The Quest for a Researchable Problem: Collaborative Use and Application of a Shared Online Bibliography and Database Manager

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"You write a few lines of code and suddenly life is better for a hundred million people; that's software ("Go To", p. 2). Charles Simonyi, Principal Developer, Microsoft Word software program

Introduction and Purpose

As students in a doctoral dissertation seminar at New York University, we embarked on the challenging task of working collaboratively in the development of a researchable problem statement related to issues of teaching and learning basic computing skills at the undergraduate level. One purpose of this paper was to document how we collaboratively used the RefWorks™ software tool to develop a bibliographic knowledge base related to understanding curriculum practices of *Introduction to Computing* courses at the top 25 undergraduate U.S. business schools. A second purpose was to identify the conceptual frames and variables (independent and dependent) from empirical studies that have shown to influence students' basic computing skills and knowledge acquisition.

Questions

1. What do we know from the literature about how different factors may impact the way college students learn and acquire basic computing skills?
2. What do we know from practice about what "best schools of business" are doing to promote student learning of basic computing skills?

This paper describes practices and empirical research related to the teaching and learning of basic computing skills of undergraduate college students at the top 25 U.S. business schools.

We approached this topic with the hope of developing a researchable problem statement, although the learning process itself was the focus. We found that writing a good researchable problem statement is a complex activity. We wanted to investigate current practices and relate them to frames and variables from the literature, again with the hope of discovering a problem, yet we found this to be a daunting task. Writing a good problem statement is far from effortless (O'Connor, 2000). What appeared at the outset to be a somewhat methodical and simple activity was not.

The overarching purpose of this paper was to document our collective experiences as novice researchers faced with an authentic research opportunity. The hope was that it might inform each of our respective doctoral dissertations and perhaps offer a model for researchers at all levels as a means of starting collaborative research efforts.

Approach

We used a four-pronged strategy in attempting to answer our questions:

1. Learn to use a new web-based bibliographic software tool supported by our university to build a collaborative database;
2. Search for empirical studies associated with acquiring basic computing skills and knowledge; (Theory)
3. Search for *Introductory Computing Courses* in the core curricula of the top 25 undergraduate U.S. business schools; (Practice)
4. Collaboratively discuss and reflect upon theory and practice findings as a possible application to defining a researchable problem

Using Refworks™ Database Manager

RefWorks™, a web-based bibliographic and database manager software program, was used as a collaborative tool to store and manage our research materials, reported in this paper. This tool allowed for the creation of a knowledge database consisting of empirical studies associated with acquiring basic computing skills and knowledge, and course materials to understand the curricular strategies in *Introductory to Computing* courses at the top 25 undergraduate U.S. business schools. Using an online information service provider like ProQuest® allowed for the visual scanning of articles, tagging, saving, and importing of research articles into the RefWorks™ database. We managed the RefWorks™ database by creating folders consisting of related articles according to descriptors found. For each item in the database, user spaces were assigned to each group member for writing notes, which served as a mark of imported ownership. As many as 5 members can be assigned individual user spaces. Characteristics of this database tool include the ability to index descriptors and authors upon importing references; the ability to edit descriptors and create folders for organizational purposes; the ability for multiple users to log into the same database of articles and share research efforts; the ability to add footnotes, quotations, and a bibliography in a particular style set without having to purchase any additional software; a free 30 day trial period to individual users (otherwise a $50.00 annual fee) and free usage for students in site-licensed institutions. New York University had purchased a site-license.

The RefWorks™ tool provides easy filtering and sorting capabilities, automatic backups and upgrades; built-in compatibility with other online databases (EBSCOhost, Silverplatter, ERIC, ProQuest, etc.); exporting to Microsoft ® Excel and Access software programs; and cross-platform access from Mac, PC or UNIX. RefWorks™ also assisted in the process of writing this paper as the collection of citations are easily placed in the body of text through the use of {{ }} characters, correlating to the citation number, compatible with Microsoft ® Word 97 (and later versions) word processing software. Other notable features of RefWorks™ is the ability to access from anywhere with a web connection, read other users' comments on collected articles, and storage on the RefWorks™ server instead of an individual's computer hard drive.

New York University supported RefWorks™ beginning the Fall of 2002 and library personnel scheduled several introductory workshops throughout the semester. Our group was a beta test site for New York University. To get started, we attended a private training session with a university reference librarian and received an instructional handout. We continued to work with both the university reference librarian and RefWorks™ customer support throughout the semester to develop our skills in using this tool.

