Improving Retention for Principles of Accounting Students: Ultra-Short Online Tutorials for Motivating Effort and Improving Performance

Carol Springer Sargent, A. Faye Borthick, and Amy R. Lederberg

ABSTRACT: As student learning outcomes and retention receive more attention in higher education, failure rates in principles of accounting courses, gate-keeper courses for business majors, are coming under scrutiny. This study shows promising results from use of a learning innovation, ultra-short online videos, for addressing three common reasons for poor performance: intimidating class environments, low aptitude, and low motivation. For students at all achievement levels, tutorial use rates were above 60 percent, even though there was no course credit for viewing them. Students using the tutorials had significantly lower course drop rates and better pass rates. Tutorial use was correlated with higher exam scores, although the effect was moderate. Based on analysis of the two-year periods before and after implementation, the use of tutorials was correlated with higher course grades. Tutorial use remained at high levels two years after implementation even without instructors encouraging students to use them.

Keywords: aptitude; online tutorial; intimidation; motivation; principles of accounting; retention; self-efficacy; supplemental instruction.

INTRODUCTION

As student learning outcomes, retention, and progress toward completion of undergraduate degrees receive more attention in higher education, failure rates in principles of accounting courses, gatekeeper courses for business majors, are coming under scrutiny. Typical explanations for poor performance in the principles courses include the demands of family, work, and extracurricular activities; intimidating classroom environments; low aptitude; and low motivation (Wooten 1996). This study analyzes the impact of a learning innovation, ultra-short online videos, designed to target the latter three factors and thus improve student effort, learning, and retention. In addition, unlike typical instructional innovations, these materials, once created, require little continuing faculty effort.

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HYPOTHESIS DEVELOPMENT

Lack of Confidence with Intimidating Subject Matter

Many college students have math anxiety (Hembree 1990), and they bring this crisis of confidence in completing math-related tasks to their introductory accounting course (Stone 1994; Stone et al. 1996; Gracia and Jenkins 2002). The accounting literature estimates that about 25 percent of introductory accounting students feel unsure or not confident in their ability to succeed (Byrne and Flood 2005). For college students, beliefs about math ability account for more variance in math scores, more than any other motivational or background variable, because low beliefs about ability suppress adaptive academic activity (Siegel et al. 1985; Gist et al. 1989; Pajares and Miller 1994). Students intimidated about their ability to work math tasks give up quicker, avoid tasks, and hesitate to ask for help (Zimmerman and Martinez-Pons 1990; Middleton and Midgley 2002; Kim et al. 2006).

Increasing subject matter mastery dominates other interventions in reducing math anxiety (Benson 1989; Hembree 1990; Meece et al. 1990). Principles instructors, however, must cover a prescribed set of topics for entire classes, sometimes in large lecture formats. They necessarily move on to the next topic, even if some students have not yet mastered the current topic. As a course routine, building in a process for remediation, re-teaching topics, and tailoring instruction to individual students should reduce avoidant behaviors that math anxiety prompts (Yates 2005).

Fortunately, digital media provide convenient platforms to provide remediation, individualization, and re-teaching. Modern textbooks often include a range of supplemental learning aids. So far these resources have not reduced the failure rates of students in introductory accounting classes (Kealey et al. 2005).

Low Aptitude

Accounting is complex, potentially taxing short-term memory for novices or low-ability students that have not yet linked ideas together systematically, or that do not know a large body of facts (Smith et al. 1993; Sweller and Chandler 1994). The cognitive literature suggests helping these students learn incrementally with learning experiences that break down complex ideas into smaller parts (Smith et al. 1993; Sweller and Chandler 1994; Mayer et al. 2002; Ayres 2006), which has worked in teaching the accounting equation (Edmonds and Alford 1989), earnings per share, and asset disposition (Byrd and Byrd 1987).

Students with limited knowledge are particularly vulnerable to flawed ideas and partial understandings (Smith et al. 1993). Accounting has a conceptual aspect and a procedural aspect. Weak learners can understand the process, but not the concept, or understand the concept, but not the process. Lapses in either lead to systematic errors that can be detected, diagnosed, and corrected (Siegler 2003). Several studies have shown that targeting misconceptions works better than providing more instruction (Körner 2005; Muller et al. 2007; Huang et al. 2008).

