JOURNAL OF EMERGING TECHNOLOGIES IN ACCOUNTING
Vol. 14, No. 1
Spring 2017
pp. 63–75

American Accounting Association
DOI: 10.2308/jeta-51653

Innovative New Apps and Uses for the Accounting Classroom

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ABSTRACT: New instructional technologies provide educators with opportunities for student engagement and collaboration. As technology evolves, educators will spend more time identifying and testing new platforms. This instructional resource paper reviews several recent innovative technologies by providing brief descriptions, pricing, and current and potential uses. More specifically, this paper examines Doceri and DisplayNote in detail. My results from analyzing exam scores and course grades identified that the use of Doceri improves overall course performance in an introductory managerial accounting class. Poll Everywhere is an audience response system using mobile phones, Twitter, and the web in place of clickers. Student surveys suggest that the use of the Poll Everywhere app encourages questions and class discussions. Students perceived they participated more, and the class provided more illustrative examples with the utilization of the Poll Everywhere app. Top Hat is a cloud-based classroom and student response system used to increase student engagement during lectures using cell phones, tablets, or other devices. Finally, nClass and Asana are new tools to consider for classroom adoption and future research.

Keywords: innovative classroom technologies; new apps; new teaching tools.

INTRODUCTION

Educators do not need a crystal ball to predict that advances in technology will actively influence the future of the accounting classroom (Asino 2014). The Pathways Commission (2012, 72) report sponsored by the American Accounting Association (AAA) and American Institute of Certified Public Accountants (AICPA) recommend that instructors "transform learning experiences to reflect current and emerging technologies." The *Routledge Companion to Accounting Education* notes pedagogical considerations should include technology in accounting education (Apostolou, Dorminey, Hassell, and Rebele 2015). The Conversational Framework, an influential theory developed originally in 1993 and upgraded and expanded by Laurillard (2002), envisions the learning process between the student and teacher as an iterative dialog and describes how technology positively affects student learning in higher education courses (Premuroso, Tong, and Beed 2011).

According to Leidner and Jarvenpaa (1995, 287), "[T]echnology can be used to facilitate the display of information, to increase access to explicit external information, and to improve the sharing and construction of knowledge." At an increasing rate, new instructional technologies have entered the educational arena, providing opportunities to enhance the undergraduate experience through a wider array of learning media. It is important that the providers of accounting education stay current with new teaching methods that will assist in improving student competencies (McVay, Murphy, and Yoon 2008). Technology is a recognized part of the overall tools for supporting and enhancing teaching and learning (McVay et al. 2008).

Businesses have their technology tools. For example, the accounting profession uses accounting software or Accounting Information Systems such as Microsoft Dynamics GP (Great Plains), Oracle, Oracle Hyperion Financial Management, or Sage software. Businesses have Excel, Enterprise Resource Planning (ERP), Key Performance Indicators (KPI), and dashboards to aid in the decision-making process. Professors are no different; they need tools to engage through flexible teaching methodologies. New technologies offer ways to invigorate instruction, whether in traditional classrooms, online, or in blended learning environments (J. Holland and J. Holland 2014).

One of the primary objectives of accounting education is to prepare students for a successful professional life (McVay et al. 2008). Albrecht and Sack (2000) reveal the insufficiency of exposure by accounting students to the impact of technology on business and the ways in which to leverage technology toward business decisions. It is challenging for accounting students to

Editor's note: Accepted by Hui Du.

Submitted: June 2016
Accepted: November 2016
Published Online: December 2016

learn and engage with the technology used in the accounting field. Professors need to introduce students to the various technologies, such as Excel, that they will contend with in the corporate business environment. A recent study by Yu, Churyk, and Chang (2013) suggested that employers evaluated interns as weak in spreadsheet skills, and alumni perceived their weakness in technology competencies. Howieson et al. (2014) interviewed personnel (n = 3) and employers (n = 29) at Australian organizations about the importance of technical and nontechnical skills for accounting graduates. Fifty-eight percent of respondents thought that teaching technical skills was the responsibility of the academic institution. Hence, accounting professors are expected to feel comfortable with technology and expose their students to that technology.

Learners today are digital learners and the instructional methods should match their demands (Daher and Lazarevic 2014). Today's students are always online and use technology extensively. College students appear to enjoy technology, believe it to be beneficial, and expect to be able to use it effectively (Khanlarian and Singh 2014). Youth today spend several hours each day using digital technology (Jenkins, Clinton, Purushotma, Robison, and Weigel 2006), with incoming university students labeled as "Digital Natives" who are experienced and comfortable with technology such as computers, cell phones, and other digital tools (Newton, Tucker, Dawson, and Currie 2014). Accounting students have become technologically savvy, and faculty should be encouraged to continue to extend the traditional boundaries (Apostolou et al. 2015). Today's professors are busier than ever and are interested in using tools that save time, engage students, and enrich the classroom experience. The use of technology in instruction requires acquiring new skills and developing a sufficient level of understanding of computer software and the internet (Daher and Lazarevic 2014). As technology evolves, accounting educators will probably spend less time creating content and more time identifying packaged platforms to use in the classroom (Apostolou et al. 2015). Professors should maintain a dynamic student-centered classroom where technology is a powerful learning tool (Judson 2006). Premuroso et al. (2011) believe that the combined use of appropriate pedagogy and technology can improve the educational experience.

