

An Examination and Analysis of Technologies Employed by Accounting Educators

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Abstract

The purpose of this study is to investigate the current state of accounting education in terms of the technology being employed by professors in accounting courses. The study addresses the following two interrelated research questions: (1) what technologies are accounting educators using in the classroom, and (2) what technologies and related software and databases are accounting educators requiring their students to use in and outside of the classroom? A survey-based cross-sectional field research design was used to gather information from accounting educators related to the above research questions. Findings indicate that, in general, today's accounting students are obtaining valuable experience with a wide array of IT tools – both hardware and software – in their accounting courses. However, the study also reveals some areas in which better use of technology could be made and provides recommendations for the community of accounting educators to consider. Finally, the study's results provide a baseline representation of the current use of technology in accounting education programs. Such a baseline should prove valuable to future researchers studying trends in the use of technological tools in accounting education.

Background and Motivation

The American Accounting Association, recognizing serious deficiencies in the ways in which accounting students are educated, formed the Accounting Education Change Commission (AECC) nearly 30 years ago. The stated mission of the AECC is to be a “catalyst for improving the academic preparation of accountants so that entrants to the accounting profession possess the skills, knowledge, and attitudes required for success in accounting career paths” (AECC 1990). A position statement issued by the AECC called for significant revisions in the techniques and methods used to educate accounting students in order to better prepare them for entry into the accounting profession:

Students must be active participants in the learning process, not passive recipients of information. They should identify and solve unstructured problems that require use of multiple information sources. Learning by doing should be emphasized. Working in groups should be encouraged. **Creative use of technology is essential** (emphasis added) (AECC 1990).

More recently, Albrecht and Sack (2000) published a monograph that once again advocated that widespread revisions be made to the educational process in accounting, noting that very little had changed since the formation of the AECC and emphasizing the importance of prompt action:

Accounting leaders and practicing accountants are telling us that accounting education, as currently structured, is outdated, broken, and needs to be modified significantly. ... If serious changes are not made, accounting education will lose its relevance to our business schools, to our students, and to the employers who might otherwise be interested in our students (Albrecht and Sack 2000).

Except in a few schools, these warning signals—warnings about the future viability of accounting education—have largely gone unheeded. In too many respects, accounting education is being delivered the same way today as it was 20 or 30 years ago. ... Now, instead of encouraging change in accounting education in order to stay current (as former studies did), our message is more urgent. We believe that because practice has changed so dramatically and because accounting education has not kept up, we have lost ground to other business majors, to corporate competitors, and to other types of educational programs. In too many ways, business and technology have passed us by and we must now change quickly just to survive. We cannot emphasize strongly enough that it is now survival we are talking about, not merely changing to be better. There can be no further delays without serious consequences (Ibid.).

One area in particular where Albrecht and Sack (2000) noted that accounting education is deficient is in the use of technology. In 2012, the Pathways Commission on Accounting Higher Education published its report on recommendations for the future structure of higher education in accounting (Behn, Ezzell, Murphy, Rayburn, Stith, and Strawser 2012). Among the Commission's recommendations was, yet again, a call for increased use of technologies throughout the accounting curriculum.

The importance of developing accounting students' technological skills is also recognized by the American Institute of Certified Public Accountants. The AICPA Pre-Certification Core Competency Framework identifies skills necessary for students entering the accounting profession (AICPA 2017a). These skills, or "competencies," are grouped into three categories: accounting competencies, professional competencies, and business competencies. In the accounting competencies category, *Technology and Tools* is listed as a key skill and is described as follows: "Identify and utilize relevant technology and tools to analyze data, efficiently and effectively perform assigned tasks..."

There is a growing body of research addressing the effect of technology on student performance in accounting courses. Recent studies have examined a range of technology-related topics such as online homework management systems, online vs. traditional course delivery approaches, assessment tools such as clickers, and several others. Morris, Burnett, Skousen, and Akaaboune (2015) find that students using an IT tool (i.e., an online-based instruction platform) perform better overall in their accounting courses than students who do not, while Tan and Ferreira (2012) find that the use of accounting software improves the depth of students' understanding of activity-based costing. Sargent, Borthick, and Lederberg (2011) provide evidence that students' use of online tutorials in accounting principles courses improves pass rates, retention rates (i.e., students are less likely to drop the course), and exam scores. Lusher, Huber, and Valencia (2012) compare student performance in accounting principles courses taught in a "smart" classroom setting to that in a fully computerized setting. Students in the computerized setting performed better on homework and tests, but not on in-class assignments or group projects. Chen, Jones, and Moreland (2013) examine the effect of course level on the effectiveness of online accounting education as compared to traditional in-class delivery. Their findings suggest that students in advanced-level courses perform better in a traditional setting, whereas the delivery mode (traditional vs. online) was not important to introductory level students.

Phillips and Johnson (2011) investigate the student learning effects of online homework systems (OHS) as compared to intelligent tutoring systems (ITS) in the introductory financial accounting course. While both systems provided benefits, their results suggest that students, on average, gained more knowledge when using an ITS than when using an OHS. This is attributed to feedback and instructional support differences in the two systems. In a later study,

Hahn, Fairchild, and Dowis (2013) examine pen and pencil homework, OHS, and ITS in the introductory financial accounting course. In contrast to Phillips and Johnson's (2011) findings, no learning differences between ITS and OHS were found across several performance measures. In addition, neither the ITS or OHS systems provided any learning advantage over traditional pen and pencil homework in that study.

