Issues in Accounting Education
Vol. 11, No. 2
Fall 1996

CROSS-CULTURAL COMPARISONS

An Empirical Investigation of Knowledge, Skill, Self-Efficacy and Computer Anxiety in Accounting Education

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ABSTRACT: Accounting practitioners and academics are reexamining the core skills that are taught in undergraduate accounting education. We report the results of two studies that investigate the relationships among knowledge, skill, self-efficacy, and computer anxiety in an accounting education setting. In the first study, some participants received both software-specific training and accounting systems knowledge (SSTASK), while others received only accounting systems knowledge (ASK). In the second study, all participants received accounting systems knowledge (ASK) for eight weeks, followed by eight weeks that combined software-specific training and accounting systems knowledge (SSTASK).

The results of both studies suggest that: (1) SSTASK generates larger increases in certain types of accounting-related self-efficacy than ASK, (2) self-efficacy measures (e.g., spreadsheet, database and computer self-efficacy) may be more relevant to accounting education than computer anxiety measures, and (3) measures of self-efficacy may be increasingly useful as diagnostic tools as accounting education places more emphasis on skills relative to knowledge. We conclude by arguing that recent educational reforms in accounting suggest a need to more clearly delineate the relationships among accounting instruction, knowledge, skill, self-efficacy and anxiety.

ACCOUNTING education is in a period of profound change. A number of recent critiques, including those of the "Bedford Committee" (American Accounting Association

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Sincere thanks to the KPMG Peat Marwick Foundation for grants to the first author and to Waqar Ahmed, Jackie Hammersley, Bobbi Jones, Kathryn Kadous, Kin-Yew Low, Anne Magro, Loren Nikolai, Jim Parker, and the editor and two anonymous reviewers for comments on previous drafts. Thanks also to our colleagues for their cooperation, support and good humor. The data, descriptions of the data and analysis procedures, and copies of the instruments from this study are available from the second author. We encourage and are willing to participate in replications of this work.

Committee 1986), the Big 6 "White Paper" (Perspectives on Education 1989), and the Accounting Education Change Commission's Position Statement Number One (AECC 1990), call for dramatic, substantive changes in the knowledge and skills that are taught in accounting education. A common aspect of most recent calls for change in accounting education is an increased emphasis on knowledge and skill related to information technology, computing and accounting systems. For example, both the Bedford Committee (1986, 182) and AECC's Position Statement Number One (1990, 309) identify the "design and use of information technology" as a core dimension of basic accounting education. Similarly, the AECC's Position Statement Number Two (1991, 250) argues that the first course in accounting should include coverage of "...the principles underlying the design, integrity, and effectiveness of accounting information systems." Many public accounting firms now expect incoming accounting graduates to have both a general knowledge of accounting systems and a set of specific skills related to information technology. For example, a spokesperson for Coopers & Lybrand (*New Accountant* 1992, 6) observes:

> The new staff member should have a conceptual understanding of accounting information systems and the ability to use generally accepted micro-based tools (e.g., spreadsheet and word processing software). Experience with other applications software and experience with information systems in the business world is a plus.

The calls for increased attention to systems in accounting education are not confined to public accountants. A recent research study jointly sponsored by the Institute of Management Accountants and the Financial Executives Institute used a combination of methodologies to determine the knowledge and skills that high-level accounting and financial executives considered most important in accounting education (Siegel and Sorensen 1994). One of the five "most under-prepared" topics identified by the executives was information systems design.

Many accounting academics have responded to these calls for an increased focus on information technology knowledge and skill. For example, AECC sponsored undergraduate accounting curriculum innovations at Arizona State University (Williams and Sundem 1991), Brigham Young University (Albrecht et al. 1994), North Carolina A & T State University (Williams and Sundem 1991), the University of Massachusetts (Williams and Sundem 1990) and the University of Southern California (Diamond and Pincus 1994) all heavily emphasize the development of accounting systems knowledge and computer-related skill.

The current and proposed changes in accounting education are likely to affect undergraduate accounting students' perceptions of and experience with accounting education. One obvious potential effect of the dramatic changes in accounting education is that students will emerge from the new curricula with differing sets of knowledge and skill. Less obvious, but of potentially equal importance, are the effects of changes in accounting education on students' beliefs in their ability to accomplish accounting-related tasks (i.e., their "accounting-related self-efficacy") and students' feelings about computers and computer-based technology. For example, measures of student self-efficacy are increasingly recognized as important diagnostic tools that are useful in understanding the knowledge and skills which students believe they possess (Angelo and Cross 1993). Computer self-efficacy (Hill et al. 1987) and computer anxiety (Rosen and Maguire 1990) are important predictors of students' willingness to learn about and use computer systems.

One purpose of this paper is to investigate how changing the relative emphasis on accounting knowledge versus skill affects undergraduate accounting students' knowledge, skill, various types of self-efficacy and computer anxiety. Another purpose is to examine the relationships among some measures (e.g., self-efficacy, computer anxiety) that are of potentially greater relevance as accounting education increases its emphasis on computer-related skill and knowledge. The context of this investigation is teaching a set of knowledge and skills that are increasingly recognized as important to accounting education: accounting systems knowledge, and computer, spreadsheet and database skills.

In the following section, we define and describe the concepts of knowledge, skill, self-efficacy and computer anxiety in the context of accounting instruction. Following this, we describe the methodology and results of two studies designed to investigate the effects of accounting systems knowledge (ASK) only versus software-specific training and accounting systems knowledge (SSTASK). The first study employs a cross-sectional design which examines ASK and SSTASK between groups. The second study employs a longitudinal design which examines the effects of both ASK and SSTASK on the same group. We conclude by arguing that recent educational reforms in accounting suggest a need to more clearly delineate the relationships among accounting instructions, knowledge, skill, self-efficacy and anxiety.

KNOWLEDGE, SKILL, SELF-EFFICACY AND COMPUTER ANXIETY IN ACCOUNTING EDUCATION

Knowledge and Skill in Accounting

Distinguishing educational goals that relate to the development of knowledge vs. the development of skill has been an important advance in educational theory and assessment in professional domains (e.g., Carter 1985).[1] In the context of professional education, knowledge is the state of knowing something, while skill is the ability to use one's knowledge to perform a task (Bloom et al. 1956; Romiszowski 1981). Knowledge is considered dichotomous (i.e., either present or absent) whereas skill exists at many levels. Knowledge is considered necessary but not sufficient for skill; skill cannot exist without knowledge. More simply, knowledge is what one knows; skill is what one can do.[2] Instruction that emphasizes knowledge is primarily concerned with increasing students' ability to recall and communicate specific facts and concepts. Instruction that emphasizes knowledge and skill is concerned with increasing students' ability to use facts and concepts to accomplish specific tasks, or to increase students' ability to apply abstract principles to specific problems (Angelo and Cross 1993).

The importance of, and distinction between, accounting-related knowledge

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[1] Although the distinction between knowledge and skill was recognized in early work on education theory and assessment (e.g., in Bloom et al. landmark "Taxonomy of Educational Objectives" 1956, 38–39), it has only recently been commonly applied to the establishment and assessment of educational objectives.

[2] A related distinction in psychology is between procedural and declarative knowledge (e.g., Davis and Solomon 1989). Procedural knowledge is similar to the education literature's use of the word "skill." Declarative knowledge is similar to the education literature's use of the word "knowledge."

and skill has been recognized by accounting academics. For example, both the Bedford Committee (1986) and the AECC's Position Statement Number One (1990) distinguish between the knowledge and skills necessary for accounting practice. Similarly, Deppe et al. (1991) identify an expanded set of competencies for accounting practice that distinguish between accounting-related knowledge and skill. In addition, many recent descriptions of accounting curriculum innovation distinguish between knowledge and skill-related objectives (e.g., Ainsworth and Plumlee 1993; University of Illinois 1990).

Electronic Spreadsheet Training in Accounting Education

Most employers now expect graduating accounting majors to have basic skills in preparing and using electronic spreadsheets (*New Accountant* 1992). For example, Heagy and McMickle (1988) surveyed 122 CPAs and 172 accounting academics regarding the computing knowledge and skill they considered important and unimportant in accounting education. Accounting practitioners ranked the ability to use electronic spreadsheets as second in importance out of 59 possible topics (only "internal control" was ranked higher). However, many accounting academics have been reluctant to incorporate spreadsheet training into the accounting curriculum. For example in the Heagy and McMickle (1988) survey, electronic spreadsheet training was the topic with the largest difference in rankings between practitioners (ranked 2nd) and academics (ranked 38th).