This paper reviews several different apps based on the author's experience in teaching undergraduate accounting classes. This study discusses several new and innovative technologies, providing a description of the device, pricing, application in the classroom, and suggestions for possible other uses of the tool.

This paper contributes to the literature by summarizing, classifying, and describing broader uses for technology apps in the accounting classroom. This paper reports the results of students' survey responses as to the enrichment of learning with the utilization of the apps. Empirical tests using student exam scores and course grades collected at a public university from two sections of an introductory managerial accounting course provide the results for determining the advantage of using the apps. This study also collects data from two sections of an auditing class (one with the use of Poll Everywhere and one without) investigating the variations among the groups.

The remainder of this paper contains the literature review, experimental design, results, and conclusions. The next section reviews the literature for the three categories of the apps: presentation, communication, and participation apps. This section also suggests uses of the apps in the classroom. Following is the experimental design. The following section details the results of the experiments using t-tests. The paper concludes with a summary of the findings, implications, and overall conclusions.

LITERATURE REVIEW

Presentation Apps

DisplayNote

Use of collaborative tools may increase knowledge acquisition quickly and efficiently while making global connections for broader perspectives (Holland and Holland 2014). One option for classroom use is DisplayNote (see, http://www.displaynote.com/). The software transforms presentations for presenters and participants. DisplayNote features wireless presenting, real-time collaboration, screen mirroring, and presentation capture (DisplayNote 2015). DisplayNote software allows faculty and students to use a mixture of iPads, Android tablets, PCs, and Macs in a collaborative mode (DisplayNote 2015). DisplayNote allows any participant in the audience to "Bring Your Own Device (BYOD)" and connect to the presentation. DisplayNote allows faculty to view apps from their tablet on the classroom computer and projector, allowing freedom to move around the classroom. DisplayNote gives faculty the ability to view and display students' screens to the projector, giving faculty control to annotate a PowerPoint presentation, and allows students to capture and annotate the faculty presentation on their device. The system is capable of posing questions and receiving responses from students. The presentation file saves on the audience member's device, and the participants can take notes only visible to them. Many students bring laptop computers or mobile devices to college classes (Maloy, Edwards, and Evans 2014). Why not have the students engage in the lecture and use their laptops? Students consistently write to one another using phones, tablets, and computers (Maloy et al. 2014). It makes sense for instructors to use these common devices for active and engaged learning.

The number of connections determines DisplayNote pricing, with 40 connections costing 360 £. Site licenses are available for enterprise solutions. DisplayNote allows for a 30-day trial period. There is no need for additional software and apps when

asking questions of the audience utilizing DisplayNote. The results of the polls tabulate for the presenter. I use the question results to gauge the understanding of the topic and adjust my lecture based on the students' comprehension. If students are not mastering a concept, then I might spend more time discussing the issue further. DisplayNote allows the presenter to ask questions without leaving the platform. In my experience, challenges arise with connectivity issues to DisplayNote. Participants were, on occasion, having difficulty connecting to the app and remaining connected.

Doceri

As a result of experiencing some connectivity challenges with DisplayNote, I reverted to using Doceri. Doceri (see, https://doceri.com/) allows your iPad or another tablet to become your wireless pointer and clicker. Doceri is a scalable suite of products that allows an educator to control a computer's desktop, control audiovisual technology, and annotate (Doceri 2014). With Doceri, professors can use a tablet as the control for the computer and not speak to the whiteboard. Additionally, the iPad app allows the recording of audio and screen capture of the PowerPoint lecture slides. The Windows version of Doceri does not presently allow audio recordings, whereas the iOS Mac app has this feature. Martin, Arendale, and Blanc (1997) demonstrate the learning value of supplemental instruction based on a combination of live-lecture videos. Doceri lets you capture those short videos during your live lecture. Screencasts or video lectures are intended to support the students' review of basic concepts, for either initial learning or assessment review (Brecht and Ogilby 2008).

Doceri has a whiteboard function allowing one to write with a finger or stylus to answer problems or highlight key content areas. Handwriting the solution steps for problems in Doceri adds annotations made on the screen with whiteboard backgrounds to your current project. By writing on the tablet, you create annotations in a file for subsequent availability to students. I use this feature as you would a whiteboard to show the systematic solution to the problem. Instructors can record all activities for upload to a learning management system (LMS) for later student use. Students absent from class or missing a part of the solution can access the videos at any time. The problem to solve can be in a PowerPoint or jpeg file and shows the step-by-step solution.