RefWorks™ LLC, co-founded by Earl Beutler, Colleen Stempien, and Kirk Schneider, experts in the field of information databases, is a privately owned Limited Liability Corporation. The company is "set up, at this point, to primarily handle the development and support of the RefWorks™ product with the sales and marketing done through a worldwide network distributor" reports Colleen Stempien (e-mail communication, November 10, 2002). The product beta tested in August 2001 and the full product released in January 2002. The web site address is: http://www.refworks.com.

Curriculum Practices at the Top 25 Undergraduate U.S. Business Schools

A web-based search was conducted on the top 25 undergraduate U.S. Business Schools, as rated by the Deans and Senior Faculty at AACSB Business Schools and published in 2003 Edition *U.S. News and World Report* (September 23, 2002 p.115), to document their curricular practices in the delivery of basic computing skills. Some course descriptions and syllabi for the *Introduction to Computing* course at the top 25 undergraduate U.S. Business Schools were found using online methods. Where no *Introduction to Computing* course was indicated on the web site, one of us telephoned the Dean's office at the business school asking for information regarding strategies for teaching basic computer skills to undergraduate business school students.

Using a spreadsheet application, as shown in Table 1, we listed the 25 business schools according to the 2003 Edition *U.S. News and World Report* rank. The column headings in Table 1 showed the categories of where *Introduction to Computing* courses were taught. The categories are: not found in business school curriculum, non-credit course offered at the university technology center, non-credit course offered at extension college, for-credit certificate program, embedded in university core curriculum, contained in business core curriculum, course offered in business school curriculum, or the provision of a waiver test.

It appeared that the data showed most of the top 25 business school programs offered an *Introductory to Computing* course as part of their core curriculum. Only five schools (Berkeley, University of Wisconsin, Washington University in St. Louis, University of Washington, and University of Arizona) appeared not to have a basic computing course. Representatives that we spoke with reported that their undergraduate business programs did not require a basic computing course as part of the core curriculum: they expected their students to come into the program with basic computing skills. These basic skills could be acquired either through a non-credit course at a technology center or an extension college/university. A sixth school (University of Virginia) required a basic computing course only for students in the IT concentration. Another school (University of Washington) had an additional option of a certificate-granting computing course. Of note, only the University of Florida web site was clear in its indication that it was possible for business majors to test out of the basic computing course requirement.

As Table 1 also showed, the course names for the basic computing class varied at the top 25 schools, as did the number of credits ? from one to three. Some schools tended to go beyond calling the course simply *"Introduction to Computing"* or *"Fundamentals of Computing."* In fact, four schools included a business label or orientation in the course title, such as *"Business Computing Skills," "Business Software Development," "Computer-Based Systems for Management Support," or "Business Information Systems*." Another school named their course *"Problem Solving Using Computers and Software"* or in the case of MIT, they named their course *"Introduction to Computers and Engineering Problem Solving."*

Literature Review

Each of us independently searched for articles and other publications relevant to answering our first question, "What do we know from the literature about how different factors may impact the way college students learn and acquire basic computing skills?" Through our collaborative effort, we found that the expectation of student preparedness with basic computing skills can be difficult for universities to ascertain and determine. The literature points to several possible variables that may affect a student's preparedness for computing skills, such as basic computer literacy (Lambrecht, 2000; Gordon & Chimi, 1998; Hindi et al., 2002), faculty attitude and behavior toward computers (Basinger, 1999; Selwyn, 1999a; Selwyn, 1999b; Lynch, 2002; Altschuler, 2002), instructional formats applied in computer classes (Shaw & Giacquinta, 2000; Creighton & Kilcoyne, 2000; Ross et al., 2001; Chen, 2002), students' demographics (Wilson, 2002; Selwyn, 1999a), student attitudes towards computer technology (Karsten, 1998; Zhang, 1998), and student learning styles (Drysdale, 2000; Ross et al., 2001; Belanger, 2000; Creighton, 2000; Simon, 2000). These are the variables that researchers are using as they investigate how students learn basic computing skills.

Computer Literacy

The expectation of basic computer literacy for incoming college freshmen may produce challenges for universities (Yates, 2000; Hindi et al., 2002; 2001 National Survey). Basic computer literacy can be evaluated by a student's prior computer classes (secondary school curriculum) and experiences (home or job), as well as student computer ownership (Gordon & Chimi, 1998; Hindi et al., 2002). Gordon & Chimi (1998) and Hindi et al. (2002) found that a key hindrance to computer literacy is the lack of consistent standards in high school curriculum for computer instruction. High school curriculum can vary significantly, with some focusing on word processing while others select spreadsheets or hardware information. Students come to college with varying degrees of computer knowledge, skills, and experiences. In one study of college students and computers, Partee (as cited in Gordon & Chimi, 1998) suggested that implementing computer-based techniques into the college classroom "is hampered because of inadequate preparation in high schools (caused primarily by limited funding), which leaves many college students computer illiterate" (p. 4). Computer ownership is another factor found to improve computer literacy (Gordon & Chimi, 1998; 2001 National Survey). Results of these studies indicated that a gap might exist between what faculty members *think* college-bound students know or should know in the computing skill area, and what they *actually* do know.

