficiently find information that addresses the need
3. be able to apply and use the acquired information to the information need
4. use the materials found legally and ethically (ACRL 2004).

Problem solving could be identified as a soft skill; and desired by employers. Kepner and Tregoe identified a set of Problem Solving activities;

1. problem identification
2. gather relevant information
3. identify possible causes
4. identify possible solutions
5. test the possible causes
6. come up with solutions
7. make a decision
8. monitor the results (1997).

PROBLEM STATEMENT AND STRATEGY

This research attempts to identify ways that IS educators can do a better job of instilling strong analytical and problem solving skills combined with excellent interpersonal and team skills. Likewise, it attempts to develop student’s ethical skills as they relate to the identification and use of information. Since these skills are difficult to teach as subject matter, the approach taken is to integrate all of the goals into a learning experience that will incorporate all of the desired skills.

To accomplish these, it is important to recognize the natural relationships that exist between the information literacy standards and the set of desired problem solving skills

described by Kepner and Tregoe. Table 1 illustrates this relationship which serves as the basis for the assignment used in the solution model.

Info Lit Standard	Problem Solving Stage
Know when information is needed	Problem identification and generation of possible solutions
Be able to find needed information	Gather relevant information, identify possible solutions
Be able to apply and use the acquired information	Come up with solutions, make a decision, monitor the results

Table 1 – Linking Information Literacy Standards and Problem Solving Skills

Information systems curricula can teach and integrate the desired competencies into their curriculum via effective assignment design and by building upon skills students have been required to master in previous coursework. The Solution Model that follows illustrates how one university has created and refined a methodology for teaching students how to apply basic research skills to enhance problem solving to develop decision-making, critical and creative thinking, and apply these composite skills to technical business issues/problems. Once they complete this process, students have demonstrated their ability to work as part of a team to conduct and present research on current issues and technologies in a business-like format and in a real-world context.

THE SOLUTION MODEL – THE ASSIGNMENT

Through a combined effort of two Computer Information Systems (CIS) professors and the Business Librarian at JMU an assignment was developed (and continues to evolve), that requires students to integrate the elements of Model Curriculum's and general education's principles. This integration is accomplished consistent with developing the skills employers want in potential hires and long-term employees. It uses current information systems topics and trends, while allowing students the freedom to pursue a specific topic that is of interest to them. We believe the use of information to develop problem-solving behaviors and interpersonal and group communication skills make our graduates more attractive to employers.

JMU's General Education Program has adopted the ACRL standards for student information literacy skills and has incorporated the standards into curricular learning objectives. All entering first-year students are introduced to the basics of higher education research concepts through Go For the Gold (<http://www.lib.jmu.edu/gold/default.aspx>), a set of web-based modules that develops their awareness of library resources and introduces them to the world of research databases. By the end of their second semester, all students are required to successfully complete a competency-based online Information Seeking Skills Test (ISST).

Specialized research skills are developed in the majors. Typically, students in major programs are instructed by a subject-specific librarian who introduces them to the process and sources of research important to their field of study.

Telecommunications is a 300 level course that serves as the introductory course for computing and information systems majors from three departments (Computer Science, Computer Information Systems and Integrated Science and Technology). During the first or second week of class the Business Librarian meets with the class in the Library to introduce them to the project and to direct the students to specific library resources such as Gartner (www.gartner.com), Telemangement Forum (www.tmforum.org), and Safari Tech Books that will be useful to begin the project. Students begin their research with an individual assignment during the second week of the course by using the Gartner Group's research database (www.gartner.com) to identify a "trend" in the telecom field that may serve as the topic for their group's research project. Information-seeking skills are tested here as students are required to seek our information in a field about which they have little or no background. Problem solving skills are honed as students look for a potential "problem" to solve. Critical and creative thinking is emphasized by requiring students to develop a research question based on the information they found.

Next, students use their Gartner Group article to prepare an individual single page long research proposal and must include an article from a recognized, refereed research journal that will be used to complete the answer to their research question. The combination of the Gartner Group database and research journal article help students learn the different types of research resources available and recognize the differences between the types of treatment each resource offers to their chosen topic. This is also helpful in introducing students to the resources available to them to solve problems with the literature of their discipline as a source of potential solutions that they may use to develop their own.

During the fourth week of the course, students are grouped into research teams by the instructor. Attempts are made to create teams made up of students with interest in similar topics. Instructors also attempt to diversify teams based on individual students' majors. Each team is responsible for selecting a team research topic and question from the work and they can choose from any of the topics they worked on individually. Each student must use information resources to investigate their selected trend and summarize what they have found as a "pitch" to persuade the group to work on that topic.

During the remaining weeks, teams are required to consult trade journals to further research their topic. Again, an important goal is to develop an understanding of how research services, reviewed journal articles, and trade publications each provide unique and complimentary treatment of their research topic, and to instill the significance of professional reading and continuing education. This is particularly important in this rapidly-changing field. This part of the assignment can be an easy "sell" to most students. It gives them an opportunity to enhance their skills sets to potential employers and allows them an opportunity to further learn the language of the practitioner.

Groupware provides resources that students can use to share data and collaborate interactively with each other during the course of the project. Two group status reports are collected during the course of the semester to encourage student teams to make incremental process instead of waiting until the final week to complete their project.

There is a process to warn and ‘fire’ noncontributing team members during the course of the project (add Reif/Kruck citation).

During the final week of the semester, each group is responsible for two deliverables. The first is a written report, generally 15-20 pages long, with appropriate citations. The second is a twenty minute in-class presentation of their findings to their classmates. Each deliverable is evaluated independently.

RESULTS AND LESSONS LEARNED

This assignment has evolved in two major phases since being initiated in 1999. The enhancements include moving from allowing students carte blanche choice of topics to directing them more closely to current topics. A second enhancement involved tailoring the Business Library session towards specific research resources instead of using a high-level overview of resources.

Students have reported that they are satisfied with the results of this work. They share the results with potential employers during internship and permanent position interviews as a means of demonstrating their “soft skills” to potential employers. Student self esteem is enhanced as they recognize that they are capable of producing management-type research reports; thus further developing critical and creative thinking skills. Several students have continued their work and have either submitted, or are in the process of submitting, their work to research journals for publication.

Faculty are pleased to find that undergraduate students are capable of producing quality research. Student’s contributions enhance course content and provide an interesting array of current topics to culminate the course, illustrating how all of the course material can be aggregated and applied to real-world types of problems.

As our University responded to requests by accrediting bodies to demonstrate that our students were receiving research skills instruction, we were able to cite this project as an example of our commitment. Perhaps the most positive indicator of our success beyond the positive student and employer comments is the fact that many more students are participating in student paper competitions sponsored by professional organizations, are presenting research papers at conferences, and are working with faculty to publish their work in research journals.

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