Video lectures are web-viewable files that present lecture materials and narrative instruction from a course's instructor (Brecht and Ogilby 2008). Video lectures provide instructor-delivered models of reasoning and problem solving (Brecht 2012). Video lectures make instructor-quality lectures accessible to students for viewing and studying as much as needed to meet their individual learning demands. Video lectures detail step-by-step explanations of the material used in classroom lectures, and presentation occurs at a more unhurried delivery pace than that in the classroom (Brecht and Ogilby 2008). Video lectures serve two strategic purposes. First, they give additional teaching time to students who cannot fully understand the course material through the classroom lectures alone (Brecht and Ogilby 2008). Second, video lectures allow class coverage of more complex and challenging subject material that is more appealing to many students (Brecht and Ogilby 2008). Doceri allows you to screen and audio capture your live lecture by solely recording through the app. You can annotate, audio explain, and screen capture more complex and detailed lessons to support student comprehension. Doceri is relatively inexpensive for a single desktop license, costs $30, and the iPad app is free. The Windows-based app is available for $5.99 (Doceri 2014).

Doceri is an excellent app allowing the professor freedom to move around the class and even hand the tablet to a student for selection of a correct answer. The app works best with a fine-point stylus to allow handwriting to emulate that of pen and paper. Doceri has different pen types that you can select. I find a fine-point stylus is easiest when solving accounting problems since the numbers are easier to transcribe on the tablet and not as thick.

I use Doceri in the classroom regularly. I annotate on the PowerPoint lecture slides and record my live lecture to upload to the LMS. Learning management systems are software systems designed to manage course content and course activities. These tools (e.g., WebCT, Blackboard, Canvas, D2L, Sakai) integrate technology and pedagogical features into a web-based system that allows instructors, even those who are unfamiliar with web-based technologies, to design, deliver, and manage an online, hybrid, blended, or class-based course (Ioannou and Hannafin 2008). The students can review the annotation of the PowerPoint slides allowing for more listening in class and less note taking, as the annotations will be accessible after the lecture. Frey and Birnbaum (2002) find most students agreed that computer-assisted instruction in class had a positive effect on lectures, especially in helping them take notes and study for exams (Debevec, Mei-Yau, and Kashyap 2006). Students reveal they frequently take notes while viewing lecture capture videos (Luna and Cullen 2011), and the majority of students feel that their notes are subsequently more valuable (Brotherton and Abowd 2004). Doceri is an easy to use app to produce and provide supplemental resources to classes. Peter and Carolyn Wilson use lecture capture to record video and audio during classroom lectures and place it in the LMS. Peter Wilson states, "Lecture capture specifically allows students to learn at their speed, to stop the tape and go back when something gets more complicated" (Holtzblatt and Tschakert 2011). A University of Wisconsin online learning study shows that the vast majority of students prefer lecture capture (Veeramani and Bradley 2008). Lecture capture, defined here as the capturing of some or all elements of a live lecture in digital format, is becoming increasingly

popular in higher education (Newton et al. 2014). Students report a positive attitude toward classes using lecture capture, improving their attitude and mood toward other classes (Francom, Ryan, and Kariuki 2011). Doceri is the conduit, providing a smooth and seamless lecture capture during live classes.

Anecdotal comments from student evaluations reveal that students find the solved problems to be the most helpful. The solved problem detailing and explaining the solution is an excellent learning resource for students. Several students may not understand the solution when exposed to it for the first time in class, but after subsequent review, they seem to grasp the accounting concept better. This element is especially useful in Intermediate Accounting I and II classes, where the computational problems are more complex. For example, with investment or lease accounting, the students view and repeat the video of the solved problems from the class lecture. This feature offers transferability to online learning or hybrid courses. For example, the professor uploads to the LMS the solution from a lecture class topic. The next class meeting the professor can gauge mastery with another problem on the same topic.

For online courses, Doceri serves as an inexpensive screen capture and audio recording of lectures. Additionally, Doceri used alone can be a helpful solution for video and audio capture of solving accounting problems. Screencast technology allows learning outside of class, affording the professor more time to facilitate project-based learning during class (Holland and Holland 2014).

Mini-explanations are feasible with Doceri. Whatley and Ahmad (2007) address the development of relatively short videos that summarize key material previously presented in the classroom. Their intent is to support student review of basic concepts, for either initial learning or assessment review (Brecht and Ogilby 2008). For example, one class could start with a brief introduction to the main concepts, before the lecture class meeting. During the lecture class meetings, I solve problems. At the next class meeting, a comprehensive problem review takes place. As professors teach multiple sections of the same course, I find that students often tend to have similar questions. To save time and direct students to supplemental resources, the instructor can record audio and screen capture a mini-lesson explaining the issues and upload it to the LMS. Bergman and Sams (2012) recommend shorter videos to increase student engagement. Doceri allows for sharing of files via YouTube or Dropbox and saves any annotations and recordings as projects. It is relatively easy to upload a project to YouTube channels established for the course, or to upload to Dropbox for retrieval and subsequent placement in the LMS.