Chui, Martin and Pike (2013) explored the impact of the use of student response systems (SRS or "clickers") on student performance in the accounting principles course. Students using clickers performed better on in-class multiple choice quizzes, had more confidence, and spent less time preparing than students who did not use clickers. However, no significant difference in examination performance or overall course performance was detected between the two groups. Eng, Lea, and Cai (2014) also examined whether the use of clickers enhanced student performance in the financial accounting introductory course. In one semester, clickers were used in the course, in another semester, they were not. The results indicate that students had a positive experience using clickers, that clicker scores were positively associated with test scores, and that students using clickers had higher test scores overall.

Humphrey and Beard (2014) surveyed U.S. accounting faculty regarding their use and perceptions of online homework software (OHS). The majority (66%) of respondents currently used OHS in their classes, while 17 percent had discontinued use and 21 percent had never used OHS. Users typically had fewer years of teaching experience, taught more sections, and had lower faculty rank than non-users of OHS. Many OHS users had favorable views of OHS. Concerns expressed by respondents included cost, whether or not OHS enhance student learning, dissatisfaction by many students when using OHS, and student cheating. Fatemi, Marquis, and Wasan (2014) compared the performance of students using OHS to those who used traditional manual homework in the intermediate accounting course. They found that students using an OHS to complete homework assignments performed better when solving problems on exams compared with students who completed their homework manually. However, when answering multiple choice questions on exams, students who had completed their homework using the OHS performed significantly worse than other students. The authors concluded that OHS may be better for developing problem-solving skills, while the manual homework approach may better enhance conceptual understanding and critical thinking.

Litherland, Carmichael, and Martinez-Garcia (2013) report on a pilot test of an e-assessment system (OeLe) capable of grading and providing feedback on free-text responses to conceptual accounting questions. The system was used to evaluate student responses on an exam in the undergraduate financial accounting course. The authors conclude that use of the e-assessment system appears to provide a more focused overall marking process (than manual marking alone) and upon further development has potential for use in accounting applications. However, they note that use of the system in accounting may require changes in current teaching and assessment practices.

The current study extends these research lines by addressing the following two interrelated research questions: (1) what technologies are accounting educators using in the classroom, and (2) what technologies and related software and databases are accounting educators requiring their students to use? These are important and timely areas of study given the effects of technology on student performance observed in the studies cited above and increasing expectations regarding IT tool competencies for today's accounting professionals.

Methodology

This study utilized a survey-based cross-sectional field research design to gather information from accounting educators regarding the current state of accounting education, including the methods and technologies currently being used by accounting faculty to educate students, and how future accounting education can be improved. Two-thousand six-hundred and seventy-five survey instruments were sent to accounting educators via email. Recipients were chosen randomly from the *Hasselback Directory of Accounting Faculty*. *Qualtrics* online survey software facilitated the distribution of the survey instrument to faculty. The instrument began with a cover letter explaining the purpose of the study and instructing recipients to base their responses on the accounting course they taught most frequently in the preceding three years (i.e., their "referent course"). Respondents were assured that their individual responses would be kept confidential, and they were free to decline answering any questions that made them feel

uncomfortable. As an incentive to complete the survey, a \$250 cash prize was offered to an individual selected at random from the pool of respondents.

The survey instrument was dynamic and consisted of six key questions related to the faculty members' use of technology in their courses¹. Since the instrument included conditional questions, not all respondents answered all questions. The survey questions were based, in part, on the findings and recommendations of the AECC (1990) and Albrecht and Sack (2000) reports, with the specific intent of developing an instrument to assess the current state of accounting education with regard to technologies employed in accounting courses.

The instrument (see Appendix) began by asking respondents to identify the primary course they taught in the last three years and its level (graduate; undergraduate). Next, respondents were asked to indicate, for their referent course, the specific types of software their students are required to use. Respondents were also asked to report how they use IT hardware in their accounting classes. Following these technology questions, faculty were asked whether they require students to access organizations' or companies' websites or online databases in their courses and, if so, to specify which one(s) they use. Subsequent questions addressed the use of learning management systems (LMS), such as Moodle and Blackboard/WebCT to facilitate course administration, and the use of online homework and grading systems, such as WileyPlus. Near the end of the instrument, participants were invited to share anything they would like that had not been addressed previously in the survey. The final section of the instrument addressed participants' demographics.

Pilot testing of the survey instrument was completed using accounting instructors at a university in the United States. Results of the pilot tests led to several changes to the survey's layout, instructions, and questions to improve clarity and to improve the flow of the questions.

Methods of analysis

Multiple methods were used to test for statistically significant differences in variables. Chi-square independence of classification tests were performed to test for differences in demographic data of early and late respondents as well as differences in their responses to questions about the use of technology in their courses. Contingency analyses were used in conjunction with chi-square tests and one-sample t-tests to identify significant differences in the types of software and hardware used in graduate courses vs. undergraduate courses, small vs. large classes, and whether respondents' years of teaching experience are related to the use of technology in their courses. Results of these tests are presented in the next section.

Results

Respondents' demographics and tests for nonresponse bias

Of the 2,675 surveys emailed to professors, 159 surveys were undeliverable (6%). Of the 2,516 surveys that reached the recipients' inboxes, 325 surveys were started by the recipients (13%), and 300 of those were returned to the researchers (92%). Thus, the overall response rate was 12 percent (300/2,516). Participants provided demographic data along the following dimensions: academic rank, years of teaching experience, highest degree earned, type of institution where the participant is employed, age, and gender. Additionally, participants indicated the average number of students enrolled in each section of their referent course as well as the topic and level of that course. Table 1 presents the distribution of participants' responses to those questions.