Prior success with incremental approaches suggests that course designers might assist weaker students by using a “knowledge in pieces” approach, enabling students to succeed with smaller bits and build up the knowledge base needed for more complex tasks. Weak students could benefit from supplemental instruction that enables mastery learning of small pieces, and offers guidance on misconceptions to help them build up to the same level of knowledge as their classmates.

Inadequate Motivation

Empirical work confirms what most accounting instructors already know from experience—motivation carries more predictive value than ability for students in introductory business classes (Kruck and Lending 2003), and principles of accounting students can overcome low aptitude by...
increasing their effort (Wooten 1996). Motivating effort may be one of the key issues in introductory accounting courses, especially since most students are non-majors, whose level of interest may be low. It is an even greater problem for weak or less confident students, who may need extra support, but do not want the stigma attached to remedial work and are therefore hesitant to ask for help (Karabenick and Knapp 1988, 1991; Moore and LeDee 2006; Fayowski and MacMillan 2008). Techniques for motivating introductory accounting students include offering novel ways to learn and giving immediate feedback (Greer 2001; De Lange et al. 2003; Marriott and Lau 2008), although one study claimed that without significant course credit, students will not complete extra work voluntarily (Elikai and Baker 1988). To be successful, extra instruction should require little additional effort from students, be distinctly different from traditional course activities (Bueschel 2008), and be open to all achievement levels to avoid any stigma associated with use.

To attenuate poor motivation, learning activities can be made readily accessible through digital media that respond to students’ expectations for anytime, anywhere learning activities with immediate impact. This approach is consistent with Gee’s (2003, 61–62) principles for maximizing learning in interactive video settings:

1. The learner must be enticed to try, even if he/she already has good grounds to be afraid to try.
2. The learner must be enticed to put in lots of effort even if he/she begins with little motivation to do so.
3. The learner must achieve some meaningful success when he/she has expended this effort.

Supplemental Instruction

Extra instruction, in all its various forms, has improved mastery to some degree for all students, although effect sizes vary depending on the match of the resource to the learner’s needs (Congo and Schoeps 1993; Simpson et al. 1997). Unfortunately for introductory accounting students, the effect sizes from supplemental instruction have been low (Etter et al. 2000; Jones and Fields 2001; Potter and Johnston 2006) or not significant (McInnes et al. 1995). On the brighter side, studies in the accounting literature found increased learning with virtual learning tools (Daroca and Nourayi 1994; Parker and Cunningham 1998; Jones and Fields 2001; Lane and Porch 2002; Potter and Johnston 2006). Most accounting students openly embraced virtual learning (Martin et al. 1995; Wells et al. 2008); and the more accounting students used online supplements, the better their learning outcomes were (Jones and Fields 2001; Dowling et al. 2003; Turner et al. 2006).

In an analysis of 132 introductory accounting classes from 21 four-year colleges, the average participation rate for supplemental instruction was 27 percent (Etter et al. 2000). At one university where supplemental instruction was added to the first accounting course, 18 percent of the students tried it, but only 28 out of 1,359 students attended more than half of the sessions, making it hard to justify the implementation effort (Jones and Fields 2001). For supplemental instruction to work to support intimidated, low-aptitude, or poorly motivated students, higher participation rates will be needed.

Hypotheses for Prompting Effort to Improve Retention

Supplemental instruction that improves mastery may be an antidote to lack of confidence (i.e., when one learns something in a subject, that subject becomes less intimidating to the learner [Benson 1989; Hembree 1990; Meece et al. 1990]). Low aptitude might be overcome by breaking down complex ideas into smaller units (Smith et al. 1993; Sweller and Chandler 1994; Mayer et al. 2002; Ayres 2006), explaining worked examples, and pointing out common misunderstand-
ings to students (Körner 2005; Muller et al. 2007; Huang et al. 2008). To address low motivation, learners can be offered readily accessible activities that give learning results quickly with minimal effort (Gee 2003). We propose testing the effects of supplemental instruction designed to ameliorate lack of confidence, low aptitude, and inadequate motivation by offering students a set of three-minute online videos affording access to concise direct instruction on essential concepts and worked examples, and coaching on misconceptions. The hypotheses we propose are:

**H1:** Participation rates of tutorials by low achievers will be significant, even without course credit.

**H2:** Students using tutorials will be less likely to drop the course and more likely to pass the course than non-users.