There are two common approaches to teaching the accounting information systems (AIS) course. The first teaches basic factual knowledge about computers and accounting systems (i.e., accounting systems knowledge (ASK)) using traditional "textbook" approaches. The second integrates software-specific skill training (e.g., spreadsheets) and accounting systems knowledge (SSTASK) using both textbooks and hands-on use of computers (cf. Levitan 1988). How might an ASK vs. a SSTASK approach, that included spreadsheet training, affect spreadsheet knowledge and skill? It would seem obvious that, if SSTASK instruction in spreadsheets is well designed, students' spreadsheet knowledge and skill should increase with spreadsheet-relevant SSTASK. This suggests:

H1: Instruction that includes software-specific training and accounting systems knowledge (SSTASK) will increase software knowledge and skill (manipulation check of SSTASK instruction).

Task-Specific Self-Efficacy

Guided primarily by the pioneering work of psychologist Albert Bandura (1977, 1982, 1986), self-efficacy is emerging as an important psychological construct in understanding why people choose to pursue particular activities and the extent of effort they devote to these activities (e.g., see Druckman and Bjork 1994). Self-efficacy judgments are beliefs about one's ability to mobilize the physical, intellectual and emotional resources needed to successfully accomplish a task (Bandura 1986; Eden and Kinnar 1991).

Task-specific self-efficacy is the extent of belief in one's ability to successfully accomplish a specific task (e.g., create a spreadsheet).[3] Bandura (1986) argues that an individual's task-specific

[3] Previous research has investigated the effects of task-specific self-efficacy in a variety of settings, including training and education (Bandura and Schunk 1981; Eden 1990; Eden and Ravid 1982; Eden and Shani 1982), sales performance

(Continued on next page)

self-efficacy arises from four informational sources. In descending order of impact these are: *enactive attainment*, *vicarious experience*, *verbal persuasion* and *physiological state*. *Enactive attainment* (i.e., successful performance of the task) has the largest impact on task-specific self-efficacy, since successfully performing a task is incontrovertible evidence of one's ability to do the task. Next best is *vicarious experience*, i.e., seeing someone similar to one's self performing the task. *Verbal persuasion* involves a credible teacher or peer convincingly arguing that one can successfully perform the task. Finally, one's emotional reactions of fear or success related to a task (i.e., one's *physiological state*) also affect one's sense of self-efficacy.

Only preliminary research on self-efficacy has been conducted within accounting education. For example, Stone et al. (1994) report results suggesting that differences in accounting instruction can affect accounting undergraduates' self-efficacy in technical accounting skills vs. communication and interpersonal skills. Also relevant to accounting education is research investigating computer-related self-efficacy, which is a form of task-specific self-efficacy (Harrison and Rainer 1992; Murphy et al. 1989). This research suggests that computer instruction that includes software-specific training can increase computer self-efficacy more than instruction that includes only computer knowledge (Anderson et al. 1980–81; Gist et al. 1989; Oliver and Shapiro 1993). Two forms of task-specific self-efficacy that are likely to be of increasing importance to accounting education are software-specific (e.g., spreadsheet or database self-efficacy) and computer self-efficacy.

Software-Specific Self-Efficacy

Software-specific training and accounting systems knowledge (SSTASK) is likely to increase software-specific self-efficacy (e.g., spreadsheet or database self-efficacy) more than ASK alone since well-designed SSTASK explicitly incorporates *enactive attainment* (i.e., successfully using spreadsheets) and *vicarious experience* (i.e., seeing similar others successfully using spreadsheets) as a part of the learning process. Because SSTASK explicitly incorporates these two important methods of increasing task-specific self-efficacy, we predict that SSTASK will increase students' software self-efficacy more than will ASK.

H2: Instruction that includes both software-specific training and accounting systems knowledge (SSTASK) will increase software self-efficacy more than instruction in accounting systems knowledge (ASK).

Computer Self-Efficacy

SSTASK should also increase computer self-efficacy more than ASK by providing *enactive attainment* and *vicarious experience* learning opportunities with computers. This suggests:

H3: Instruction that includes both software-specific training and accounting systems knowledge (SSTASK) will increase computer self-efficacy more than instruction in accounting systems knowledge (ASK).

Computer Anxiety and Accounting Education

Computer anxiety is a psychological construct that is related to, but distinct

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Footnote 3 *(Continued from previous page)*

(Barling and Beattie 1983), athletic performance (Barling and Abel 1983; Weinberg et al. 1981), complex decision making (Bandura and Jourden 1991; Stone 1994), snake handling among phobics (Bandura and Adams 1977; Bandura et al. 1977), and a variety of work-related settings (Eden 1986, 1988, 1990).

from, computer self-efficacy. Computer self-efficacy is an individual's belief (not feeling) about whether he or she is efficacious with computers. Computer anxiety is a fear (i.e., a feeling not a belief) of computers (Chu and Spires 1991; Torkzadeh and Angulo 1992). Research suggests that computer anxiety is relatively common among college-age undergraduate students (Lepper 1985; Pope-Davis and Vispoel 1993; Rosen and Maguire 1990). Although evidence on the effects of instruction and training on computer anxiety is mixed, there is some evidence that well-designed instruction and training can decrease computer anxiety (Rosen and Maguire 1990). One implication of this evidence is that well-designed SSTASK or ASK may decrease computer anxiety by demystifying computers and thereby lessening the extent to which students perceive computers as threatening. This suggests:

H4: Either software-specific training and accounting systems knowledge (SSTASK) or accounting systems knowledge instruction (ASK) will decrease computer anxiety.

Relationships Among Measures

This study is the first to examine the relationships among the psychological constructs of knowledge, skill, self-efficacy and computer anxiety in accounting education. An important issue is whether measures of **perceived** ability and anxiety (e.g., self-efficacy and computer anxiety) correlate with measures of actual ability (e.g., spreadsheet and computer knowledge and skill). Measures of perceived ability are less threatening and less likely to induce dysfunctional reactive effects than measures of actual ability (Cook and Campbell 1979). If measures of perceived ability and anxiety and measures of actual ability are correlated, then measures of perceived ability may be useful in accounting education as diagnostic tools or as substitutes for measures of actual ability (cf. Angelo and Cross 1993).

We hypothesize that measures of perceived ability and anxiety will be correlated with actual ability prior to, but not after, instruction. After instruction, the variability of both perceived and actual measures is likely to decrease (Spector 1981). As a result, participants' perceptions of their abilities are likely to be less predictive after instruction than before, since there is less variability to explain (i.e., the differences between and within participants are much smaller). More specifically, we predict that: (1) spreadsheet self-efficacy and spreadsheet knowledge/skill (i.e., perceived and actual spreadsheet ability), and (2) computer self-efficacy and knowledge (i.e., perceived and actual computer ability), will be significantly and positively correlated prior to, but not after, the SSTASK and ASK treatments. This suggests:

H5: Pretest measures of software-specific self-efficacy and software-specific knowledge and skill will be positively correlated.

H6: Posttest measures of software-specific self-efficacy and software-specific knowledge and skill will be uncorrelated.

H7: Pretest measures of computer self-efficacy and computer knowledge and skill will be positively correlated.

H8: Posttest measures of self-efficacy and computer knowledge and skill will be uncorrelated.

We predict a similar but reversed relationship between computer anxiety and knowledge/skill. Specifically, we predict a negative correlation in pretest measures of computer anxiety and knowledge/skill, but no correlation in posttest measures.

H9: Pretest measures of computer anxiety and computer knowledge and skill will be negatively correlated.

H10: Posttest measures of computer anxiety and computer knowledge and skill will be uncorrelated.

Summary

Despite evidence of their importance to education, there is little evidence exploring the relationship among anxiety, self-efficacy, knowledge and skills in accounting education. We conducted two studies exploring the effects of different types of accounting instruction on, and the relationships among, these psychological constructs.

METHODOLOGY OF STUDY 1—CROSS-SECTIONAL STUDY AT UNIVERSITY A

Overview

For the past seven years, most accounting majors at University A have taken introductory accounting information systems (AIS) after completing a prerequisite course (offered by the computer science department) that differs from semester to semester. Some versions of the prerequisite course have included four to eight hours of electronic spreadsheet training (depending on the semester in which the class was taken), others have not. As a result, some accounting majors at University A have substantial knowledge and skill in designing and using electronic spreadsheets, while others have never used electronic spreadsheets. We used the naturally occurring difference in students' spreadsheet skills to compare the effects of SSTASK vs. ASK in accounting systems education. Therefore, Study 1 compares the effects of providing SSTASK to a sample of students who lack both spreadsheet knowledge and skill and accounting systems knowledge, with providing ASK to a sample of students who are trained in electronic spreadsheets but lack accounting systems knowledge.

Spreadsheet Knowledge and Skill Pretest

During the semester in which the study was conducted, 160 students enrolled in AIS. On the second day of class, all students took an independently administered spreadsheet knowledge and skill test.[4] Students who either: (a) scored equal to or higher than 80 percent on the test or (b) had previously taken the test and scored equal to or higher than 80 percent received course credit worth 3 percent of the total available points in the class. Students who did not pass, and had not previously passed this test were required to pass the test sometime during the semester to receive course credit related to electronic spreadsheets.