Educational videos provide several benefits including (1) reinforcing reading and lecture materials, (2) enhancing student comprehension and discussion, (3) providing greater accommodation for diverse learning styles, (4) increasing student motivation and enthusiasm, and (5) promoting teacher effectiveness (Holtzblatt and Tschakert 2011). Learners can watch systematic explanations of concepts with visual examples to gain increased understanding of complex concepts. The digital presentations allow each student to learn at their own pace with the ability to pause and replay as needed. Students can view the presentation on their personal schedule when they are the most receptive to learning (Holland and Holland 2014).

Based on the preceding discussion, this study proposes the following hypotheses:

H1: Students learning in a classroom with the use of Doceri video lecture captures perceive that the app benefits their learning.

H2: Students in the classroom with the use of Doceri have higher exam scores than the students in the class without the app use.

H3: Students in the classroom with the use of Doceri earn a higher course grade than the students in the class without the app use.

Communication Apps

Top Hat

Top Hat (see, https://tophat.com/) is a cloud-based classroom and student response system used to increase student engagement during lectures using cell phones, rather than clickers (Indjejikian, Matějka, Merchant, and Van der Stede 2014). Top Hat is a robust tool that takes attendance, polls the class, and provides an overall class management tool. Top Hat provides a command center to run and manage all aspects of the course from one platform (Indjejikian et al. 2014).

Students appear to favor electronic response systems over traditional lecture formats. Judson and Sawada (2002) note that students find clickers to be helpful in comprehension. In a study of clicker use within biology classes, Brewer (2004) concludes that the use of clickers allowed instructors to receive feedback that helped set the appropriate pace of the course. Clickers can also enhance reflection and understanding when used in a small group discussion (Brewer 2004; Brickman 2006). Draper and Brown (2004) similarly argue that clickers allow increased interactivity during lectures and that even students in the smallest classes appreciated the increased anonymity afforded by the use of clickers. Morling, McAuliffe, Cohen, and DiLorenzo (2008)

assessed the efficacy of clickers in four sizeable sections of introductory psychology. Students are more likely to respond to instructor questions and participate in classroom discussion when clickers are used (Greer and Heaney 2004; Hoffman and Goodwin 2006). Top Hat has the functionality of clickers without the need for a separate device. Students respond without the use of the clicker, but use the web to record the response anonymously. Top Hat provides reports and real-time information enabling the professor to gauge the mastery of the concepts presented.

Top Hat is free for college and university professors, allowing educators to manage unlimited courses with one account. Top Hat has LMS integration with several platforms (D2L, Blackboard, Canvas, and Moodle) (Indjejikian et al. 2014). Sakai integration is forthcoming. Top Hat is similar to Doceri and DisplayNote in that it grants the professor, when using an iPad, to move away from the podium. Students subscribe to Top Hat for course access. Student subscriptions are as little as $24 for a semester of access (four months) (Indjejikian et al. 2014). Based on survey comments, my students were unhappy with having to pay additional money to access the course. The students noted that since they paid for the course, they should not have had to pay to access another platform. Greer and Heaney (2004) mention similar negative comments about the clicker cost. To help with implementation, detail the use of Top Hat in the syllabus and provide the bookstore with the explanation about the requirement of Top Hat for the course. These actions help to mitigate resistance from the students on the first day of class.

I find the best feature of Top Hat is that the professor can present material, launch questions, and get real-time student feedback without leaving the lecture slides (Indjejikian et al. 2014). These options are available from the lecture slides feature on the dashboard. By asking questions spontaneously during the lecture, an educator can gauge students' understanding. Students are more likely to participate in the class discussion because of response anonymity. The attendance feature is brilliant. Students who are in the class must text a code to Top Hat recording their presence. Top Hat eliminates the need to call roll or distribute a roster sheet to take attendance.

Students register for the course via Top Hat, and all content is in one platform. Top Hat keeps attendance, polls, and grades in one place. With Top Hat, an LMS is not necessary, allowing the professor to work outside of the constraints of an LMS.

Poll Everywhere

Poll Everywhere (see, https://www.polleverywhere.com/) is an audience response system that uses mobile phones, Twitter, and the web. Responses display in real time via charts in PowerPoint or Keynote. The free Poll Everywhere mobile app is perfect for responding to polls, presenting surveys, and clicking through PowerPoint presentations. Two reasons to use surveys are (1) to promote learner engagement in class and, (2) the benefits related to anonymity (Freeman, Blayney, and Ginns 2006). The free version of the website is limited to a maximum of 25 participants. Poll Everywhere requires a pricing plan for more participants and access to reports on the results of the polls. You can create polls or surveys by selecting your question type and typing in your questions. Several different types of questions are available (e.g., multiple choice, open-ended questions and answers series, clickable image) when creating a poll. Multiple-choice questions allow for several answer choices, i.e., not limiting responses to two or four answer choices.