**H3:** Students using tutorials will improve their exam grades more than non-users.

The problems, remedies, and hypotheses concerning student effort and retention are modeled in Figure 1.

The hypotheses are tested in two studies spanning different time periods with different levels of data detail. Study 1 is based on tutorial use by students in two large sections (320-seat auditorium) of Principles of Accounting II (the second of the introductory accounting courses) in Spring 2007, analyzed at the student level. In Study 2, the tutorials created and implemented in Spring 2007 were used in every section of the course for the two years after the implementation term (six consecutive terms including the implementation term). To assess the long-term effects of tutorial use, student performance in the two years before and in the two years after implementation are compared and analyzed at the term level.
Participants

Participants were students enrolled in two large lecture classes of Principles of Accounting II in Spring 2007 (n = 426) taught by the first author at a large urban public university with a diverse study body.

Design of the Learning Experience: Online Tutorials

The attention-getting promise of the tutorials for appealing to students with low motivation was the claim that "you will improve in just three minutes." Easy access (i.e., available anywhere on the web, 24/7) minimized the effort needed to test this promise. The intent of the tutorial design was to prompt poorly motivated students to investigate this claim.

While accounting topics typically build on each other, tutorial topics were as discrete as possible so that students could start at any point in the course. When this was not possible, a tutorial would direct the learner to view a prior tutorial and then return to the current one. As an additional motivational aspect, the tutors were kept to three central concepts per chapter (27 concepts and skills in total, Appendix A) to avoid overwhelming the learner with the volume of material to be learned.

The second major aspect of the design was to create tutors that would meet the cognitive needs of weak or intimidated learners so that their first engagement with the innovation would "achieve some meaningful success" (Gee 2003, 62). Cognitive load theory suggests that instruction for inexperienced learners should not only simplify complex ideas, but also avoid seductive details and busy screens (Sweller and Chandler 1994). Therefore, each three-minute video pertained to one foundational idea with a simple voice-over PowerPoint look and feel, and no animation and minimal artwork. To provide practice, feedback, and reinforcement immediately after the three-minute instruction, two or three worked problems were offered, starting with an easy one, and then one or two harder ones. For the benefit of math-anxious students (Hembree 1990), the voice was warm, relaxed, and unhurried, and the tone conveyed confidence that understanding this foundational idea was achievable in short order with a few new learning experiences.

Twenty-seven ultra-short videos were created for the course, three for each of nine chapters covered in the departmental syllabus. The two principles of accounting courses used an integrated text, which organizes topics by financing, operating, and investing activities (Ainsworth et al. 2003). Consequently, the Principles of Accounting II course had managerial and financial accounting topics and included some cumulative materials from the first introductory course (e.g., journal entries and financial statements).

Tutorial topics were chosen based on their importance to understanding later topics (e.g., present value of money is critical to learning net present value and bond valuation), or because they were typical learning bottlenecks (Middendorf and Pace 2004) (e.g., annuities, disposing of assets, and indirect operating cash flow presentation, salvage value use in depreciation, present versus future value, bond payments versus bond expense, and cash versus accrual accounting). Appendix A contains a list of tutorial topics by chapter.

The video for each tutorial was created from 15–20 slides, starting with a concise explanation of the main concept, using lay terms rather than technical jargon to convey the terminology (an obstacle for weak learners), moving to how the main idea can be used to solve accounting

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1 At this school, the introductory accounting courses for all business majors have the titles of Principles of Accounting I and Principles of Accounting II, rather than the traditional titles of Principles of Financial Accounting and Principles of Managerial Accounting.
problems, revealing the strategy or process steps needed, and finally inviting learners to try to solve a problem. Interspersed throughout each tutorial were informal comments highlighting typical misconceptions or errors. The instruction was designed to avoid repeating the associated lecture, giving students that might not understand the lecture a fresh explanation of the concepts while discouraging them from skipping lectures.