The possibility of nonresponse bias was tested via analyses of the internal variation of "early" and "late" respondents' demographic factors of professional rank, teaching experience, and type of university at which the respondent is currently employed (non-PhD-granting vs PhD-granting) and their responses to questions about the level and subject of the course they teach most frequently and how they use technology in their classes. Specifically, comparisons were

¹ The instrument also included nine demographic questions and eight questions related to active learning. The latter topic is beyond the scope of the current paper and is not discussed further.

performed of the demographics and responses of “early” respondents (n=153) who returned their survey within three days of the initial survey distribution with those of “late” respondents (n=114) who responded only after a follow-up reminder was sent 30 days after the initial distribution.² Results of chi-square independence of classification tests reveal no significant differences between early and late respondents ($p > 0.10$ for all tests). Although such tests are unable to disprove conclusively the existence of nonresponse bias, they support the assertion that nonresponse bias is unlikely to affect the interpretability of the study’s findings. Nevertheless, given the overall response rate of 12 percent, nonresponse bias remains a possibility.

Use of Information Technology Software

The top technology software that faculty require students to use, and the percentage of respondents who require it, are word processing software (68%), spreadsheet software (66%), Email software (52%), web browser software (51%), and presentation software (36%). Less frequently required are accounting/bookkeeping software (8%), tax software (8%), database software (7%), audit software (6%), and flowcharting/drawing software (5%). Least frequently required software (< 5%) relate to graphics, social media, and programming languages.

Hardware

Most respondents (79%) use a computer or tablet during class to present course material. Many faculty also reported they use document cameras in class (42%). About one in five respondents require students to use computers during class to work problems or take notes. Audience response systems (i.e., “clickers”) are not widely used by accounting faculty, with only seven percent of respondents reporting they use such systems. Other technologies less frequently employed during class time are Skype (e.g., for guest speakers), smart boards, Polyvision’s eno interactive whiteboard, DVDs, and polling software other than clickers.

Several respondents shared specific comments regarding their use of technology, including, “I require students to make presentations using Prezi” and “On days where I have an elaborate game/activity planned, I use multiple computers and software to run the activities and monitor team progress and results.” Other comments included, “Group discussion and posting notes from the discussion for participation,” “Use of mobile phones as survey response tools,” and “I pre-record lectures and students download them from the ... webpage.”

Online Databases and Websites

Fifty-one percent of respondents require students to access organizations’ or companies’ websites or online databases in their courses. The two most widely utilized websites are the FASB’s website (31%) and SEC/EDGAR (25%). Also frequently used are the IRS’s website and corporate/CPA firm websites (both are used by approximately ten percent of respondents) and the AICPA and PCAOB websites (used by nine percent of respondents). Others mentioned by respondents were the websites of the IASB, GASB, IIA, and IMA, each of which is used by fewer than three percent of the respondents.

Learning Management Systems

The majority of respondents (89%) use some type of learning management system (LMS) to facilitate course administration. Forty-six percent indicated that they use Blackboard/WebCT, while 15 percent use Moodle. Less frequently specified were Desire 2 Learn (10%) and Canvas (5%). Faculty reported they use an LMS for a variety of purposes, with the most common use being to disseminate class content such as assignments, lecture notes, and/or PowerPoint slides to students (89%). Other common uses of LMS are to post grades and attendance (52%), for class announcements and communications (49%), and for collection of assignments from students (48%). Other less

² The rationale for comparing characteristics of early and late respondents to test for nonresponse bias is based on the assumption that demographic characteristics of late respondents are more like those of nonrespondents than early respondents. Therefore, if comparisons of early and late respondents indicate no significant differences between the two groups, then the results of the survey can be generalized with greater confidence (Atif, Richards, and Bilgin, 2012).

frequent uses of LMS are for online quizzes (21%), for chat rooms and discussion groups (13%), and for posting recorded lectures or videos (8%).

Most respondents seem to view LMS as a beneficial tool and make extensive use of its features. For example, the following comment was offered by a respondent explaining why he/she uses an LMS: “(It) provides easy access to course materials for students. Also, they turn assignments in electronically which allows for paperless work. In addition, publisher resources connect directly with the LMS.” However, a few of the respondents feel less favorably and shared some rather candid negative comments about their experiences with LMS, such as the following: “The school makes me do it. I hate the damn thing.”

Online Teaching and Learning Resources

Another interesting resource used by some faculty is online homework and grading systems such as Connect (McGraw-Hill), CengageNow, WileyPlus, and others. However, most accounting faculty (58%) do *not* use these online systems in their courses. Of those instructors who currently do use one, McGraw-Hill’s Connect is used most often (48%), followed by WileyPlus (20%), CengageNow (14%), and Pearson Education’s MyAccountingLab (7%). Eleven percent of faculty use some other system, such as TurnItIn, MyLearningSpace, APLIA, and SpeedGrader.

Additional Comments from Respondents

Faculty were invited to comment on any matters that had not been addressed previously in the survey. Respondents expressed a wide range of mixed opinions regarding how technology should be used in accounting courses. Space precludes reporting all of the comments; however, a sampling of particularly thought-provoking ones is provided (see Table 2). These comments clearly show that accounting educators have mixed opinions regarding how technology should be used in accounting courses.