One hundred seven students either passed or had previously passed the spreadsheet test; 53 did not pass and had not previously passed the test. All of the students who did not pass and had not passed the test took a spreadsheet course in which they received ten hours of training in electronic spreadsheets. All of the students who took this course passed the spreadsheet test later in the semester.

Accounting Systems Knowledge (ASK) and *Software-Specific Training and Accounting Systems Knowledge* (SSTASK) Groups

The 107 students who passed or had previously passed the spreadsheet test were identified as the *accounting systems knowledge* (ASK) group since, in the semester of the research study, they received only instruction in accounting

[4] This test was administered by a university instructional center that specializes in teaching computing knowledge and skills.

systems knowledge. The 53 students who did not pass and had not passed the spreadsheet test were designated the *software-specific training and accounting systems knowledge* (SSTASK) group, since they received instruction designed to improve both their knowledge of and skills in electronic spreadsheet design and use and their knowledge of accounting systems. All students in the course were required to practice their electronic spreadsheet skills. Specifically, all students were required to complete and hand in spreadsheet problems that represented 20 percent of their grade in the AIS course.[5]

Equivalency Tests Between ASK and SSTASK Groups

Since our participants were naturally (i.e., not randomly) assigned to treatment groups, initial differences between the groups are a potential confound that could impede our ability to make inferences about the relationships between the variables of interest (Cook and Campbell 1979; Spector 1981). We distributed a survey on the first day of class to identify the differences that existed between the groups in their age, number of high school accounting classes, previous computer usage, self-reported cumulative GPA, self-reported accounting GPA and months of previous work experience. In addition, we obtained data from the University registrar's office on participants' logical and mathematical intelligence, as measured by high school rank and ACT (or SAT equivalent) scores.[6] We also measured participants' spreadsheet and computer self-efficacy, computer anxiety, spreadsheet knowledge and skills and computer knowledge, as described below.

Repeated Measures of Self-Efficacy and Anxiety

At the beginning (first class day) and end (class 28 of 30 class periods) of the semester, we measured participants' spreadsheet and computer self-efficacy and computer anxiety. The measures used were as follows:

1) **Spreadsheet self-efficacy**—we revised and adapted an instrument used in previous research (Gist et al. 1989) to measure the extent to which participants believed that they could successfully perform the basic behaviors necessary to design and use electronic spreadsheets (e.g., "I can save a file in Lotus 1-2-3," "I can get on-line help in Lotus 1-2-3 if I need it," etc.);
2) **Computer self-efficacy**—we revised and adapted an instrument used in previous research (Gist et al. 1989) to measure the extent to which participants believed that they could successfully perform the behaviors necessary to use a computer to perform a set of basic computing functions (e.g., "I can backup my data files on a microcomputer," "I can send electronic mail to a friend at another University," etc.);
3) **Computer anxiety**—we used two measures of computer anxiety, one was a 24-item instrument developed by Oetting (1983) (referred to herein as "Oetting computer anxiety"). The other was a 19-item instrument developed by Heinssen et al. (1987) (referred to herein as "HG&K computer anxiety"). Both of these measures are designed "to provide a general

[5] These assignments were done in 3 to 4 member groups and, on average, the assignment scores were quite high (average = 95.7%) with little variability between groups. Therefore, we did not include these assignments as measures of students' spreadsheet knowledge and skill.

[6] Consistent with theories suggesting that intelligence is a multidimensional phenomena with only weak correlations between dimensions (e.g., Gardner 1983; Sternberg 1984), we argue that prior academic performance and standardized intelligence test scores capture only the logical and mathematical dimensions of intelligence.

measure of computer anxiety" (cf. Tenth Mental Measurement Yearbook 1989).

Prior to conducting a pilot study, we asked two accounting systems colleagues to evaluate each of the instruments' content validity, and we revised the spreadsheet and computer self-efficacy instruments based on their suggestions. We also conducted a pilot study (n = 239) to test the internal consistency of the instruments. In addition, we measured the internal consistency and test-retest reliability of the instruments in the multiple administrations conducted in this study. Table 1 summarizes the data on the internal consistency and test-retest reliability of the instruments. One common metric for evaluating internal validity measures is that they exceed .50 (Ebel and Frisbie 1991). As is shown in columns 1 and 2 of table 1, all of the measures of the instruments far exceed this benchmark of internal consistency ($\alpha \geq .84$). In addition, the average correlations among administrations of the instruments also suggest high test-retest reliability ($r \geq .49$).[7]

Measures of Spreadsheet Knowledge and Skill and Computing Knowledge

We tested participants' spreadsheet knowledge and skill, and computing knowledge, at the beginning and end of the semester using the following measures:

1) **Pre- and posttest of spreadsheet knowledge and skills**—all students took a standardized spreadsheet knowledge and skills test at the beginning of the semester that was developed by an independent campus unit whose mission is to teach computer knowledge and skills. We also used the last spreadsheet knowledge and skills test score of the semester of the SSTASK participants as a posttest measure;
2) **Computing knowledge pretest**—we developed a 15-item test to measure participants' basic knowledge of computing. This test asked participants a set of basic questions about computing (e.g., what is a megabyte, and for what is the term "LCD" an acronym). This test was

[7] In the pilot test, we also examined whether the order in which the instruments were administered affected participants' responses or the time required to complete the instrument. The data indicated no statistically significant differences in either responses or time to complete in any of the instruments for the three orders tested in the pilot study ($p > .50$). We therefore used only one order for the instruments in Studies 1 and 2.

TABLE 1
Cronbach's α and Average Correlations Among Administrations for Study 1 Measures of Self-Efficacy and Anxiety

	Cronbach's α — Pilot Test	Average Cronbach's α — Studies 1 & 2	Average Correlation Among Administrations— Studies 1 & 2
Spreadsheet Self-Efficacy	.94	.91	.54
Computer Self-Efficacy	.88	.84	.49
Getting Computer Anxiety	.88	.88	.73
HG&K Computer Anxiety	.91	.91	.51

$p < .01$ for all correlations in this table administered on the first day of class. To provide incentives for exerting effort on the test, students received full credit on their first class quiz if they answered 90 percent of more of the pretest questions correctly;

3) **Computing knowledge posttest**—at the end of the semester, we administered a 66-item test of participants' knowledge of accounting and information systems. One of several versions of this examination is used each semester at University A as a standardized measure of student performance in AIS. None of the questions on this test related to spreadsheet knowledge or skills. In addition, to avoid the necessity of deceiving our participants (i.e., claiming that the items they had seen on the pretest were not on the final test), we did not include the test items from the pretest on the posttest.[8] As a result, our design did not include true pre- and posttest measures of computing knowledge, since the pre- and posttest measures differed.

We computed the K-R20 statistic, which is among "the most widely accepted methods for estimating reliability," as a measure of the internal reliability of the tests (Ebel and Frisbie 1991, 83). The K-R20 statistics for: (1) the pretest of computing knowledge equaled .70, (2) posttest of computing knowledge equaled .80, and (3) spreadsheet knowledge and skill test averaged .67.[9]

Dependent and Demographic Measures

We separately summed the scores of each participant for the pre- and posttest measures of spreadsheet self-efficacy, computer self-efficacy and computer anxiety. We also separately summed each of the participants' pre- and posttest scores of spreadsheet knowledge and skills, and computing knowledge, as a percentage of total available points. Based on our first-day survey, we also examined data on participants' (1) sex (i.e., male or female), (2) age, (3) number of high school accounting classes, (4) self-reported cumulative GPA, (5) self-reported accounting GPA and (6) years of previous work experience. We also collected four measures of participants' previous computer use: (1) whether participants owned computers, (2) number of classes taken in high school in which they used computers, (3) years of work experience using computers and (4) total number of years they have used a computer. We also analyzed data on logical and mathematical intelligence, as measured by participants' high school rank and ACT (or SAT equivalent) score.

Data Analysis

We began by testing for initial (i.e., beginning of the semester) differences between the ASK and SSTASK groups. For the demographic and background variables on which we had a single measure (e.g., sex, age, etc.) we tested for initial differences using *t* tests. For the demographic and background variables on which we had multiple measures (i.e., the four measures of previous computer use; the two measures of logical and mathematical intelligence) we tested for initial differences using MANOVAs. For the variables on which we had both pretest and posttest measures (e.g., spreadsheet self-efficacy, computer self-efficacy, etc.), we tested for initial differences by examining the pretest dif-

[8] The Human Subjects Committees at both University A and B prohibit research that deceives participants.