**Procedure**

The tutorials were loaded into the learning management system WebCT, which recorded the date and time of each tutorial use by student. Students had no knowledge of the tracking and received no course credit for tutorial use. Due to obstacles in creating the first tutorials, the first nine tutorials were loaded the week before the first exam, but the rest of the tutorials were loaded approximately the same week as the lecture that introduced the topic. The week before the first exam (when the first nine tutorials were loaded), the instructor demonstrated how to find the tutorials and encouraged students to use them as a review for the exam. After the first exam, the instructor routinely mentioned which tutorial pertained to that week’s topic.

At the end of the course, the instructor distributed a survey asking students if they tried various course resources, including the tutorials, and asking for qualitative feedback about which resources were most useful in helping them learn. After submitting grades to the registrar, the instructor requested an activity report of student viewing of the tutorials from the campus technology group.

**Measures**

**Tutorial Use**

Some students only viewed one tutorial or two tutorials within 10–20 seconds of each other, indicating that they previewed the tutorials, but decided not to use them after the preview. Therefore, a “user” was defined as a student who viewed three or more tutorials. Because the logging software did not record the time when a file was closed, the number of uses was defined as “the number of file launches.”

**Math Aptitude**

Math aptitude was measured with Math SAT score, which was available for students entering the university as first-term freshmen (n = 317, 74.4 percent) but not for students transferring from other institutions (n = 109, 25.6 percent).

**Achievement**

Cumulative grade point average (GPA) measured academic achievement. The GPA cutoffs to separate the participants into low, middle, and high achievers were selected as values above and below the mean that placed approximately 25 percent of the participants in the low group and 25 percent in the high group. For the low group, the GPA cutoff was 2.5 or less (28.9 percent of the students); for the high group, above 3.2 (24.6 percent of the students). The correlation between GPA and Math SAT was low enough to permit including both variables in the same model (Pearson correlation = 0.287).

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2 Because the project was initially a retention program and not a research study, participants did not complete consent forms. The authors obtained approval from the campus institutional review board to conduct this work as an archival study.
Exams

Students took three departmental exams, one at week five, another at week ten, and a cumulative final exam at the end of the 15-week term. Exams contained only multiple-choice questions from departmental exams used in prior terms. In successive terms, about 25 percent of the questions were changed either slightly (e.g., dollar amounts and company name) so repeating students would not have exams identical to those in prior terms, or replaced due to minor changes in course content.

RESULTS: STUDY 1

The data met the assumptions of normality except for two outliers for cumulative GPA (one was 7.9 standard deviations lower than the mean and the other was a GPA of 0.0), and both were retained as valid data. Attributes of tutorial users compared to non-users are summarized in Table 1. Compared to students not using the tutorials, students using the tutorials had lower Math SAT scores ($F = 5.4, p < 0.02$), higher cumulative GPA ($F = 17.4, p < 0.001$), higher accounting GPAs ($F = 6.07 p < 0.01$), and higher credit hour loads ($F = 18.7, p < 0.001$). The pattern of lower aptitude but higher grades signals a higher level of motivation, indicating that users and non-users likely differed on this aspect.

H1: Participation

Tutorial use and grades are summarized in Table 2 by achievement level. Participation was high among all three groups: 61.0 percent for low achievers, 74.7 percent for middle achievers, and 77.1 percent for high achievers. Excluding students that dropped the course, participation was 68.7 percent for low achievers, 80.1 percent for middle achievers, and 80.2 percent for high achievers. We believe the 61.0 percent use by low achievers supports H1, which predicted significant