I use the "Questions and Answers" series throughout class. This function allows questions from the audience. I find this useful when students do not want to participate in class or ask questions. Anonymity is a critical factor affecting student willingness to participate in class exercises. Freeman et al.'s (2006) study results indicate that students' propensity to engage with in-class questions increases with the degree of anonymity provided to the students in revealing their response. Anonymity is particularly useful with younger students and students taking their first accounting course. The students are more apt to submit their question via text or the web allowing the professor to answer questions immediately with no hand raising, and to answer supplemental questions. Since teaching accounting usually involves journal entries, I use the clickable image question type to display answer choices with journal entries. This format displays cleanly, and the students may click anywhere on the journal entry image to select it as their answer choice. When evaluating the class's understanding of complex accounting topics, for example, data options in Accounting Information Systems, I choose to poll the class via open-ended questions. The answers from the class display in several formats such as text, word cloud, cluster, or ticker. The ticker format is useful as it relates to accounting, particularly if the discussion centers on current market events, as it resembles the Bloomberg stock ticker, familiarizing students with seeing the results in this format.

This discussion leads to the following hypotheses:

H4: Students learning in a classroom with the use of Poll Everywhere perceive that the app benefits their learning.

H5: Students in the classroom with the use of Poll Everywhere perform higher on exams than the students in the class without the app use.

H6: Students in the classroom with the use of Poll Everywhere earn a higher course grade than the students in the class without the app use.

TABLE 1

Summary of Tools

Application Software	Website	Price	Description
Doceri	https://doceri.com/	$30	Scalable suite of products that allows a teacher or presenter to control the audiovisual technology of the computer's desktop by using a tablet.
DisplayNote	https://displaynote.com/	360 £	Wireless presenting, real-time collaboration, screen mirroring, presentation capture.
Poll Everywhere	https://www.polleverywhere.com/	Free if under 25 participants	Real-time audience response system that uses mobile phones, Twitter, and the web.
Top Hat	https://tophat.com/	Free for professors	Classroom and student response system used to increase student engagement during your lectures using their cell phones.
nClass	https://www.getnclass.com/	Free	Platform to improve attendance, increase class participation, and improve student engagement.
Asana	https://asana.com/	Free	Web and mobile application designed to enable teamwork without email.

Participation Apps

nClass

Use nClass (see, https://www.getnclass.com) to increase student participation, quiz students via the web or mobile app, and improve attendance and student engagement without the use of classroom clickers (nClass 2012–2014). nClass is a desktop application that facilitates and enhances classroom learning. nClass is currently available for iOS, Android, and the web. As with Top Hat, nClass allows the professor to take attendance via passcode entry. nClass has an added feature for attendance allowing GPS to serve as an option for recording attendance.

I am considering using nClass as an alternative to Top Hat because it is entirely free. It has the same functionality as Top Hat, with content, quizzes, and attendance. Additionally, nClass is cloud based. I will pilot nClass and assess if it is a suitable replacement for Top Hat.

Asana

Asana (see, https://asana.com/) is the web and mobile application designed to enable teamwork without email. Asana is free for teams of up to 15 members. Asana provides one place to access conversations and tasks that are actionable and transparent. Asana is a virtual collaboration tool, which allows you to log in via Google+. You can add attachments to projects via Dropbox, Box, or Google Drive. The best features are the due dates and calendar functionality. The calendar allows you to view the team goals and milestones, based on the prescribed due dates. All conversations and tasks are viewable on one platform, Asana.

Collaboration forms the foundation of a learning community, bringing students together to support the learning of each member of the group while promoting creativity and critical thinking (Holland and Holland 2014). Cooperative learning involves groups of students working together to solve problems (Slavin 1991). Laird and Kuh (2005) studied the use of technology in a university setting, reporting a good fit between information technology and its use in collaborative learning. Asana is a great tool to use for committee meeting collaborations or to implement in the classroom for group projects. Future studies may have auditing classes complete a group audit project requiring the use of Asana as a collaborative team tool. Khanlarian and Singh (2014) report increased engagement in the use of technology, which could lead to more time spent on tasks.

Table 1 summarizes the applications described in this paper. The table explains each app and details how it is applied in accounting courses. Additionally, the paper provides potential future uses for the apps. The paper only tests the efficacy of the presentation app Doceri and the communication app of Poll Everywhere. The participation app testing remains for a future study.