[9] The K-R20 statistic for the spreadsheet knowledge and skill test is based on a sample of 19 tests examined. As a result of the small sample size for the spreadsheet knowledge and skill test, the K-R20 statistic is biased towards a low level of agreement.

ferences between the SSTASK and ASK group in a repeated measures ANOVA.

After determining initial differences between the SSTASK and ASK groups, we analyzed participants' spreadsheet and computer self-efficacy and computer anxiety, using repeated measure ANOVAs and ANCOVAs. The two predictor variables in the ANOVAs and ANCOVAs were (1) the type of instruction received, as a between-participants, independent variable with two levels (i.e., ASK and SSTASK), and, (2) time (i.e., the pre- and posttest measures of computing knowledge, spreadsheet knowledge and skills, anxiety and efficacy) as a within-participants repeated measure.[10] The covariates included in the ANCOVAs were the differences in the ASK and SSTASK groups in previous experience, knowledge and demographic characteristics.

We had pre- and posttest measures of spreadsheet knowledge and skill for the SSTASK group but only pretest measures of spreadsheet knowledge and skill for the ASK group. We analyzed the pretest differences between the SSTASK and ASK groups using a *t* test. We tested H1 (i.e., the effect of spreadsheet training on spreadsheet knowledge and skill) for the SSTASK group using repeated measures ANOVA. We used a *t* test instead of an ANOVA to test the hypotheses related to computing knowledge since we did not have true repeated measures of computing knowledge (i.e., we used different pre- and posttest measures).

RESULTS AND DISCUSSION

Pretest Measures of Equivalency Between SSTASK and ASK Groups—Demographic Data

Two significant differences existed in the pretest demographic characteristics of the SSTASK and ASK groups. First, participants in the SSTASK group had completed more hours of accounting than had participants in the ASK group ($t(80) = 2.2$, $p = .03$). Second, participants in the ASK group had higher levels of logical/mathematical intelligence (Wilks' Lambda (2, 145) = .88, $p < .01$). Specifically, participants in the ASK group had a higher average high school rank ($F(1, 172) = 5.5$, $p = .02$) and higher ACT (or SAT equivalent) scores ($F(1, 146) = 18.7$, $p < .01$). There were no significant differences between the SSTASK and ASK groups in the number of men and women (i.e., sex) ($p = .64$), age ($p = .15$), number of high school accounting classes taken ($p = .95$), self-reported cumulative GPA ($p = .08$), self-reported accounting GPA ($p = .99$), overall years of work experience ($p = .18$) or previous computing experience ($p = .51$).

Pretest Measures of Equivalency Between SSTASK and ASK Groups—Knowledge, Skill, Self-Efficacy and Computer Anxiety.

Consistent with the group assignments, the ASK group had, on average, a higher level of spreadsheet knowledge and skill ($t(157) = 8.2$, $p < .01$). The ASK group correctly answered, on average, 77.3% of the spreadsheet knowledge and skill pretest questions while the SSTASK group correctly answered 42.0%. The ASK group also had higher computer knowledge than the SSTASK group ($t(159) = 3.7$, $p < .01$). Specifically, the ASK group correctly answered, on average, 59.5% of the pretest computer

[10] An alternative approach to analyzing the repeated measures data would have been to compute the differences between pre- and posttest measures and to use these differences as dependent variables. However computing difference measures increases error variance and, consequently, decreases the power of statistical tests compared with repeated measures analyses (e.g., Harris 1963; Spector 1981).

TABLE 2
Study 1 Repeated Measures ANOVA of Skill, Knowledge, Self-Efficacy and Computer Anxiety
(Significant results (p ≤ .05) shown in bold)

	Pretest Differences: SSTASK vs. ASK Groups				Posttest Differences: SSTASK vs. ASK Groups				Main Effect — Time		Group By Time Interaction	
	SSTASK Mean	ASK Mean	F	p	SSTASK Mean	ASK Mean	F	p	F	p	F	p
Self-Efficacy Measures												
Spreadsheet Self-Efficacy	**30.5**	**41.8**	**31.4**	**< .01**	49.1	49.6	0.1	.74	**137.1**	**< .01**	**22.8**	**< .01**
Computer Self-Efficacy	38.7	40.1	0.7	.41	46.4	47.4	0.4	.55	**80.7**	**< .01**	0.1	.80
Computer Anxiety Measures												
Oetting Computer Anxiety	53.8	54.3	0.0	.84	47.9	49.3	0.4	.55	**51.5**	**< .01**	1.5	.22
HG&K Computer Anxiety	38.5	39.2	0.1	.75	37.1	37.9	0.1	.75	1.5	.23	0.4	.53

Note: Measures of computer knowledge and skill are omitted from this table since different pre- and posttest measures were used.

knowledge questions, while the SSTASK group correctly answered 46.3%.

Table 2 presents the repeated measures ANOVA pretest differences between the SSTASK and ASK groups. On average, the ASK group had higher spreadsheet self-efficacy ($F(1, 154) = 31.4$, $p < .01$), but there were no pretest differences in computer self-efficacy ($p = .41$) or in either measure of computer anxiety ($p \geq .75$), between the SSTASK and ASK groups (see table 2).

Tests of Hypotheses—Spreadsheet Knowledge, Skill and Self-Efficacy

Hypothesis one is a manipulation check testing whether SSTASK instruction in spreadsheet knowledge and skill increases spreadsheet knowledge and skill. Consistent with H1, there is a significant main effect for time on spreadsheet knowledge and skill for the SSTASK group data ($F(1, 49) = 127.7$, $p < .01$). Specifically, the spreadsheet knowledge and skill test scores of the SSTASK group increased from an average of 42.0 on the pretest to 87.5 on the posttest.

Hypothesis two predicts a larger increase in spreadsheet self-efficacy for the SSTASK than the ASK group. To test this hypothesis, we examined the joint effect of group and time on spreadsheet self-efficacy. If the hypothesis is supported, we should see: (1) a significant group by time interaction and (2) post-hoc analyses indicating that spreadsheet self-efficacy increased more in the SSTASK than the ASK group.

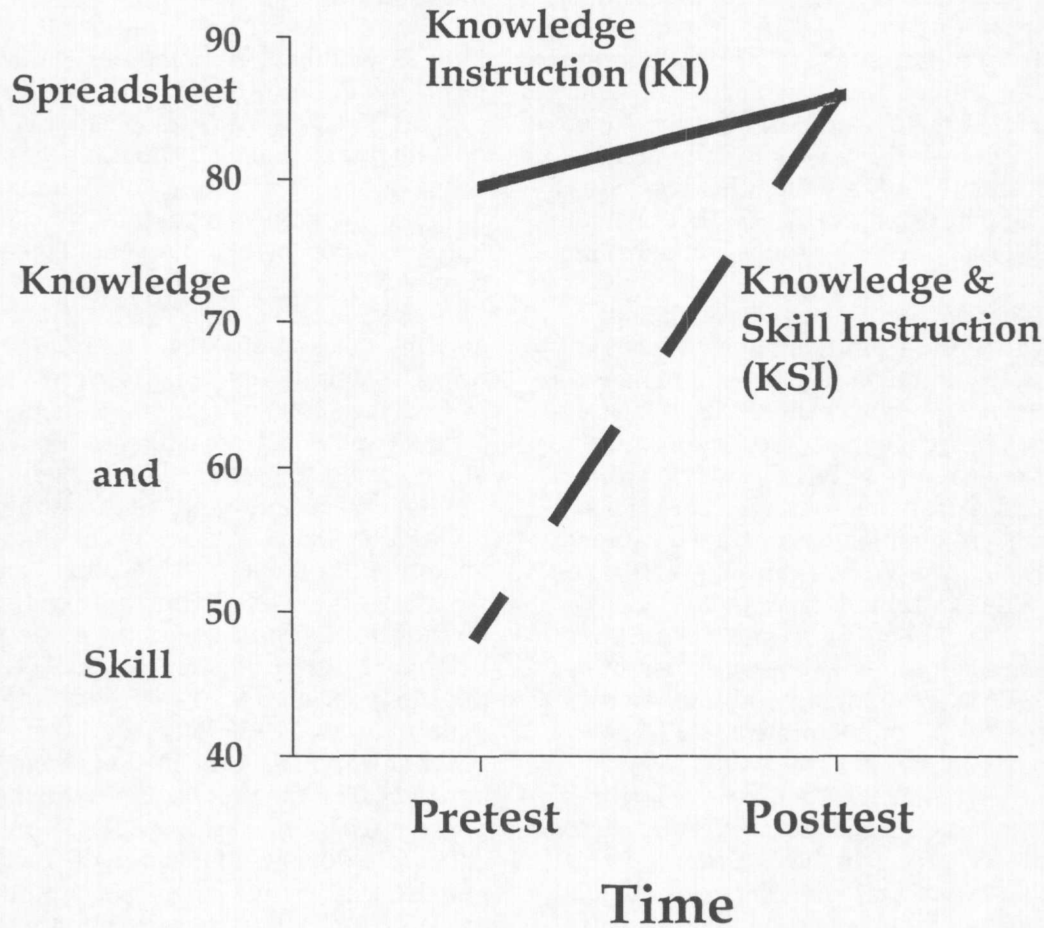
Consistent with H2, there is a significant group by time interaction on spreadsheet self-efficacy ($F(1, 154) = 22.8$, $p < .01$, see table 2). Post hoc analyses indicate that the interaction is consistent with H2 (Tukey HSD test, $p < .05$). Specifically, the self-efficacy of both the SSTASK and the ASK groups increases between the pre- and posttests. However, the increase in spreadsheet self-efficacy is greater for the SSTASK than for the ASK group. Figure 1 illustrates this interaction.