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**TABLE 1**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Non-Users</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participants</td>
<td>122</td>
<td>304</td>
</tr>
<tr>
<td>Percent male</td>
<td>40.2%</td>
<td>46.7%</td>
</tr>
<tr>
<td>Age</td>
<td>22.59 (3.19)</td>
<td>23.21 (5.25)</td>
</tr>
<tr>
<td>SAT verbal</td>
<td>530.31 (71.96)</td>
<td>517.84 (70.02)</td>
</tr>
<tr>
<td>SAT math ($p &lt; 0.02$)</td>
<td>554.02 (75.71)</td>
<td>533.58 (69.91)</td>
</tr>
<tr>
<td>Cumulative GPA ($p &lt; 0.001$)</td>
<td>2.61 (0.71)</td>
<td>2.87 (0.56)</td>
</tr>
<tr>
<td>Accounting GPA ($p &lt; 0.01$)</td>
<td>2.14 (1.02)</td>
<td>2.40 (0.92)</td>
</tr>
<tr>
<td>Credit hour load ($p &lt; 0.001$)</td>
<td>10.37 (5.38)</td>
<td>12.30 (3.55)</td>
</tr>
<tr>
<td>Exam 1 score</td>
<td>73.95 (14.47)</td>
<td>75.22 (13.68)</td>
</tr>
<tr>
<td>Exam 2 score</td>
<td>74.74 (16.10)</td>
<td>76.22 (14.87)</td>
</tr>
<tr>
<td>Final Exam score</td>
<td>71.51 (13.24)</td>
<td>73.16 (14.34)</td>
</tr>
</tbody>
</table>

*a Opened tutorials two or fewer times during term.

*b Excludes transfer students, for which SAT scores were not available ($n = 109$, 23 non-users and 86 users).

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3 Excluding the outliers did not change the results of any analysis.
participation by low achievers. The average of 31.3 views per low-achieving student further supports the hypothesis. Even though there were only 27 tutorials, the mean number of views averaged over 31 for all achievement levels (Table 2).

Tutorial use by topic was the highest for the first chapter of the term (Figure 2) due to a flurry of previewers—students that opened up one or two tutorials but viewed the second one less than 20 seconds after viewing the first one. The drop off in views after Exam 1 displayed in Figure 2 reflects the cessation of use by students who withdrew from the course (530 views or 5.14 percent of the total views were by students who dropped after Exam 1). Views by student do not distinguish between those that viewed the full set and those that might have repeated certain topics strategically. Views by topics in order of presentation over the term (Figure 2) indicate that after the initial flurry of previews and early use by those that dropped the course, use over the term varied by topic.

Examining participation by demographic categories, we found that full-time students were more likely to use the tutorials ($\chi^2[1, n = 304] = 6.12, p = 0.013$) than part-time students. We found no difference in the likelihood of tutorial use by major (accounting versus non-accounting) ($\chi^2[1, n = 304] = 0.487, p = 0.485$), gender ($\chi^2[1, n = 304] = 1.51, p = 0.219$), or race ($\chi^2[7, n = 304] = 13.74, p = 0.056$).

**H2: Retention and Course Pass Rate**

A $\chi^2$ test of withdrawal rates between users (10.85 percent) and non-users (35.25 percent) showed that users were significantly less likely to withdraw from the course ($\chi^2[1, n = 426] = 35.34, p < 0.001$). A $\chi^2$ test of pass rates (grade of C— or better, Table 3) between users (81.9 percent) and non-users (59.2 percent) showed that users were significantly more likely to pass the course ($\chi^2[1, n = 426] = 26.12, p < 0.001$).

Repeating these tests on only the low-GPA group revealed that significantly more low-achieving non-users dropped the course (45.8 percent) than low-achieving users (24.0 percent)

---

**TABLE 2**

<table>
<thead>
<tr>
<th>Cumulative GPAs by Achievement Level</th>
<th>Spring 2007 Mean (Std. Dev.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low: ≤ 2.5</td>
<td>Middle</td>
</tr>
<tr>
<td>Number of participants</td>
<td>123</td>
</tr>
<tr>
<td>Participants using tutorials</td>
<td>75</td>
</tr>
<tr>
<td>Percent using tutorials</td>
<td>61.0%</td>
</tr>
<tr>
<td>Average number of views for users</td>
<td>31.30 (29.9)</td>
</tr>
<tr>
<td>Exam 1 score</td>
<td>65.6 (13.9)</td>
</tr>
<tr>
<td>Exam 2 score</td>
<td>66.1 (16.4)</td>
</tr>
<tr>
<td>Final Exam score</td>
<td>61.4 (15.0)</td>
</tr>
<tr>
<td>Percent passing course</td>
<td>48.7%</td>
</tr>
</tbody>
</table>

*Users opened tutorials three or more times during term.*

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4 Participants were 30.3 percent black, 35.9 percent Caucasian, 16.0 percent Asian, and 17.8 percent Other (mostly international).