EXPERIMENT DESIGN

The study uses a quasi-experimental research design with students registered in an introductory managerial accounting course over two semesters. Additionally, an auditing class similarly tests the hypotheses for Poll Everywhere. To obtain a high degree of internal validity and to achieve close comparison between the courses, the same instructor taught both classes. All classes met for 50 minutes, three times per week. All classes use the same syllabus, course content, homework, and tests. This study compares student performance using each exam grades and total course points as different measures of learning, consisting of Exam 1, Exam 2, Exam 3, Final Exam, and total course points.

Sample

Students from an AACSB accredited university that is part of a 14-state university system in the U.S. provide the sample. The university system's mission is to teach most of the state-university students, which translates to relatively low admission requirements compared to higher-tier universities. Students vary widely in education interests, academic ability, and aptitude for the course subject. The university resides in a small rural area where students are traditional and live mainly on campus. Many students have part-time jobs and are active in student life and organizations. Courses provide value for students when instruction and study resources are available online; whether in an online course or a classroom course with online resources. Students can attend class as required or individually needed: attendance is not mandatory.

Participants originate from a traditional classroom section of an undergraduate course of introductory managerial accounting and an auditing course. The same instructor taught each class and administered the course in the same way, except for the use of the app. Using this approach allowed for the "control" of differences due to the instructor, evaluation criteria, and other potential confounds. The app use and non-use app sections involved two separate sections over two semesters.

This study tested Doceri's utilization in a first-level principles of managerial accounting class in a public university's business school. The course is a requirement for all students majoring in business or pursuing a business minor. Approximately 80–85 percent of the students major in a field other than accounting. The control group consisted of the class without the app. The experimental group utilized the app. Eighty-six students enrolled in two sections of a managerial accounting principles course at a public university in the U.S. participated in the study. One class section (experimental group; $n = 43$) used the app, another class section (control group; $n = 43$) did not use the app. The instructor, course materials, quizzes, and exams were the same for the experimental and control groups.

Additionally, this study tests the use of Poll Everywhere in an auditing class. The auditing course is a required course for accounting majors. Forty students enrolled in two sections of auditing. The experimental group consists of ten students and the control group not using the app had 30 enrolled students.

A 1,000-point total grade consisting of 165 points of homework assignments, 185 points in quizzes, and 650 points for examinations determine the total course grade for the managerial accounting class. Each exam tests the learning objectives of the course, with the final exam encompassing a cumulative review of all learning objectives. Each exam is specific to the learning objectives most recently covered, with the final exam as a heavier weight testing all course learning objectives. For the auditing class, a similar 1,000-point scale applies, with 75 points for homework, 250 points for cases, and 675 for exams. The final exam for the auditing course is not comprehensive.

In the managerial accounting class, exams are objective consisting of multiple-choice and problem-based questions comparable to those assigned in the homework. A correct answer is determinable for each question. Both sections receive the same exam questions scrambled and algorithmically changing the numbers of the problem but asking for the same objective. The exams are graded automatically via computer, eliminating the professor's ability to give the treatment group higher exam grades. Whereas in the auditing class, exams consist of fewer multiple-choice questions and more short answer questions.

Methodology

This study uses the independent samples t-test to measure the differences between samples regarding the exam grades and grade distributions. An independent samples t-test compares the variables (exams and course grade) between the two modes: using the app and not using the app. The one-tailed test appropriately measures whether one sample's grade distribution has more students with higher grades on exams and higher course grades than another sample's distribution.

Survey questions were used to test H1 and H4. The survey asked students whether the technology use was appropriate, the class time was effective, and the class allowed for a positive learning environment. The survey also questioned if the class provided increased knowledge and understanding and if the students were actively involved in the learning environment.

In the managerial accounting class, the treatment group utilized Doceri for lectures. In the auditing class, the professor presented lectures interspersed with short multiple-choice questions administered via Poll Everywhere.

TABLE 2

Comparative Perceptions of Doceri App Use in Introductory Managerial Accounting

	Mean and Standard Deviation			
Item	**Mean App (n = 13)**	**Std. Dev.**	**Mean No-App (n = 24)**	**Std. Dev.**
The use of technology was appropriate.	4.85	0.376	4.63	0.495
The use of class time was effective.	4.69	0.855	4.33	0.637
The learning environment created was positive.	4.77	0.599	4.42	0.881
The class encourages questions and discussion.	4.77	0.439	4.58	0.584
Examples and illustrations provided.	4.54	0.877	4.50	0.511
The class increased my knowledge and understanding.	4.69	0.630	4.29	0.751
The course actively involved me in the learning.	4.54	0.776	4.25	1.032
I actively participated in the course.	4.23	0.832	4.13	0.741

1 = Strongly disagree, 5 = Strongly agree.

This study tests the use of the app as a supplemental learning aid associated with student examination performance in an auditing course for two semesters at a single university in the U.S. with 40 students. One section of the course used the app and the other did not. Between the app and non-use app groups, the instructor, textbook, and exams remain constant.