Although it is unlikely that any one particular type of technology or IT tool will be equally effective or desirable in every accounting course, it seems plausible that some types are more useful in certain courses than others. The next section explores that issue.

Contingency Analyses

IT Tools by Course Level

To identify the extent to which accounting educators’ use of technology differs across course level, responses were grouped by undergraduate vs. graduate courses. First, the IT hardware tools used by accounting faculty during class are considered (see Table 3). Overall, the percentages of instructors using various IT tools in graduate courses are quite similar to those in undergraduate courses. The use of a computer or tablet by the instructor while teaching graduate classes (85%) is slightly more common than in undergraduate classes (77%). Also, while only four percent of respondents do *not* use any type of IT hardware during their graduate classes, eight percent of undergraduate classes do not use any type of IT hardware. However, these differences are not statistically significant.

Next, the types of software used in undergraduate and graduate courses are identified (see Table 4). Word processing software and spreadsheet software are used in the majority of both undergraduate and graduate courses. Presentation software is used significantly more in graduate courses than undergraduate courses (50% vs. 29%; $t=3.704$; $p<0.001$), while database software, web browser software, accounting software, programming languages, and flowcharting software are more common in undergraduate courses than graduate courses. Each of these latter differences is statistically significant ($p\leq 0.05$).

Next, the use of IT tools by each discipline (i.e., course subject) is dissected (see Table 5). The results provide some additional noteworthy observations. First, the use of spreadsheets is required more than any other type of software in nearly every accounting course, ranging from 48 percent of taxation courses to 90 percent of accounting information systems courses. Word processing software is also required in many courses, ranging from 38 percent of managerial accounting courses to 89 percent of auditing courses. In addition, students are required to use presentation software (e.g., PowerPoint) in a wide range of accounting courses, beginning with the first principles course (24%) through

advanced accounting (24%) and auditing (30%). In contrast to the widespread use of spreadsheets, word processing, and presentation software, however, accounting students are required to use database software, flowcharting software, and accounting software in only very few accounting courses, with the exception of the accounting information systems course. Lastly, respondents were invited to specify any other software they require their students to use that was not explicitly included in the survey instrument; responses included: RIA Checkpoint, Adobe Connect, Turnitin, SAP software, SPSS, QlikView, Checkpoint PPC, Confirmation.com (auditing software), ALEKS, Netsuite, Prezi, TopHat, Concordance (by LexisNexis), and YouTube.

IT Hardware by Class Size

Next, responses were grouped according to class size to assess the potential effects of class size on the IT tools used in class. There is a significant increase in the percentage of instructors using document cameras when class size increases from 25 or fewer students to more than 25 students (≤ 25 students=23%; >25 students=48%; $\chi^2=10.58$, $t=3.65$, $p<0.001$; all significance levels adjusted via the Bonferroni correction). Class size has no significant effect on other uses of IT during class, including whether the instructor uses a computer/tablet to present course material in class, requires students to use computers during class, or whether the instructor uses “clickers” in class.

IT Tools by Years of Teaching Experience

Finally, faculty members’ years of teaching experience and use of IT tools in class were analyzed to identify any relationship between those two factors. Although the majority of faculty members at all levels of experience use computers/tablets during class to present course material, a smaller proportion of faculty with more than 30 years of teaching experience use computer/tablets during class than faculty with 30 or less years of experience (>30 years = 65%; ≤ 30 years = 80%; $\chi^2=4.38$, $t=1.86$, $p=0.03$). Years of teaching experience has no significant effect on other uses of IT during class, including whether the instructor requires students to use a computer to take notes or work on assignments in class or uses an audience response system (clickers) in class.

Discussion

Academic accounting programs have been widely criticized in the past for generally being unresponsive to repeated calls for change. For instance, Albrecht and Sack (2000) warned that, because accounting education programs had failed to make necessary changes to remain relevant, the survival of accounting education was in peril. Fortunately, the dire predictions of Albrecht and Sack and others that accounting might become irrelevant to business have not come to pass. Graduates of accounting programs continue to be in high demand, and accounting today is as relevant to business as ever. Now, in this current study conducted many years after the publication of the Albrecht and Sack monograph, we gain insight into today’s state of accounting education in terms of the ways IT hardware and software are currently used in accounting courses. It is quite likely that the widespread application of both old and new technologies by accounting educators evidenced in this study has contributed to the relevance and success of today’s accounting students and programs. However, there are still several areas in which improvements are needed. The study’s key findings are summarized below.

Spreadsheet software and word-processing software are the two categories of software students are most frequently required to use, with both types of software being required in the majority of both undergraduate and graduate accounting courses. This is encouraging. In the study by Albrecht and Sack (2000), proficiency in spreadsheet and word-processing software were the two technology skills ranked highest in terms of importance for accounting graduates. Proficiency with these types of software is even more essential for today’s accounting professionals than it was 15 years ago. Students need to possess the technological skills demanded by employers, and most accounting educators seem to understand the importance of using technology assignments incorporating spreadsheet and word-processing software to teach technology skills. However, more can be done. Why do 33 percent of accounting faculty *not* require the use of spreadsheet and word-processing software in the courses they teach most often? Furthermore, in Albrecht and Sack’s (2000) survey of practitioners, database management software received a ranking of 2.41 (on a scale of 1 to 3), which is roughly half-way between “critical” and “nice to know, but not critical.” Additionally, the CPA exam requires the use of technology skills to access and research electronic databases. This suggests that the use of database software should be an important component in the accounting

curricula. Although slightly more than half of accounting faculty require students to use online databases and/or corporate websites in their courses (i.e., the FASB website, SEC/EDGAR, the IRS website, and corporate websites), very few accounting faculty currently require their students to use database management software such as Microsoft Access or SQL.