5 For the sake of brevity, the $\chi^2$ tests discussed here are not presented in Table 3.
(\(\chi^2[1, n = 123] = 6.56, p < 0.01\)). Significantly more low-achieving users passed the course (56.0 percent) than low-achieving non-users (37.5 percent; \(\chi^2[1, n = 123] = 4.01, p < 0.05\)), which supports H2 that users will be less likely to drop the course than non-users.

Examining the results by demographic categories, we found that full-time users were less likely to drop (\(\chi^2[1, n = 304] = 54.82, p < 0.000\)). We found no differences in drop rates based on

TABLE 3
Retention Rates Spring 2007 Mean

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Non-Users(^a)</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participants</td>
<td>122</td>
<td>304</td>
</tr>
<tr>
<td>Number of withdrawals</td>
<td>43</td>
<td>33</td>
</tr>
<tr>
<td>Percent of students withdrawing</td>
<td>35.25%</td>
<td>10.85%</td>
</tr>
<tr>
<td>Number of participants passing (Grade A, B, or C)</td>
<td>71</td>
<td>249</td>
</tr>
<tr>
<td>Percent of participants passing (Grade A, B, or C)</td>
<td>59.2%</td>
<td>81.9%</td>
</tr>
</tbody>
</table>

\(^a\) Opened tutorials two or fewer times during term.
accounting versus non-accounting majors ($\chi^2[1, n = 304] = 0.978 \ p = 0.323$), gender ($\chi^2[1, n = 304] = 0.913 \ p = 0.339$), or race ($\chi^2[6, n = 304] = 0.351 \ p = 0.743$).

Tutorial use was significantly associated with passing the course ($t = 3.68, \ p < 0.001$) in a regression analysis with passing (yes/no) as the outcome variable, GPA as a control for motivation and achievement, Math SAT as a control for aptitude, and tutorial use as the predictor. Dropping Math SAT from the model to include transfer students gave similar results ($t = 3.85, \ p < 0.001$). These results support H2 that users will be more likely to pass the course than non-users.

**H3: Exam Grades**

With hierarchical linear modeling (HLM), exam score growth over the term was analyzed longitudinally as a function of tutorial use (Hox 2002; Raudenbush and Bryk 2002; Singer and Willett 2003). HLM is a multi-level regression approach that analyzes two aspects of the data: the intercept or starting point, in this case Exam 1, and the slope, the change in exam scores over the term. The intercept reveals initial differences between students, while the slope shows changes over time within each student and between students. The slopes can be divided into several components to model different influences on growth. In this study, the final models included a time component to model growth from non-tutorial influences and an intervention component to model growth from tutorial views.

The HLM analysis included three models (Table 4). Model 1, the unconditional model, shows that the intercept (i.e., average exam one score of 74.43) differed significantly between students. Model 2 added a variable for time (weeks) and shows that exam scores decreased significantly, on average 0.34 points per week during the term. Decreasing scores over the term is consistent with the material becoming more challenging as the course progresses. Model 3 added GPA and Math SAT to explain differences in starting exam scores (intercept) and tutorial use to explain changes in exam scores over the term (slope). All three variables were significant in Model 3—tutorial use and Math SAT at the $p < 0.05$ level, and GPA at the $p < 0.001$ level.$^6$

Model formulas were:

\[
\text{ExamScore}_{it} = \pi_0 + \pi_{1i}(\text{Week})_i + \pi_{2i}(\text{TutorialUse}) + e_{it}. \\
\pi_0 = \beta_{00} + \beta_{00}(\text{GPA}) + \beta_{00}(\text{MathSAT}) + r_{0i}. \\
\pi_{1i} = \beta_{10}. \\
\pi_{2i} = \beta_{20}.
\]

Substituting the Level 2 equations into the Level 1 equation yields the combined model:

\[
\text{ExamScore}_{it} = \beta_{00} + \beta_{00}(\text{GPA}) + \beta_{00}(\text{MathSAT}) + \beta_{10}(\text{Week})_i + \beta_{20}(\text{TutorialUse}) + e_{it}.
\]

While regression analysis includes only one error term, indicating that some unexplained variance exists, HLM offers several error terms, which allow for locating unexplained variances.