Faculty Attitude and Behavior toward Computers

The lack of basic student computing preparedness may be a wider reflection of higher education faculty's unwillingness to transform their role and update (or acquire) their own computer skill set (Basinger, 1999; Sewlyn, 1999a; Shaw & Giacquinta, 2000; Hopson, 2002). Many authors bemoan the failure of faculty to incorporate computers into teaching practices despite the accessibility of technology in the classroom (Basinger, 1999). U. S. national survey statistics report the percentages of faculty who do not use computers in teaching: only 20% use course management tools although 80% have access to them; 33% did not even use e-mail to correspond with students (Lynch, 2002). Selwyn (1999a) found that professors perceive computer skills courses to be of little or no use at the university level. Even in more vocational streams, professors perceived computers as taking them out of their control and responsibility zones (Selwyn, 1999b). A study of graduate students' attitudes, uses, needs, and preferences with regard to academic computing by Shaw and Giaquinta (2000) suggested, "faculty will need to expand their own skills in relevant computer applications, the integration of computer use into curricula, and the creation of computer-rich learning environments" (p. 38). One survey of 416 national post-secondary institutions indicated that most faculty involved in teacher-training programs fail to show their students how to incorporate technology into their classroom instruction (Basinger, 1999). Faculty may soon face pressure for greater incorporation of technology into curricula (Altschuler & McClure, 2002) as colleges and universities continue to levy high technology fees. In some situations, these high fees may accompany mandated purchase or lease of a laptop computer.

The pressure to incorporate technology into the curriculum represents a major role change for many faculty members. The creation of a technology-enriched classroom environment represents a major-shift from teacher-centered to student-centered. Hobson (2002) reports that such a role shift in conjunction with the technology-enriched curriculum results in a positive effect on student acquisition of higher-order thinking skills. The implication of the Hobson study is paramount ? that technology is a tool that allows students to move beyond knowledge acquisition to knowledge application. Faculty unwillingness to shift to a student-centered curriculum appears to represent a theory and practice dichotomy. It may be representative of too close of a bond between faculty and their disciplines and a shift may mean a shift off-center. Simply stated, relearning ideas using a new method may not translate well for some faculty members, thus their hesitance. What some faculty members may fail to see is their disciplines can perhaps be taken to new heights and dimensions in the same way it has moved students' thinking to new heights, with technology as the tool.

<u>Student Demographics</u>

Gender, age, and subject concentration were the most discussed demographic variables predicting the acquisition of basic computing skills. Wilson (2002) found no significant gender bias in comfort with computers, the significant predicator for success in an *Introduction to Computer Science* course for computer majors at a Midwestern university. Another study among more than 300 graduate education students in a Northeastern university found that gender had no effect on frequency of computer use, satisfaction with current skills, or attitudes toward the value of computers in schoolwork (Shaw & Giacquinta, 2000). Orr, Allen, and Poindexter (2001) reported that gender did not predict computer liking or anxiety in their study of 214 students enrolled in a computer literacy course. Wilson (2002) also found that time spent with computer gaming, which has a much higher use among males, has a significant negative correlation with success in learning basic computing. A math background was the second most significant predictor of success in the *Introduction to Computer Science* course that Wilson (2002) studied. On the other hand, in a large U.S. survey (First-Year Females…, 2001), confidence in computer skills has shown to be much lower among female than male freshmen, even though usage was the same. Orr, Allen, and Poindexter (2001) found that age correlated with less anxiety, more confidence, and a greater liking for computers, whereas Shaw & Giacquinta (2000) showed age was not a variable in use, comfort or attitudes toward computers. Program affiliations did predict performance in computer introduction courses. Note surprisingly, Shaw & Giacquinta (2000) found that graduate students in a program of Educational Technology used computers more frequently and for more purposes than other Education graduate students surveyed. However, the differences were smaller than the authors expected. Ray et al. (1999) found women had more positive attitudes toward computers than men. It appears that the demographic variables studied are diminishing in value for predicting computing attitudes and skills.