Hypothesis three predicts that SSTASK will increase computer self-efficacy more than ASK. The data do not support H3. There is no significant group by time interaction on computer self-efficacy ($F(1, 154) = 0.1$, $p = .80$). There is a significant main effect of time on computer self-efficacy in the repeated measures ANOVA ($F(1, 154) = 80.7$, $p < .01$). This effect results from a 18.9% increase in computer self-efficacy, i.e., from an overall average of 39.7 on the pretest to 47.2 on the posttest. This suggests that SSTASK and ASK were equally effective at increasing computer self-efficacy.[11]

Hypothesis four predicts that either SSTASK or ASK will decrease computer anxiety. Consistent with H4, there is a significant main effect from time on the Oetting measure of computer anxiety in the repeated measures ANOVA ($F(1, 154) = 51.5$, $p < .01$). This effect results from an 11.8% decrease in computer anxiety, i.e., from an overall average of 54.0 on the pretest to 48.3 on the posttest. This indicates that SSTASK and ASK were equally effective in decreasing the Oetting measure of computer anxiety. Contrary to H4 however, there is no main effect from time on the HG&K measure of computer anxiety ($F(1, 154) = 1.5$, $p = .23$). The data for the Oetting measure of computer anxiety therefore support H4, but the data for the HG&K measure do not.

[11] As a control for participants' beliefs about whether they were, in general, efficacious, we also measured *general self-efficacy* (GSE) at the beginning and end of the semester (Eden and Kinnar 1991; Sherer et al. 1982; Tipton and Worthington 1984). There were no significant pretest differences, no main-effects due to type of instruction or time, and no joint effects from instruction and time on GSE ($p \geq .32$).

FIGURE 1
Joint Effect of Time and Group on Spreadsheet Knowledge and Skill



Repeated Measures Analyses: ANCOVAs

Because participants were not randomly assigned to groups, we ran three separate ANCOVAs that were identical to the ANOVA described in table 1. Each included one of the pretest nonequivalent variables, i.e., (1) self-reported hours of accounting completed, (2) logical/mathematical intelligence, and (3) pretest computing knowledge. There were no substantive differences between the ANCOVAs and the ANOVA results reported previously.

Tests of Hypotheses—Relationships Among Measures

Hypothesis five predicts a positive correlation between pretest measures of software-specific self-efficacy and knowledge/skill, while H6 predicts no relationship between posttest measures of these variables. Because we had both pre- and posttest measures of spreadsheet knowledge and skill for only the SSTASK group, we tested H5 and H6 using the SSTASK participants' data only. The data support these hypotheses.

Consistent with H5, there is a significant, positive spreadsheet self-efficacy and spreadsheet knowledge/skill correlation in pretest measures (r = .63, p < .01). Consistent with H6, there is no significant correlation between posttest measures of these variables (r = .11, p = .45).

Hypothesis seven predicts a positive correlation between pretest measures of computer self-efficacy and computer knowledge/skill, while H8 predicts no relationship between posttest measures of these variables. The data support these hypotheses. Consistent with H7, there is a significant, positive computer self-efficacy and computer knowledge/skill correlation in pretest measures (r = .51, p < .01). Consistent with H8, there is no significant correlation between posttest measures of these variables (r = .10, p = .18).

Hypothesis nine predicts a negative correlation between pretest measures of computer anxiety and computer knowledge/skill, while H10 predicts no relationship between posttest measures of these variables. The data also support these hypotheses. Consistent with H9, there is a significant, negative computer anxiety and computer knowledge/skill correlation in both pretest measures of computer anxiety (Oetting measure: r = –.43, p < .01; HG&K measure: r = –.35, p < .01). Consistent with H10, there is no significant correlation between posttest measures of these variables (Oetting measure: r = –.02, p = .80; HG&K measure: r = –.07, p = .35).

Summary of Study 1 Results

The data support the contention that the addition of a spreadsheet training module can affect the knowledge, skills and self-efficacy of accounting undergraduates. Students who completed ten hours of spreadsheet training (i.e., the SSTASK group) had significant increases in spreadsheet knowledge and skill, and had larger increases in spreadsheet self-efficacy than students who received instruction designed only to deliver accounting systems knowledge (ASK). At the same time, SSTASK and ASK were equally effective at increasing computer self-efficacy and decreasing the Oetting measure of computer anxiety. There were no effects from instruction on the HG&K measure of computer anxiety. In addition, the data suggest that correlations among measures of self-efficacy and knowledge/skill and computer anxiety and knowledge/skill are higher in pre- than in posttest measures this suggests that measures of self-efficacy and anxiety may be more useful as diagnostic rather than as evaluative measures in accounting education.

MOTIVATION FOR STUDY 2

One advantage of the two-group (i.e., SSTASK and ASK), pretest-posttest nonexperimental design used in Study 1 is that it increases internal validity by allowing for both longitudinal (i.e., over time) and cross-sectional (i.e., between group) comparisons (Spector 1981). A disadvantage of the research design used in Study 1 is that it is nonexperimental; i.e., participants were not randomly assigned to groups. While appropriate statistical procedures (i.e., ANCOVA) were used to control for initial nonequivalencies in groups, statistical adjustments, based on initial nonequivalencies, are less powerful methodologies for determining causality than are true experiments in which participants are randomly assigned to groups (Cook and Campbell 1979). Unfortunately, random assignment of participants can also create ethical and internal validity problems (Blumberg and Pringle 1983). For example, in our study random assignment would have forced spreadsheet instruction on some participants who did not need it and denied it to some who did need it. Random (and therefore arbitrary) assignments to experimental groups can also create reactive effects in field research that negate the intended assignments (Cook and Campbell 1979).

An alternative nonexperimental research design to that used in Study One is an interrupted time series design that allows for an examination of the effects of both ASK and SSTASK on the same group. In an interrupted time-series design, all participants receive the same treatments over time. An interrupted time-series design has the advantage of eliminating pretest nonequivalencies between groups since *all* participants receive the *same* treatments. The desire to examine the previously discussed issues using an interrupted time-series design was one of the motivations for Study 2, which was conducted at a different university (University B) than was Study 1.

A second motivation was to examine the robustness of our results at another university with a different skill and knowledge focus in its AIS class. At University B, all accounting majors take a prerequisite course, prior to taking the AIS course, that includes extensive instruction in computer and spreadsheet knowledge and skills. As a result, University B AIS students have, on average, a higher level of computer and spreadsheet knowledge and skills than the AIS students at University A.[12]

Database Skills in Accounting Education

Organizations are increasingly developing accounting systems that integrate their internal and external reporting capabilities and provide accounting information to users in on-line databases (Elliott 1994). Cushing (1989) discusses the feasibility and consequences of an "events" approach to corporate financial reporting in which corporate financial data is made available on-line to interested users. The SEC's EDGAR system illustrates such an approach. Corporate financial information is filed with the SEC using electronic media. This database is then available through EDGAR to investors, security analysts and the public (Cushing 1989).

Given these developments, it is not surprising that practicing accountants see database knowledge and skill as increasingly important for accounting majors. For example, Heagy and McMickle's (1988) survey of CPAs and accounting academics suggests that training in database management systems is considered very important by practitioners but is inadequately emphasized in undergraduate accounting programs. Specifically, training in database management systems was the topic with the second largest difference in rankings between accounting practitioners (ranked 20th) and academics (ranked 48th). Only electronic spreadsheets had a larger difference in rankings between practitioners and academics.

Accounting Systems at University B

The AIS course at University B is naturally structured into two eight-week modules. The first module consists of accounting systems knowledge (i.e., ASK), while the second module combines database software training with accounting systems knowledge (i.e., SSTASK). We used the naturally occurring ASK and SSTASK modules of the AIS

[12] We administered the same spreadsheet pretest at University B as we administered at University A. University B students performed, on average, equivalent to the University A ASK student sample. Both the University B and the University A ASK students outperformed the University A SSTASK students on this test ($F(2, 222) = 43.1$, $p < .01$) (Tukey post hoc comparisons, $p \leq .05$).

course at University B to implement an interrupted time-series design examining the longitudinal effects of ASK and SSTASK. We tested H2 through H4 and H6 through H10 from Study 1 in the database instruction setting of the AIS course at University B.