RESULTS

H1 predicts that Doceri benefits student learning. I tested the use of the app as a supplemental learning aid in the principles of managerial accounting course with 13 students receiving instruction with the use of Doceri and 24 students not receiving instruction with Doceri. Table 2 shows the mean responses for several questions intended to provide different measures of the comparative effectiveness of the two alternative delivery methods: app use, and non-use app. Students responded to each of these items on a five-point Likert scale from 1 (Strongly disagree) to 5 (Strongly agree). The results support H1, suggesting that the use of Doceri benefited student learning, with the mean of the app group at 4.69, while the mean of the non-use app group is 4.29. Additionally, the results suggest that the app use was considered by students to be appropriate (mean app = 4.85; mean non-use app = 4.63). However, students in the treatment group also indicated having a more active learning class (mean app = 4.54 versus mean non-use app = 4.25) and positive learning environment (mean app = 4.77 versus mean non-use app = 4.42).

H2 forecasts the use of Doceri as having a positive effect on the app use group with higher exam scores. Analysis based on independent sample t-test results supports H2. The results illustrate that students using the app significantly outperformed students not using the app in all exams except the first one. The Exam 1 outcome could be explained by students becoming familiar with the app.

H3 purports that the use of Doceri will result in higher overall course grades. The results in Table 3 support H3, with an association between the use of the app and overall course performance, measured by total points earned in the course based on a 1,000-point scale. Students earned an average of 834.31 total course points in the Doceri group as opposed to students with the non-use app earning 758.03 total course points. The results suggest a significant association between the engagement of the app and higher exam scores for the last three exams and total course results with the use of Doceri.

Nine students who received instruction with the utilization of the app responded to the survey, and 17 responses were received from the control group. The results of Table 4 support H4, students benefited from the use of Poll Everywhere. The results suggest that the utilization of the app provided appropriate usage of technology (mean app = 5.00 versus mean non-use app = 4.41) and created a positive learning environment (mean app = 5.00 versus mean non-use app = 4.53). The use of the Poll Everywhere app in auditing encouraged questions and discussion (mean app = 5.00 versus mean non-use app = 4.65). Students agreed that the class provided examples and illustrations (mean app = 5.00 versus mean non-use app = 4.29).

The results for H5 (in Table 5) reveal that students using the Poll Everywhere app did not perform significantly better on exams than those students in the classroom without the app use. The findings do not support H5. Students only performed higher on Exam 2. Note the final exam in this class is not cumulative, thereby students did not prepare as well for the final. As in the managerial accounting group, the students did not perform better on Exam 1. Students' test scores were greater for students who used the tool for Exam 1, 98 versus 96.83, although not statistically significant. There are statistically significant differences at the 0.05 level of significance between the app and non-use app students for Exam 2 only.

TABLE 3

Results of t-tests and Descriptive Statistics Exam 1, Exam 2, Exam 3, Final Exam, and Overall Course Grade by Doceri Use

	Group								
	Non-Use App			App					
Outcome	M	SD	n	M	SD	n	F-value	Significance Level	df
Exam 1	79.25	23.10	43	78.05	16.82	43	1.040	0.311	84
Exam 2	71.87	18.85	43	79.14	12.07	43	7.176	0.009*	84
Exam 3	76.85	22.87	43	92.15	7.86	43	33.602	0.000*	84
Final Exam	64.70	21.66	43	70.33	13.60	43	5.127	0.026*	84
Course Grade	758.03	174.78	43	834.31	74.62	43	5.960	0.017*	84

* Indicates $p < 0.05$.
t(df) is t(degrees of freedom).
$t(df) = 84$; $p = 0.782$.
$t(df) = 84$; $p = 0.036$.
$t(df) = 84$; $p = 0.000$.
$t(df) = 84$; $p = 0.152$.
$t(df) = 84$; $p = 0.010$.

The results of the independent sample t-test for H6 regarding the use of the app and the course grade do not support H6. Students in the class using Poll Everywhere did not perform better in overall course points. This result indicates no association between the app use and higher student exam performance and overall course grade.

Table 6 summarizes each application by category affirming its potential use in accounting classrooms. Additionally, the table proposes suggestions for future research.

Table 7 summarizes the results of this study. Doceri use provides higher exam scores for most exams and the overall course total points. Poll Everywhere's usage in the auditing class did not demonstrate higher exam or course grades. Both treatment groups perceived the app did benefit their learning.