Topic-specific software (audit, flowcharting, tax) is used by a relative low percentage of faculty teaching courses in the related disciplines (audit, AIS, tax). Only one-third of faculty teaching Auditing integrate some type of auditing software in the course. Flowcharting software is integrated in fewer than half of AIS courses and only seven percent of Auditing courses. Fewer than 60 percent of tax professors integrate tax software into their course. Accounting software is used in 62 percent of AIS courses but in only six percent of accounting-centric courses (Accounting Principles, Cost Accounting, Intermediate Accounting). Again, more can be done. Why do more than 40 percent of tax faculty *not* require the use of tax software in their courses? And why do two-thirds of audit faculty *not* require their students to use some type of generalized audit software? While the answers to these questions are not clear, one can speculate as to some possible reasons. Reid (2014) provides a framework of barriers to adoption of technology by faculty in higher education. Some possible reasons identified by Reid (2014) that might help explain accounting faculty's resistance to integrating discipline-specific software include the time and effort required to integrate the software into the course, lack of instructor knowledge or familiarity with the software and/or how to effectively apply the software to enhance teaching and student learning, monetary costs of implementing the software, and difficulties scheduling classrooms with appropriate equipment. The next section provides recommendations to help administrators and faculty mitigate these barriers to implementation.

Recommendations

While significant advances have been made in the use of technology in accounting education since the publication of the Accounting Education Change Committee's report in 1990 and the monograph by Albrecht and Sack in 2000, there is, of course, room for additional improvement. Accordingly, the following changes for consideration by the accounting community are recommended:

- (1) Increase coverage of database software. Accounting programs should consider devoting more attention to database skills in the accounting curriculum. Database skills, like spreadsheet and word-processing skills, are in high demand by employers, yet only six percent of undergraduate courses and two percent of graduate courses require students to use any type of database software.
- (2) Increase the number of courses in which students must use online databases and professional organizations' websites. Accounting graduates need the ability to utilize resources such as SEC/EDGAR, the FASB's online resources, and the AICPA and PCAOB websites to research accounting, auditing, and tax issues. Skills in using these tools should be developed while in our accounting programs if our students are to be successful professionals following graduation.
- (3) Increase the use of discipline-specific software (i.e., audit, tax) in related courses, and increase exposure to flowcharting software and accounting software in more courses than just the AIS course. For instance, given the widespread use of generalized audit software such as ACL and IDEA in public accounting firms, exposure to these types of programs at either the undergraduate or graduate level would be beneficial to students preparing for a career in public accounting. In addition, helping students develop competency using flowcharting software may contribute to their future success as business professionals.

In order for these recommendations to be implemented, administrators and faculty will need to take steps to reduce the barriers to adoption of new technology and software applications. For instance, to mitigate barriers related to the amount of time and effort required to integrate new software into a course, faculty could be provided a staff- or student-assistant to install the software and to help students with technical issues. Alternatively, administrators could offer faculty a monetary incentive to integrate relevant new software into their course.

To minimize barriers resulting from lack of instructor knowledge or familiarity with relevant software or how to effectively use it in their course, textbook writers could add more topic-specific software assignments to end-of-chapter materials. Gupta and Marshall (2010) found that end-of-chapter materials in the leading textbooks for Audit, Tax, AIS, Cost Accounting, and Intermediate Accounting rarely require the use of technology. Only 3.3 percent of the end-of-chapter problems in the textbooks examined by Gupta and Marshall (2010) required students to use technology. Increasing the number of end-of-chapter problems that involve the use of discipline-specific software might prove to be a very effective way to increase the use and integration of these software applications in the curriculum. For instance, in AIS textbooks, end-of-chapter assignments requiring the use of Microsoft Access (which is licensed for student use by many universities), and Visio would facilitate their integration into AIS courses. Similarly, end-of-chapter assignments involving ACL and IDEA would help faculty implement those applications in Auditing courses. Collaboration between textbook publishers and software companies could be beneficial in reducing the cost of software to students and facilitate the creation of end-of-chapters assignments.

This study's findings illustrate many of the ways that accounting faculty have embraced an array of technologies in their courses to enhance the student learning experience. This is very encouraging and indicative of the progress that has been made since the publication of the Albrecht and Sack monograph in 2000, as several of these technologies are relatively new and innovative and have only become available in the last 10-15 years. Since no single specific IT tool is ideal for everyone, students should be exposed to, and required to utilize, multiple types of IT tools—both hardware and software—in their courses. For instance, Phillips and Trainor (2014) point out that millennial students (born between 1982 and 2005) have been exposed to technology all of their lives and that these students generally prefer lectures and lecture materials be presented via online videos rather than during class time. Educators can use software such as Camtasia and SnagIt to create video lectures, which students can readily view outside of class using their computers or mobile devices. Phillips and Trainor (2014, p. 527) also state, "Students appear to be open to new technologies in the classroom and express a desire for professors to provide more hands-on and practical applications of the accounting content covered in their courses." Finally, it should be noted that technology has a major impact on practicing CPAs and the accounting profession, and the prevalence of technology in accounting is expected to increase in the future (AICPA 2017b).