METHODOLOGY OF STUDY 2—LONGITUDINAL STUDY AT UNIVERSITY B

Repeated Measures of Anxiety and Self-Efficacy

At the beginning, midpoint and end of the semester, we measured participants' computer self-efficacy and computer anxiety using the same measures as were described in Study 1. In addition, we developed a 12-item instrument to measure participants' *database self-efficacy*, i.e., the extent to which participants believed that they could successfully perform the behaviors necessary to use electronic database software (e.g., "I can use database processing software to create a database and input data into it." "I can get on-line help from database processing software if I need it."; etc.).

We included the database self-efficacy instrument in the pilot experiment (n = 239) that was used to test the internal consistency of the instruments developed for Study 1. In addition, we measured the internal consistency and test-retest reliability of the database self-efficacy instrument in the multiple administrations conducted in this study. The results of testing suggested both high internal consistency and high test-retest reliability in the database self-efficacy instrument (pilot study Cronbach's α = .96; average Cronbach's for this study α = .96; average correlation between administrations for this study = .65).

We measured participants' database self-efficacy at the beginning, the end of module one (i.e., at midsemester) and the end of module 2 (i.e., at the end of the semester). We examined the distribution of responses to the pretest database self-efficacy instrument to determine whether a pretest of database knowledge was necessary. These data suggested that only a small number of participants had familiarity with database software.[13] We, therefore, did not administer a database software knowledge pretest or end of module one test, since we expected that: (1) many of the respondents would not have sufficient knowledge to complete such a test and (2) the resulting low scores would have produced "floor" effects (i.e., insufficient variability) in the resulting data (Cook and Campbell 1979).

Measures of Computing Knowledge and Database Knowledge and Skill

We used the same pretest of computing knowledge as was used in Study 1. Participants also took a 55- or 70-item final examination (depending upon class section) that tested their accounting systems knowledge.[14] These tests were used as posttest measures of computer systems knowledge. We used the K-R20 measure as a measure of the internal consistency of these tests. The K-R20 statistic for both of the tests indicated high internal consistency (55-item final exam, K-R20 = .65; 70-item final exam, K-R20 = .78).

Participants also completed a database design project that required them to design a database using RBase 4.5 da-

[13] Specifically, 37 percent (i.e., 24 out of 65) of the initial database self-efficacy scores were in the bottom 10 percent of the possible response range, while only 1 respondent was in the top 10 percent of the response range. In addition, 87.7% of the responses (i.e., 57 out of 65) were at or below the midpoint of the response range (i.e., 36).

[14] As in Study 1, test items from the pretest were not included on the final examinations in Study 2.

tabase software. This project, which was worth either 15 or 18 percent of their course grade (depending upon class section), was used as a posttest measure of database knowledge and skills. We were unable to compute the K-R20 statistic for the project scores since there were only two subcomponents to the project grade (Ebel and Frisbie 1991).

Participants

Sixty-five students enrolled in the AIS course and completed the pretest measures, 61 students completed the midpoint measures and 63 completed the posttest measures.

Dependent Measures

We separately summed scores of each participant for the pretest, midtest and posttest measures of database, computer self-efficacy and computer anxiety. We also separately summed each of the participants' pretest and posttest scores of computing knowledge.

Data Analysis

We analyzed the data using a repeated-measures ANOVA with time as a three-level (i.e., pretest, midtest, posttest) independent variable. We analyzed specific differences between the pretest, midtest, and posttest measures using univariate F tests. We also examined correlations between the pretest and posttest measures of knowledge and skills, anxiety and self-efficacy.

RESULTS AND DISCUSSION

Repeated Measures ANOVA of Anxiety and Self-Efficacy Measures

Table 3 presents the repeated measures ANOVA analysis of the effects of the eight-week ASK module and the eight-week SSTASK module.

The first hypothesis tested in Study 2 is H2, which predicts that software-specific self-efficacy (i.e., database self-efficacy) will increase more with SSTASK than ASK instruction. Surprisingly, ASK *decreased* database self-efficacy ($p = .02$, from 25.2 on the pretest measure to 22.2 on the midtest measure) while SSTASK doubled database self-efficacy ($p < .01$, from 22.2 on the midtest measure to 44.4 on the posttest measure). The data, therefore, support H2, although the decrease in database self-efficacy between the pretest and midtest measures was unexpected.

We next tested H3 and H4 from Study 1. Hypothesis three predicts that SSTASK will increase computer self-efficacy more than ASK. Consistent with H3, SSTASK increased computer self-efficacy ($p < .01$) while ASK did not affect computer self-efficacy ($p = .54$).[15] Hypothesis four predicts that either SSTASK or ASK instruction will decrease computer anxiety. In the Study 2 data, ASK decreased the Oetting measure of computer anxiety ($p = .03$). However, there were no effects from either ASK ($p = .96$) or SSTASK ($p = .66$) on the HG&K measure of computer anxiety, and no effect from SSTASK on the Oetting measure of computer anxiety ($p = .18$). The Study 2 data therefore do not support H4.

Tests of Hypotheses—Relationships Among Measures

We did not test H5 in Study 2. The data support H6, which predicts no correlation between posttest measures of database knowledge/skill and software-specific (i.e., database) self-efficacy ($r = .19$, $p = .14$). The data also support: (1) H7, which predicts a positive pretest correlation between computer knowledge/skill and computer self-efficacy ($r = .30$, $p = .02$); (2) H8, which predicts

[15] Consistent with the results of Study 1, there were no effects due to either SSTASK or ASK instruction on general self-efficacy ($p \geq .82$).

TABLE 3
Study 2 Repeated Measures ANOVA of Self-Efficacy and Computer Anxiety
(Significant results ($p \leq .05$) shown in bold)

	Overall Model		Effect of ASK: Pretest/Midtest Comparison		Effect of SSTASK: Midtest/Posttest Comparison		Effect of ASK & SSTASK: Pretest/Posttest Comparison	
	F	*p*	Pretest Mean	Pretest/ Midtest Contrast *p* value	Midtest Mean	Midtest/ Posttest Contrast *p* value	Posttest Mean	Pretest/ Posttest Contrast *p* value
Self-Efficacy Measures								
Database Self-Efficacy	**150.7**	< .01	**25.2**	**.02**	**22.2**	< .01	**44.4**	< .01
Computer Self-Efficacy	**8.8**	< .01	42.6	.54	**43.4**	< .01	**46.2**	< .01
Computer Anxiety Measures								
Oetting Computer Anxiety	**5.2**	**.01**	**51.5**	**.03**	**49.4**	.18	**48.7**	**.01**
HG&K Computer Anxiety	0.2	.86	38.9	.96	38.7	.66	38.2	.65

TABLE 4
Summary of Tests of Hypotheses—Studies 1 and 2
(Supported hypotheses shown in bold)

Main Effects of Instruction—Hypotheses	Study 1 Results	Study 2 Results
H1: Instruction that includes software-specific training and accounting systems knowledge (SSTASK) will increase software knowledge and skill (manipulation check of SSTASK instruction).	**Supported** **Increased with SSTASK**	Not tested
H2: Instruction that includes both software-specific training and accounting systems knowledge (SSTASK) will increase software self-efficacy more than instruction in accounting systems knowledge (ASK).	**Supported** **SSTASK increased more than ASK**	**Supported** **SSTASK increased, ASK decreased**
H3: Instruction that includes both software-specific training and accounting systems knowledge (SSTASK) will increase computer self-efficacy more than instruction in accounting systems knowledge (ASK).	Not supported Increased over time for both SSTASK and ASK time	**Supported** **Increased for SSTASK, no change for ASK**
H4: Either software-specific training and accounting systems knowledge (SSTASK) or accounting systems knowledge instruction (ASK) will decrease computer anxiety.	**Supported for Oetting measure** **Decreased over time—no difference between SSTASK and ASK groups** Not supported for HG&K measure	Not supported Oetting measure decreased for ASK—no change in Oetting measure for SSTASK; no change in HG&K measure for either SSTASK or ASK.
H5: Pretest measures of software-specific self-efficacy and software-specific knowledge and skill will be positively correlated.	**Supported**	Not tested
H6: Posttest measures of software-specific self-efficacy and software-specific knowledge and skill will be uncorrelated.	**Supported**	**Supported**
H7: Pretest measures of computer self-efficacy and computer knowledge and skill will be positively correlated.	**Supported**	**Supported**
H8: Posttest measures of self-efficacy and computer knowledge and skill will be uncorrelated.	**Supported**	**Supported**
H9: Pretest measures of computer anxiety and computer knowledge and skill will be negatively correlated.	**Supported**	**Supported**
H10: Posttest measures of computer anxiety and computer knowledge and skill will be uncorrelated.	**Supported**	**Supported**

no posttest correlation between computer knowledge/skill and computer self-efficacy (r = .05, p = .70); (3) H9, which predicts a negative pretest correlation between computer knowledge/skill and computer anxiety (Oetting measure: $r = -.29$, $p < .01$; HG&K measure: $r = -.27$, $p < .01$); and (4) H10, which predicts no posttest correlation between computer knowledge/skill and computer anxiety (Oetting measure: $r = -.09$, $p = .47$; HG&K measure: $r = .01$, $p = .94$).