<u>Student Attitudes Toward Computer Technology</u>

Zhang & Espinoza (1998) found anxiety level and attitude toward computer learning to influence student's preparedness towards basic computer skills. Many studies (Orr et al., 2001; Ren, 2000; Zhang & Espinoza, 1998) cited improvement in both anxiety and attitude with proper training and instruction. Orr et al.'s study (2001) found that more experience with computers and owning a computer increased student attitude toward computer learning. Not surprisingly, a positive attitude has a high correlation with confidence level and self-efficacy for students learning new skills (Zhang & Espinoza, 1998). Research studies showed mixed results on significance between student attitudes toward computers and gender (Shaw & Giacquinta, 2000; First-Year Females… 2001, Orr et al., 2001), age (Shaw & Giacquinta, 2000; Orr et al., 2001), personality (Orr et al., 2001), learning style (Orr et al., 2001; Chen, 2002), and desire to learn computer skills (Zhang & Espinoza, 1998). Despite the multiple variables involved with these studies, student attitudes toward computers continued to be a significant factor in how students learn computing skills.

Learning Styles and Instructional Formats Applied in Computer Classes

With respect to learning styles, Svensson (1976, as cited in Drysdale, 2001) noted a difference between the learning conditions at high school and university levels. Entwistle (1990, as cited in Drydale, 2001) demonstrated that academic success and failure in higher education depends not on student characteristics or teaching effectiveness alone, but on the interactions between the students and the learning environments, and the match between presented materials and how students process them. Drysdale (2001) investigated the effects of cognitive learning styles on first year academic performance in 19 university courses over a 4-year period from 1993 to 1997, including *Computer Science: Introduction to Computers* using the Gregorc Style Delineator. The Gregorc Style Delineator is a self-report tool used to measure thinking and learning processes, designed to help individuals understand and recognize the channels by which they receive and process information efficiently. Concrete Sequential (CS) learners outperformed other learning style groups in the *Introduction to Computers* course and dominant Abstract Random (AR) learners comprised the majority of withdrawals (70%) and failures (62%). AR learners may struggle in this course because of the structure involved in the class and lab components and the preference of more spontaneous environments rich in people and stimuli. Ross's (2001) findings echoed Gregorc's; sequential learners performed better in computer courses than random learners did.

Along with individual learning styles, instructional formats affected student learning of basic computer skills (Basinger, 1999; Selwyn, 1999a; Selwyn, 1999b; Lynch, 2000; Altschuler, 2002). The most widely used instructional practice identified in our research of the top 25 undergraduate business schools was the traditional lecture/laboratory method. We discovered one study of a university that successfully shifted from a traditional lecture/laboratory method of teaching microcomputer applications to a self-paced course with fewer instructors (Creighton & Kilcoyne, 2000). They reported adding four help sessions and practice tests to retain students and maintain performance in the self-paced course.

Discussion and Reflections

Using Refworks™

We pilot tested RefWorks™ because it was new product to New York University. Our collective experience using this tool was mostly positive, but we found limitations that could be a hindrance for future collaborative research teams.

A significant benefit to our collaborative process was the ability to access articles from any location via a web connection and read shared comments on articles collected. Independently, we were able to search for articles and even provide links to the article if the article was online. One task in research is the time-consuming literature review and RefWorks™ provided the means for a more efficient process. Separating our comments by user number made the collaboration and discussion of articles more manageable. The ability to sort and filter keywords from the multiple selections of articles was also helpful, as our attempt to define researchable problem statements required the categorization of main themes and variables across the literature.

Overall, users of RefWorks™ could benefit from readily available on-line instructions and a comprehensive FAQ section. On a number of occasions, we could not locate a function or the function did not appear to work as expected. For example, we found importing references from electronic libraries into RefWorks™ confusing, even when automatic linkages were available. A major hurdle was the unbeknownst timing limitations (3 weeks) for imported links to online articles, which forced the issue of duplicating initial search efforts. This limitation would need to be addressed if the tool is to be helpful to any long-term collaboration projects. In reflection, RefWorks™ relied more on user intuitiveness rather than on its on-line help services. While we believe RefWorks™ can be an important collaboration tool, the program's interface design should be evaluated for end-user usability.

Despite some difficulties, the benefits of using this collaborative approach and our shared database bibliographic tool may be a model for future research collaborators because it is easy to use and offers anywhere, anytime, accessibility. In addition, we appreciated the automatic generation of references in APA format.