Limitations and Conclusions

This study is subject to limitations common to online survey research. These limitations primarily relate to the study's external validity, i.e., the ability to generalize the survey's results to the entire population of accounting educators. Two potential threats to external validity are selection bias and nonresponse bias. To control for selection bias, accounting educators were selected randomly for participation in the survey. However, to the extent that the sample was not representative of the population of accounting educators, the study's generalizability is limited. Tests conducted to evaluate the second threat—nonresponse bias—found no significant differences between several characteristics of early and late respondents. Nevertheless, we cannot disregard the possibility that respondents' decision to participate in the survey may be correlated with factors that affect their choice of IT tools used in their courses, which would reduce the sample's generalizability. These limitations should be kept in mind when interpreting the study's results.

In conclusion, this study has identified areas of significant progress made by accounting educators related to the use of information technology over the past two decades. However, while it is commendable that many accounting educators apply various IT tools in their courses, there are still many areas in accounting programs where improvements can be made. Faculty and administrators should appraise the potential benefits of the preceding recommendations and consider their implementation in the accounting curriculum.

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Table 1
Panel A
Characteristics of Accounting Faculty Respondents:
Rank, Experience, Degree, Age

Dimension	Percentage of respondents (n=256)*
Academic rank	
Lecturer (part-time)	2%
Lecturer (full-time)	11%
Clinical professor	2%
Assistant professor	27%
Associate professor	26%
Professor	30%
Other	2%
Years of teaching experience	
< 6 years	15%
6 – 10	15%
11 – 15	15%
16 – 20	11%
21 – 25	16%
26 – 30	14%
> 30 years	15%
Highest degree earned	
Bachelor's degree	2%
Master's degree	23%
Doctoral degree	70%
Other	6%
Age	
20 – 30 years	2%
31 – 40	18%
41 – 50	20%
51 – 60	34%
61 – 70	23%
> 70 years	4%
Gender	
Female	42%
Male	58%

* Three hundred surveys were received in total; however, only 256 respondents chose to answer all of the demographic questions.

Table 1
Panel B
Characteristics of Accounting Faculty Respondents
Institution type, Class size, Course level, Course subject

Dimension	Percentage of respondents
Type of institution	
Two-year school	0%
Private school w/o a doctoral program in accounting	27%
State university w/o a doctoral program in accounting	41%
Private school with a doctoral program in accounting	2%
State university with a doctoral program in accounting	26%
Other	3%
Size of class taught most frequently	
1 – 25 students	22%
26 – 50	59%
51 – 75	9%
76 – 100	4%
100 – 150	2%
151 – 200	2%
> 200 students	4%
Level of course taught most frequently	
Undergraduate	78%
Graduate	22%
Subject of course taught most frequently	
Financial acctg fundamentals (principles)	22%
Managerial acctg fundamentals (principles)	11%
Cost accounting	7%
Intermediate accounting	16%
Advanced accounting	6%
Taxation	11%
Accounting information systems	7%
Auditing / Assurance services	9%
International accounting	1%
Fraud examination / Forensic accounting	1%
Doctoral research seminar	1%
Other	9%

Table 2
Selected Comments from Respondents
Regarding the Use of Technology in Accounting Courses

<i>I use an online textbook that is more interactive for students. I believe the old paper textbooks are going the way of the dinosaur.</i>
<i>Introduction of spreadsheet use has been a useful teaching technique in Principles of Financial Accounting.</i>
<i>I require they learn to use Excel in ways that will enhance their productivity in their career.</i>
<i>I am experimenting with a hybrid flipped format - with the lectures videotaped with voice over ppt. The class then meets to work on problems and case studies (much less lecture).</i>
<i>I use accounting software in another class, but don't think it belongs in the systems class. In the AIS class, students should learn 1) the basics of relational databases (because many systems use them) and 2) how to maximize their Excel skills, as Excel is so prevalent in business today. Feedback from our students who do internships has cemented my belief that Excel skills are important to job success.</i>
<i>A lot of technology is used outside class; for example, I create YouTube videos for students to watch outside class.</i>
<i>I've tried video lectures as part of flipping the classroom.</i>
<i>I believe educators are relying too heavily on technology. The pendulum has swung too far. Tax law needs to be taught from the code and regs, and students need to see a plethora of problems demonstrated to them. The use of PowerPoints needs to be eliminated. This generation is very tactile and wants to do rather than listen. Coming from public practice, I also recognize that the graduate relies too heavily on computers to solve problems. The student should be able to solve the problem and then check to see if the computer did it correctly.</i>
<i>My biggest problem is getting students not to text. I throw them out when I catch them. Also, the heavy use of computers causes students to drift off to their Facebook or other non-class activities. I am seriously thinking about prohibiting computers in my classes.</i>
<i>I do not know if IT tools such as "Connect" are really a useful tool for students to learn materials.</i>

Table 3
Percentage of Respondents Who Use Each Type of
IT Hardware in Class (by Course Level*)

	Undergraduate	Graduate
Instructor uses a computer or tablet while lecturing to present course material (e.g. Powerpoint slides)	77%	85%
Students are required to use computers during class to work on assignments / problems	18%	17%
Students are required to use computers during class to take notes	4%	2%
Students are required to use "clickers" (i.e., an audience response system) during class	7%	6%
Instructor uses a document camera while lecturing to present course material	42%	40%
Instructor uses IT in other ways	18%	19%
None of the above; instructor does not use a computer, tablet, document camera or other IT in class.	8%	4%

* Seventy-eight percent of respondents teach an undergraduate course most frequently; 22 percent teach a graduate course most frequently.