SUMMARY AND DISCUSSION OF BOTH STUDIES

SSTASK, ASK and Accounting-Related Self-Efficacy

Table 4 summarizes the results of both studies. Hypothesis two was supported in both studies, which suggests that software-specific training (SSTASK) has larger increases on accounting-related self-efficacy than accounting systems knowledge instruction (ASK). In Study 2, the SSTASK module also increased computer self-efficacy more than the ASK module, consistent with H3. These data suggest that adding skill-building training to the accounting curriculum, at a minimum, will affect students' perceptions of their abilities. In addition, the results of both Study 1 and 2 suggest that skill-building training may be more effective than providing knowledge alone in increasing certain types of accounting-related self-efficacy.

Consistent with previous research in education (e.g., Angelo and Cross 1993), our studies also suggest that accounting-related self-efficacy measures may be useful as diagnostic measures of student ability. Pretest measures of spreadsheet self-efficacy were highly correlated with students' initial spreadsheet knowledge and skill, and pretest measures of computer self-efficacy were highly correlated with students' initial computer knowledge. However, the correlations between self-efficacy and knowledge/skill disappeared in posttest measures. Self-efficacy measures, therefore, may be of little value in evaluating performance after the delivery of common, course-specific instruction or training. Similar results were observed for the measures of computer anxiety. Specifically, pretest measures of computer anxiety were highly correlated with measures of skill/knowledge, but posttest measures of these variables were uncorrelated.

SSTASK, ASK, and Computer Anxiety

The results with respect to computer anxiety are equivocal. The results of Study 1 suggest that SSTASK and ASK may be equally effective at decreasing the Oetting measure of computer anxiety, but there were no effects from instruction on the HG&K measure. The results of Study 2 indicate that ASK may decrease the Oetting measure of computer anxiety but not affect the HG&K measure, while SSTASK may not affect either measure. It is possible that the computer anxiety results of Study 2 may be an artifact of the temporal ordering of the ASK and SSTASK treatments. Specifically, it may be that it was early-semester exposure to the University B AIS instructors that decreased the Oetting measure of computer anxiety in the ASK module in Study Two and not the content of the module itself. Additional research will be required to more clearly identify the role of instruction on affect (i.e., emotions) in accounting education.

To the extent that accounting educators and researchers find the construct of computer anxiety useful, our data suggest that the Oetting measure is more sensitive to the effects of accounting instruction than the HG&K measure. However, accounting-specific measures of self-efficacy appear to be more clearly linked to the instructional objectives of most accounting education than measures of computer anxiety. One reason for this may be that most measures of computer anxiety were developed at a time when computers were less familiar to students. Although computer anxiety is now relatively common among college undergraduates (Rosen and Maguire 1990), it may be less common as children are increasingly exposed to computers at a younger age (Lepper 1985). It may be the case that, as the computer knowledge of new accounting students increases, accounting education should focus more on accounting-related computer skills and less on students' (diminishing) fears of computers and technology.

Classroom Implications

Both studies provide support for the value of adding training modules to the undergraduate accounting curriculum. In both studies, students completing software-specific training had larger increases in software-specific knowledge and skill and software-specific self-efficacy than students receiving only accounting systems knowledge (ASK). Of course, our study does not provide evidence on whether such training is better provided in academic or employment settings. However, studies of accounting professionals indicate that, at least currently, employers believe universities should provide such training (Heagy and McMickle 1988; *New Accountant* 1992; Siegel and Sorensen 1994). Further, many of the AECC sponsored curriculum initiatives incorporate delivery of software-specific training as a part of the undergraduate accounting curriculum (e.g., Williams and Sundem 1990, 1991).

CONCLUSION

This study is the first to examine the relationships among the psychological constructs of knowledge, skill, self-efficacy and computer anxiety in accounting education. Our data suggest that the changing emphasis on knowledge and skill in accounting education, at a minimum, may affect students' self-perceptions of their own abilities. However, the relationship among knowledge, skill, self-efficacy and computer anxiety in accounting settings is complex and our studies are only a first step in understanding these relationships. While our data provide some important insights, many issues remain for future research.

Accounting educators, through the sponsorship of the AECC, are implementing dramatic changes in the knowledge and skill that are taught in accounting education. However, relatively little debate has occurred among accounting educators regarding these changes, which has led some to argue that the AECC initiatives were implemented without sufficient consideration to alternative curricula or conceptual foundations (Barefield 1991). Accounting educators and professionals both have a clear and vested interest in better preparing accounting graduates for the future demands of the profession. We believe that the success of accounting education in meeting this objective depends in part on clearly articulating the relationships among accounting instruction, knowledge, skill, self-efficacy and anxiety. We applaud educators and researchers willing to opine on and investigate these difficult, consequential and, sometimes, controversial issues.

APPENDIX
Reproductions of Administered Instruments

Scale used for questions 1 through 72:

Using the A to E scale described below, please rate the extent to which you agree or disagree with the following statements. For example, if you strongly disagree with a statement, give it a rating of "A." If you strongly agree with a statement, give it a rating of "E." Please indicate your responses on the machine-readable response form provided to you.

Rating	Degree of Agreement
A	Strongly disagree
B	Moderately disagree
C	Neither agree nor disagree
D	Moderately agree
E	Strongly agree

Computer Self-Efficacy Instrument (© Dan N. Stone and Vairam Arunachalam. May be used for academic research with proper citation. Any use for commercial gain, without written consent, is prohibited.)

The following questions ask about your ability to complete certain computer-related tasks.

1. I can execute the commands necessary to run an application program (e.g., word processing, spreadsheet) on a microcomputer.
2. I can backup my data files on a microcomputer.
3. I am comfortable using either the DOS, Windows or Macintosh operating systems.
4. I can transfer files between Macintosh and DOS-based microcomputers.
5. I can send electronic mail to a friend at another University.
6. I can use a keyboard and/or a mouse to issue commands to a microcomputer.
7. I can copy a file from a hard disk drive to a "floppy" disk.
8. I can set the file tabs so that the data on my floppy disk is not accidentally erased.
9. I can list the files stored on a "floppy" disk to see the day and time a specific file was last stored.
10. I can erase files I don't need from a floppy disk.
11. I can check a floppy disk to see if it is infected with a virus.
12. I can copy a file from a 5 1/4" diskette to a 3 1/2" diskette.

Spreadsheet Self-Efficacy (© Dan N. Stone and Vairam Arunachalam. May be used for academic research with proper citation. Any use for commercial gain, without written consent, is prohibited.)

The following questions ask about your ability to use Lotus 1-2-3.

13. I can save a file in Lotus 1-2-3.
14. I can get on-line help in Lotus 1-2-3 if I need it.
15. I can use the formulas and functions available in Lotus 1-2-3 to perform mathematical and statistical computations.
16. I can construct error-free spreadsheets in Lotus 1-2-3.
17. I can create Lotus 1-2-3 spreadsheets that include checks for data entry errors.
18. I can create professional looking spreadsheets in Lotus 1-2-3.
19. I can create professional looking graphs in Lotus 1-2-3.
20. I can transfer data that is in another file format (e.g., Excel) into Lotus 1-2-3.
21. I can issue the commands necessary to protect data in a Lotus 1-2-3 spreadsheet from being changed by someone else.
22. I can use the database features of Lotus 1-2-3 to sort the information in a spreadsheet.
23. I can use Lotus 1-2-3 macros to make it faster and easier to issue repetitive commands that I use frequently.
24. I can use Lotus 1-2-3 macros to create spreadsheets that even people who are unfamiliar with Lotus 1-2-3 can use.

Database Self-Efficacy (© Dan N. Stone and Vairam Arunachalam. May be used for academic research with proper citation. Any use for commercial gain, without written consent, is prohibited.)

Questions 25 through 36 ask about your ability to use database processing software.