CONCLUSIONS

This paper presented several new technologies for use in the classroom. Doceri and DisplayNote provide wireless access to a computer. Clickers are representative of outdated technology. Poll Everywhere is an audience response system using mobile phones, Twitter, and the web to replace clickers. Top Hat is a cloud-based classroom and student response system used to

TABLE 4

Comparative Perceptions of Poll Everywhere App Use in Auditing

	Mean and Standard Deviation			
Item	Mean App (n = 9)	Std. Dev.	Mean Non-Use App (n = 17)	Std. Dev.
The Use of technology was appropriate.	5.00	0.000	4.41	0.618
The Use of class time was Effective.	4.89	0.333	4.35	0.702
The Learning Environment created was positive.	5.00	0.000	4.53	0.800
The class encourages Questions and Discussion.	5.00	0.000	4.65	0.493
Examples and Illustrations provided.	5.00	0.000	4.29	0.686
The class increased my Knowledge and Understanding.	5.00	0.000	4.26	0.903
The course actively Involved me in the learning.	4.89	0.333	4.47	0.717
I actively participated in the course.	5.00	0.000	4.12	0.781

1 = Strongly disagree, 5 = Strongly agree.

TABLE 5

Results of t-tests and Descriptive Statistics Exam 1, Exam 2, Final Exam, and Overall Course Grade with Poll Everywhere App Use

	Group								
	Non-Use App			App					
Outcome	M	SD	n	M	SD	n	F-value	Significance Level	df
Exam 1	96.83	4.45	30	98.00	3.29	10	1.633	0.209	38
Exam 2	64.47	16.77	30	97.40	2.99	10	5.682	0.022*	38
Final Exam	91.73	17.98	30	86.50	15.26	10	0.353	0.556	38
Course Grade	859.74	106.64	30	874.97	93.8	10	0.018	0.895	38

* Indicates $p < 0.05$.
t(df) is t(degrees of freedom).
$t(df) = 38$; $p = 0.451$.
$t(df) = 38$; $p = 0.000$.
$t(df) = 38$; $p = 0.451$.
$t(df) = 38$; $p = 0.690$.

increase student engagement during lectures using smartphones. Finally, nClass and Asana are new tools to consider for classroom adoption.

This study tested the effectiveness of the Doceri application in an introductory managerial accounting course and the effectiveness of the Poll Everywhere application in an auditing course, both over two semesters. The quasi-experimental design compared exam results and total course points. Additionally, survey responses provided evidence of the benefits of student learning. Results indicate that the use of Doceri benefited student learning. Students performed better on most examinations and overall in the course with the use of Doceri. Poll Everywhere was perceived by students as benefiting learning, but did not result in higher exam or course grades.

Possible future research may involve experiments after using nClass and Asana. It would be interesting to see which single platform, Top Hat or Asana, students prefer or if an impact exists with team project scores using one tool over the other. Testing the app use would be interesting in an integrated audit group project for a sample company. Possible future research could determine a preference of students for one app over the other: for example, Top Hat or nClass. Additionally, Asana implementation may result in studies showing whether students discovered the tool to be useful for team projects or more of a hindrance. Future studies could test whether the calendar and due date functions are useful or merely another calendar that requires checking. Asana studies could focus on the use of the goals and milestones module.

Giaimo-Ballard and Hyatt (2012) mention that through routine reflection, instructors improved their teaching practice (LaPrade, Gilpatrick, and Perkins 2014). I encourage these thoughts and possible adoption of any new classroom technology tools discussed. The first time a faculty member uses a new form of technology or introduces any new component into a course, there may be awkwardness leading to increased problems and less chance of success (Morgan 2008). Please allow time to gain familiarization with the new tools. Do not let a little awkwardness stand in the way of a dynamic and engaged class. Accounting

TABLE 6

Summary of Classroom Application and Future Research

Category	Application Software	Application to the Accounting Classroom	Future Study
Presentation	Doceri	Tablet as Remote Control Annotations	
Presentation	DisplayNote	Wireless Presenting Screen Collaboration	Can you circumvent the connectivity issues and use in the classroom?
Communication	Poll Everywhere	Real-Time Polling Responses	
Communication	Top Hat	In Lieu of or in Addition to an LMS	Can you use Top Hat in place of your current LMS?
Participation	nClass	In Lieu of or in Addition to an LMS	Can nClass replace your current LMS?
Participation	Asana	Project and Meeting Organizer	Use in student group projects.

TABLE 7

Summary of Hypothesis Results

Hypothesis	Results
H1: Students learning in a classroom with the use of Doceri video lecture captures perceive the app benefits their learning.	Supported
H2: Students in the classroom with the use of Doceri have higher exam scores than the students in the class without the app use.	Supported
H3: Students in the classroom with the use of Doceri earn a higher course grade than the students in the class without the app use.	Supported
H4: Students learning in a classroom with the use of Poll Everywhere perceive the app benefits their learning.	Supported
H5: Students in the classroom with the use of Poll Everywhere perform higher on exams than the students in the class without the app use.	Not Supported
H6: Students in the classroom with the use of Poll Everywhere earn a higher course grade than the students in the class without the app use.	Not Supported

educators should continually scan the horizon and incorporate solutions that are most likely to maximize the ultimate educational objective (Schoch, Teoh, and Kropman 2006).

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