Table 4
Percentage of Respondents Who Use Each Type of
Software in Class (by Course Level*)

	Undergraduate	Graduate	Test Statistics
Word processing software (e.g., Word)	63%	74%	t=1.44, p=0.152
Spreadsheet software (e.g., Excel)	63%	58%	t=0.69, p=0.489
Database software (e.g., Access, SQL)	6%	2%	t=2.18, p=0.031
Presentation software (e.g., PowerPoint)	29%	50%	t=3.70, p<0.001
Graphics software (e.g., Adobe, CorelDraw)	2%	4%	t=1.25, p=0.213
Email software	51%	44%	t=1.10, p=0.274
Web browser software	51%	38%	t=2.12, p=0.035
Accounting software (e.g., Quickbooks, Peachtree)	9%	2%	t=3.29, p=0.001
Auditing software (e.g., ACL, IDEA)	6%	6%	t=0.02, p=0.985
Tax software (e.g., TurboTax, Intuit Tax)	7%	8%	t=0.39, p=0.694
Social media/networking (e.g., Facebook, LinkedIn, Twitter)	3%	2%	t=0.68, p=0.496
Programming languages (e.g., XBRL, HTML, VisualBasic)	2%	0%	t=1.97, p=0.050
Flowcharting software (e.g., Visio, SmartDraw)	6%	2%	t=2.18, p=0.031
Other	25%	24%	t=0.22, p=0.828
No software is used in course	7%	8%	t=0.39, p=0.694

* Seventy-eight percent of respondents teach an undergraduate course most frequently; 22 percent teach a graduate course most frequently.

Table 5
Percentage of Respondents Who Use
Each Type of Software (by Course)

	Financial Accounting (Principles) n=66	Managerial Accounting (Principles) n=32	Cost Accounting n=20	Intermediate Accounting n=46
Word processing software (e.g., Word)	53%	38%	60%	63%
Spreadsheet software (e.g., Excel)	55%	72%	75%	59%
Database software (e.g., Access, SQL)	2%	3%	10%	2%
Presentation software (e.g., PowerPoint)	24%	25%	50%	22%
Graphics software (e.g., CorelDraw)	3%	3%	0%	0%
Email software (e.g., Outlook, Exchange)	47%	41%	50%	52%
Web browser software	41%	34%	55%	52%
Accounting software (e.g., Quickbooks)	8%	3%	0%	9%
Auditing software (e.g., ACL, IDEA)	0%	0%	0%	0%
Tax software (e.g., TurboTax, Intuit Tax)	3%	0%	0%	0%
Social media / networking software	5%	0%	0%	0%
Programming languages (e.g., XBRL)	0%	0%	5%	0%
Flowcharting software (e.g., Visio)	0%	0%	5%	0%
Other software	35%	25%	15%	22%
No software is used in course	8%	9%	20%	7%

Table 5
Percentage of Respondents Who Use
Each Type of Software (by Course)
(continued)

	Advanced Accounting n=17	Taxation n=33	Accounting Information Systems n=21	Auditing n=27	Other * n=32
Word processing software (e.g., Word)	71%	67%	67%	89%	91%
Spreadsheet software (e.g., Excel)	59%	48%	90%	67%	59%
Database software (e.g., Access, SQL)	0%	3%	52%	0%	3%
Presentation software (e.g., PowerPoint)	24%	33%	38%	30%	69%
Graphics software (e.g., CorelDraw)	0%	0%	5%	7%	6%
Email software (e.g., Outlook, Exchange)	65%	52%	43%	41%	59%
Web browser software	35%	48%	62%	59%	59%
Accounting software (e.g., Quickbooks)	0%	0%	62%	0%	3%
Auditing software (e.g., ACL, IDEA)	0%	0%	14%	33%	16%
Tax software (e.g., TurboTax, Intuit Tax)	0%	58%	0%	0%	3%
Social media / networking software	0%	3%	5%	4%	3%
Programming languages (e.g., XBRL)	0%	0%	14%	4%	0%
Flowcharting software (e.g., Visio)	0%	0%	48%	7%	3%
Other software	12%	27%	29%	19%	25%
No software is used in course	6%	0%	5%	4%	3%

* "Other" includes the following courses: Accounting theory (n=6), Financial statement analysis (n=4), Fraud examination (n=3), Professional research (n=3), International accounting (n=2), Advanced managerial accounting (n=2); Contemporary accounting (n=1); Governmental/not-for-profit accounting (n=1); Accounting and decision making for MBAs (n=1); Ethics (n=1); Oil & gas accounting (n=1); Doctoral research seminar (n=2); Unspecified (n=5).

Appendix – Survey Instrument

**Accounting Education and Pedagogy:
A Survey of Accounting Educators**

We are offering a \$250 cash prize to an individual selected at random from the pool of participants who complete this survey in its entirety. This survey should take less than five minutes to complete. We urge you to participate!

This web-based survey is part of a study designed to better understand the current state of accounting education, the methods accounting faculty use to educate students, and how future accounting education can be improved.

Please base your responses on the accounting course you have taught most often in the past three years. If you do not feel a question applies to that course, please leave the question blank and skip to the next question.

Thank you for your time. To begin the survey, click the **Next Page** button below.