25. I can use database processing software (e.g., dBaseIV, R:Base, Paradox, Foxpro, etc.) to create a database and input data into it.
26. I can use database processing software to create customized input screens for data entry.
27. I can use database processing software to create queries to look at the data in a database from different perspectives.
28. I can use database processing software to create customized reports based on the information collected from queries on the database.
29. I can use database processing software to link files and view combined information from the database.
30. I can get on-line help from database processing software if I need it.
31. I can use database processing software to construct error-free databases.
32. I can use database processing software to create customized input screens that include checks for data entry errors.
33. I can create professional looking reports using database processing software .
34. I can transfer data between databases of different formats (e.g., dBaseIV to R:Base).
35. I can write customized applications in the higher-level language of a database processing software package.
36. I can use database processing software to create databases that even people who are unfamiliar with database processing software can use.

Computer Anxiety Rating Scale (reproduced from Heinssen et al. 1987)

Questions 37 through 55 ask how you feel about using computers in general.

37. I feel insecure about my ability to interpret a computer printout.
38. I look forward to using a computer on my job.
39. I do not think I would be able to learn a computer programming language.
40. The challenge of learning about computers is exciting.
41. I am confident that I can learn computer skills.
42. Anyone can learn to use a computer if they are patient and motivated.
43. Learning to operate computers is like learning any new skill—the more you practice, the better you become.
44. I am afraid that if I begin to use computers I will become dependent upon them and lose some of my reasoning skills.
45. I am sure that with time and practice I will be as comfortable working with computers as I am working with a typewriter.
46. I feel that I will be able to keep up with the advances happening in the computer field.
47. I dislike working with machines that are smarter than I am.
48. I feel apprehensive about using computers.
49. I have difficulty in understanding the technical aspects of computers.
50. It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key.
51. I hesitate to use a computer for fear of making mistakes that I cannot correct.
52. You must be a genius to understand all the special keys contained on most computer terminals.
53. If given the opportunity, I would like to learn about and use computers.
54. I have avoided computers because they are unfamiliar and somewhat intimidating to me.
55. I feel computers are necessary tools in both educational and work settings.

General Self-Efficacy (reproduced from Sherer et al. 1982)

Questions 56 through 72 ask how you feel about certain situations that may arise in your life.

56. When I make plans, I am certain I can make them work.
57. One of my problems is that I cannot get down to work when I should.
58. If I can't do a job the first time, I keep trying until I can.
59. When I set important goals for myself, I rarely achieve them.
60. I give up on things before completing them.
61. I avoid facing difficulties.
62. If something looks too complicated, I will not even bother to try it.
63. When I have something unpleasant to do, I stick to it until I finish it.
64. When I decide to do something, I go right to work on it.
65. When trying to learn something new, I soon give up if I am not initially successful.
66. When unexpected problems occur, I don't handle them well.
67. I avoid trying to learn new things when they look too difficult for me.
68. Failure just makes me try harder.
69. I feel insecure about my ability to do things.
70. I am a self-reliant person.
71. I give up easily.
72. I do not seem capable of dealing with most problems that come up in life.

Oetting's Computer Anxiety Scale (COMPAS) (© Eugene R. Oetting, Psychology Dept., Colorado State University, Ft. Collins, CO 80523. May be used for academic research with proper citation. Any use for commercial gain, without written consent, is prohibited.)

The following questions ask how you feel about using computers to do certain tasks.

For the remaining questions, please read each statement and indicate how you *feel* about that situation. Please use the rating scale below each question to indicate your response. For example, for question #73, if you are confident in your ability to use a hand calculator to add a long list of numbers, please indicate answer "a" (i.e., confident) on the machine-readable response form. If the thought of adding a long list of numbers on a hand calculator makes you "worried" please indicate answer "e" on the machine readable response form. As before, please indicate your responses to all of the questions on the machine-readable response form provided to you.

Using a hand calculator to add a long list of numbers

confident				worried
a	b	c	d	e

Having a hotel or motel bill worked out by a computer

distrust				trust
a	b	c	d	e

I generally think of computers as

friendly				unfriendly
a	b	c	d	e

Trying to use a small computer to balance a checkbook would usually be

frustrating				comfortable
a	b	c	d	e

Correcting an error on the screen

easy				tricky
a	b	c	d	e

Learning to use a small computer to do a budget

comfortable				scared
a	b	c	d	e

Interpreting a complicated computer printout
worried — secure
a b c d e

Computers give me
more control — less control
a b c d e

Making a mistake when entering data for analysis because of nervousness
likely — unlikely
a b c d e

Trying to write a program in BASIC as part of a class
worried — secure
a b c d e

Deciding which type of personal computer to buy
secure — insecure
a b c d e

Explaining a problem that you have not been able to solve to a computer consultant
frightened — fearless
a b c d e

Using a hand calculator to multiply or divide
confident — worried
a b c d e

Voting using a computer
distrust — trust
a b c d e

Just hearing the word "computer" makes me feel
interested — nervous
a b c d e

Taking a job where you have to regularly enter data into a computer
concerned — unconcerned
a b c d e

Typing on a word processor instead of a typewriter
less nervous — more nervous
a b c d e

Learning to keep records for a small business on a computer
confident — anxious
a b c d e

Knowing the right words or "language" when talking about using a computer
insecure — safe
a b c d e

Reading a book about how computers can be used
enjoy it — avoid it
a b c d e

Looking at the keyboard of a small computer
anxious — comfortable
a b c d e

Trying to use a small computer to solve math problems
frustrating — useful
a b c d e

When a message appears on the screen that you have not seen before

confident				worried
a	b	c	d	e

Trying to operate a small computer when you are all alone

worried				unworried
a	b	c	d	e

Pretest of Computing Knowledge (© Dan N. Stone and Vairam Arunachalam. May be used for academic research with proper citation. Any use for commercial gain, without written consent, is prohibited.)

Select the letter of the response that *best* answers the question or completes the sentence.

1. In a conversation, you overhear someone say that their microprocessor is a "486 machine." In this statement, the "486" refers to the:
   a) input devices used by the computer.
   b) output devices used by the computer.
   c) hard disk drive in the computer.
   d) CPU in the computer.
   e) amount of RAM in the computer.
2. A megabyte is approximately:
   a) 1,000 bytes of storage.
   b) 1,000,000 bytes of storage.
   c) 1,000,000,000 bytes of storage.
   d) 1,000,000,000,000 bytes of storage.
   e) 1,000,000,000,000,000 bytes of storage.
3. LCDs are a type of:
   a) hard disk drive.
   b) printer.
   c) video display.
   d) mouse.
   e) computer memory.
4. "RAM" stands for:
   a) readily available monitor.
   b) readily available memory.
   c) random access monitor.
   d) random access memory.
   e) radical architecture memory.
5. Which of the following companies make a DOS-based microcomputer?
   a) Apple.
   b) Beatrice.
   c) Cargill.
   d) Dell.
   e) Eprom.
6. A trackball:
   a) looks like a small gear shift lever set in a box.
   b) is a form of optical character recognition device.
   c) is a stationary device containing a roller ball device whose top is exposed outside its case.
   d) is a pen-shaped device with a ball point at the end.
   e) is a device which is rolled along the desk top in order to move the cursor on the screen.
7. Dot matrix printers:
   a) are commonly used for "desktop publishing" applications.
   b) *cannot* be used to produce multiple copies.
   c) are a type of laser printer.
   d) use a matrix of short print wires which form a character as a series of dots.
   e) All of the above.

8. Small figures displayed on a CRT that look like familiar objects such as a file folder or waste basket are called:
   a) icons.
   b) trackballs.
   c) plasma displays.
   d) wands.
   e) light pens.
9. A common word processing program is:
   a) Ami Pro.
   b) Excel.
   c) Lotus 1-2-3.
   d) DOS.
   e) PowerPoint.
10. Windows is a(n):
   a) database package.
   b) spreadsheet package.
   c) word processing package.
   d) operating system that works in conjunction with DOS.
   e) presentation package.
11. The most current version of the operating system on the Macintosh computer is:
   a) DOS 6.2.
   b) Windows 3.1.
   c) System software version 7.
   d) Excel.
   e) PowerPoint.
12. Electronic spreadsheets allow you to enter data and to perform calculations and then to manipulate the data to:
   a) control the data communications of the operating system.
   b) control the data management of the operating system.
   c) use as a decision-making tool to answer what if questions.
   d) merge text, data, and graphics to produce professional looking documents.
   e) All of the above.
13. Which one of the following types of programs is usually considered application software?
   a) Operating system software.
   b) A graphics package.
   c) System utility programs.
   d) Operating system file management programs.
   e) All of the above.
14. Application programs consist of programs that:
   a) control the use of the hardware, software, and data resources.
   b) help programmers develop information processing programs.
   c) direct the processing required for the solution to a specific problem of a user.
   d) supervise the operations of the CPU.
   e) All of the above.
15. An electronic spreadsheet package:
   a) allows you to write a term paper using a computer.
   b) spreads text among the graphs on the screen.
   c) is a computerized tool for analysis, planning, and modeling.
   d) distributes copies of text files to other users by electronic mail.
   e) All of the above.

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