Summary Comments of Curricular Strategies at the Top 25 Undergraduate Business Schools

Based on our investigation of the introductory computing classes at the top 25 undergraduate U.S. business schools, a current trend is to offer *Introduction to Computing* courses for-credit within the business school curriculum. However, we found 5 schools that did not appear to offer any credit-bearing courses for *Introduction to Computing* courses, as they expected incoming freshmen to enter with a basic computing skill set. This small grouping might represent a new practice for business schools. As Selwyn's (1999a) study reported, some postsecondary educators see computing skills as superfluous to the real objectives of higher education, as including computing skills can contaminate the academic purity of courses. Perhaps, preparedness in computing skills is irrationally justified as more students study computing in high school and enter college ready to take more advanced courses (Gordon & Chimi, 1998).

Colleges are creating innovative techniques to manage the disparity of computer skill sets of their incoming students. For example, many allow students to test out or offer non-credit courses for remedial training (Hindi et al., 2002), although this did not appear to be common practice in these 25 top business schools. To bridge the skills gap, some studies (Babcock and Woodhouse as cited in Gordon & Chimi, 1998) appeal for more articulation between high schools and universities with an expectation of developing new computer education curricula. For college professors, it is very important to vary teaching styles to accommodate the needs of all students. For example, group work, class discussion, lectures, projects, the use of audio/visual aids, hands-on labs, and case study activities are all ways to make course material more meaningful to students with diverse learning styles (Drysdale, 2001).

Reflections on the Learning Process

We appreciated the opportunity to learn about the research process through this authentic activity. We found the tasks associated with this activity and use of the collaboration method a valuable experience. Collaboration allowed us to leverage each other's strengths and learn from one another, which improved the overall quality of this research activity. The chance to share ideas and points of view in conjunction with a focused goal provided an intense and significant experience that will resonate deeper when we embark on our own dissertations. The activity's tasks provided the needed skills, thought, and insight to prepare for our own dissertations.

However, we continue to struggle with the definition of cogent problem statements. Some of the difficulties we are encountering are knowing what's worth investigating and thus, what's worth knowing. We struggle with "depth over breadth;" how much should one read before synthesizing? We struggle with timeframes; how long should a literature review take when faced with the sheer volume of available publications? We struggle with perspective as students –*what* does one measure study results against? It would be useful to determine whether our difficulties can be generalized to a large base of beginning doctoral students.

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Table 1. CURRICULA STRATEGIES FOR TEACHING BASIC COMPUTER SKILLS TO UNDERGRADUATE BUSINESS SCHOOL STUDENTS

Top 25 Undegraduate Business Schools
U.S. News and World Report - 2003 Edition (pg. 115)
As rated by Deans and Senior Faculty at AACBS Schools

		Not in B-School Curriculum	Non-Credit Course at Technology Center	Non-Credit Extension College/ University	For Credit Certificate Program	Course in B-School Curriculum	Test Out	Comments
1	University of Pennsylvania (Wharton)					x		Operations Management 101
2	MIT Sloan					x		Introduction to Computers and Engineering Problem Solving
3	University of Michigan					x		Informations Systems
4	University of California Berkeley (Haas)	x	x	x				MBA only jrs/srs
5	University of North Carolina (Kenan Flagler)					x		Business Computing Skills
	University of Virginia (McIntire)					x		Business Software Development (IT Majors only)
7	Carnegie Mellon					x		Computing Skills Workshop
	New York University (Stern)					x		Computer-Based Systems for Management Support
	University of Texas - Austin (McCombs)					x		Intro to MIS course
10	Indiana University - Bloomington (Kelley)					x		Intro to Computers and Computing
11	University of Illinois - Urbana - Champaign					x		Intro to Computers
	Univ. of Southern Cal (Marshall)					x		Prerequisite for admission into business major
	Univ. of Wisconsin - Madison	x	x					Prerequisite for admission into business major
14	Ohio State University - Columbus (Fisher)					x		Computer & Information Science 200 course - Required pre-major
	Purdue U. - W. Lafayette (Krannert) (IN)					x		Organizational Computing
	Univ. of Minn. Twin Cities (Carlson)					x		1 credit Web based wkshop
	Washington University in St. Louis (Olin)	x						
18	Emory University (Goizuets) (GA)					x		CS150 - Intro. to Computers & Programming
	Penn State - Univ. Park (Smeal)					x		Business Information Systems
	Univ. of Maryland - College Park (Smith)					x		BMGT 201
	University of Washington	x		x	x			
22	University of Arizona (Eller)	x	x	x				
	University of Florida (Warrington)		x			x	x	CGS 2531 Problem Solving Using Computer Software.
	University of Notre Dame (IN)					x		CSE 211- Fundamentals of Computing I
25	Arizona State University					x		CIS 200 Computer Applications and Information Technology