Information about the Survey

Your survey responses will be kept confidential to the extent of the law. It is possible because you are responding online that unauthorized individuals could gain access to your responses. Authorized research personnel, employees of the U.S. Department of Health and Human Services, and the Institutional Review Board at [REDACTED] may inspect the records from this research project.

The results of this study may be published. However, the data obtained from you will be combined with data from others in the publication. The published results will not include your name or any other information that would personally identify you.

Your decision to participate in this survey is completely voluntary. You are free to participate in this survey or withdraw at any time. You are free to refuse to answer any questions that make you feel uncomfortable.

This research study has been reviewed and approved by the Institutional Review Board – Human Subjects in Research [REDACTED] [REDACTED] wants to make sure that you are treated in a fair and respectful manner. Contact the university's Research Compliance Office [REDACTED] if you have questions about how you are treated as a study participant.

Questions and Contacts

If you have any questions about this research study, contact [REDACTED]

Consent to Take Part in This Survey

By continuing, you agree that:

- * You have read the preceding information describing this research project.
- * You understand that you are being asked to participate in a research study. You understand the risks and benefits, and you freely give your consent to participate in the research project outlined above, under the conditions indicated in it.
- * You have been given a copy of this information sheet. Since this is an Internet-based survey, you may copy and paste the preceding information and save it as your copy.

Please click the **Next Page** button below to indicate your consent and begin the survey.

Please indicate whether the course you have taught most often in the past three years is an **undergraduate** or a **graduate** course.

Undergraduate

Graduate

Please indicate the **subject of the course** you have taught most often during the past three years (please select only one).

- Financial Accounting Fundamentals (Principles)
- Managerial Accounting Fundamentals (Principles)
- Cost Accounting
- Intermediate Accounting
- Advanced Accounting
- Taxation
- Accounting Information Systems
- Auditing / Assurance Services
- International Accounting
- Fraud Examination / Forensic Accounting
- Doctoral Research Seminar
- Other (Please Specify)

We are interested in how you use Information Technology (IT) in your course. First, please indicate which types of software, if any, you require students to use (select all that apply)

- Word processing software (e.g., Word)
- Spreadsheet software (e.g., Excel)
- Database software (e.g., Access, SQL)
- Presentation software (e.g., PowerPoint)
- Graphics software (e.g., Adobe, CorelDraw)
- Email software (e.g., Outlook, Exchange)
- Web browser software (e.g., Internet Explorer, Safari)
- Accounting software (e.g., Quickbooks, Peachtree)
- Auditing software (e.g., ACL, IDEA)
- Tax software (e.g., TurboTax, Intuit Tax)
- Social media / networking (e.g., Facebook, Twitter, LinkedIn)
- Programming languages (e.g., XBRL, HTML, VisualBasic)
- Flowcharting software (e.g., Visio, SmartDraw)

Other (please specify):

Other (please specify):

We are also interested in how you use IT during class time (please select all that apply)

- I use a computer or tablet while lecturing to present course material (e.g. Powerpoint slides)
- I use a document camera (Doc Cam) while lecturing to present course material
- I require students to use computers during class to take notes
- I require students to use computers during class to work on assignments / problems
- I require students to use "clickers" (i.e., an audience response system) during class
- I use IT in other ways (please specify):
- None of the above; I do not use a computer, tablet, document camera or other IT in class.

Do you require the students in your course to access organization/company websites or databases? If yes, please specify.
(E.g., FASB, PCAOB, AICPA, SEC, IRS websites)

- No
- Yes

Do you use a "Learning Management System" such as Moodle or Blackboard in your course?

- No
- Yes, I use Moodle
- Yes, I use Blackboard (WebCT)
- Yes, I use another system (please specify):

In the previous question, you indicated you use a Learning Management System. Please describe how and why you use the system (e.g., which features of the system do you use?)

Do you use an online homework and grading system, such as *Connect* (McGraw-Hill), *CengageNow*, *WileyPlus*, etc?

- No
- Yes, please specify which system you use:

NOTE: Several questions in the survey have been omitted, as these questions related to active learning and are not relevant to the current paper.

Is there anything else you would like to tell us concerning your teaching methods that we have not covered?

You're almost finished! Please respond to the following demographic questions.

On average, how many students do you typically have in each section of the course you teach most frequently?

- 1 - 25
- 26 - 50
- 51 - 75
- 76 - 100
- 100 - 150
- 151 - 200
- > 200

How many years of college teaching experience do you have?

- Less than 6 years
- 6 to 10 years
- 11 to 15 years
- 16 to 20 years
- 21 to 25 years
- 26 to 30 years
- More than 30 years

Your current academic rank:

- Graduate student
- Lecturer/instructor - **part time** (non-tenure track)
- Lecturer/instructor - **full time** (non-tenure track)
- Clinical professor (non-tenure track)
- Assistant professor
- Associate professor
- Professor
- Other (please specify)

Gender:

- Male
- Female

Your current age:

- 20-30
- 31-40
- 41-50
- 51-60
- 61-70
- > 70

The institution where you teach:

- Two-year school
- Private school without a doctoral program in accounting
- State university without a doctoral program in accounting
- Private school with a doctoral program in accounting
- State university with a doctoral program in accounting
- Other (please specify)

What is the name of the institution where you teach? (optional)

Your highest academic degree:

- Bachelor's degree
- Master's degree
- Doctoral degree
- Other (please specify)

What is the name of the institution where you received your highest academic degree? (optional)

To be entered in the drawing for the \$250 cash award, please enter your email address below.