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$^6$ Model 3 excluded transfer students, who are not required to submit SAT scores. Because the integrated curriculum at the implementation school contains a high proportion of financial topics in the second principles course (typically a managerial course), transfer students that already had credit for Principles of Accounting I would have biased exam scores because of prior learning. Tutorial use was not significant with transfer students included and Math SAT left out of the model ($t = 1.27, \ p < 0.21$). Tutorial use was marginally significant without Math SAT and without transfer students ($t = 1.78, \ p < 0.075$).
For instance, there could be unexplained differences in the initial scores as well as unexplained differences in growth rates. The Level 1 error term indicates that other time-varying variables might contribute to change over time. A statistically significant Level 2 error term indicates unexplained differences between participants. All models in this study showed statistically significant unexplained Level 2 error terms (Table 4), indicating that other predictors (such as time on task, level of outside demands, interest in the topic) could improve the model even further.

Tutorial use, even though statistically significant, has low to moderate practical significance: each tutorial use improved test scores from Exam 1 to the Final Exam on average 0.096 points (Table 4, Model 3). Students viewed the tutorials on average 31 or more times (Table 2), and thus could expect an average increase from Exam 1 to the end of the semester of 2.88 exam points compared to non-users. In the plus/minus grading environment, this may move tutorial users to the next grade level.

### METHOD: STUDY 2

Given the benefits found in Study 1, the tutorials were made available to all sections of Principles of Accounting II in subsequent terms. In Study 2, we analyze whether tutorials were associated with continuing benefits without the involvement of the designer, weekly promotion during lectures, and experimental effects of students knowing they were trying a new resource. We investigated these questions in Study 2, which compared grades in the six terms before and the six terms after implementation for all instructors.7

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7 Because the project was initially a retention program and not a research study, participants did not complete consent forms. The authors obtained approval from the campus institutional review board to conduct this work as an archival study.
Participants

Participants were all students enrolled in Principles of Accounting II from Spring 2005 through Fall 2008 (six terms prior to implementation and six terms after the implementation, n = 5,787) at a large urban public university with a diverse study body.

Procedure

Data for six terms (two spring, two summer, and two fall terms) before and six terms after implementation were considered a matched set. Spring terms included more of the traditional full-time sophomores, who took Principles of Accounting I in the fall term and continued to the second course in the spring term. Fall terms included more of the part-time students, who took the course when it fit their schedules rather than in the traditional pattern. Summer students typically included a greater proportion of transient students from other schools wanting to complete the prerequisite course while home for the summer, and students not passing the course during the spring and fall terms.

Instructor practices also varied by term. Summer terms, taught in small sections without the requirement to use departmental exams, had more adjunct faculty members and graduate students as instructors. Approximately three-fourths of the students in fall and spring terms completed the course in a large lecture format with full-time faculty. In any one term, there were about 10 different instructors.

The campus technology group loaded the tutorials into the course template for the learning management system so that students in every section could see the resource listed on their homepages. Instructors were unaware of the tutorial contents or learning effects.

Measures

Tutorial Use

Because Study 2 was a retrospective study, detailed use by student was not available in the terms after the implementation term. Total views for the last term in Study 2 were available, which indicated overall use level.

Course Grade

The implementation school used a plus/minus grading system, with “pluses” adding 0.3 points and “minuses” removing 0.3 points. Thus, an A− = 3.7, a B+ = 3.3, and so forth.

Math Aptitude and Achievement

As in Study 1, achievement was measured by cumulative GPA, and math aptitude was measured with Math SAT. Correlation between these two variables was low enough to permit use of both variables in the same model (Pearson correlation = 0.246).

RESULTS: STUDY 2

The data met the assumptions of normality with no outliers. The enrollments by term, average SAT scores, average cumulative GPAs, and course grades in Table 5 show that math aptitude as measured by Math SAT was gradually increasing over the 12-term period. This pattern was consistent with the gradual increase in admission requirements at this university, as well as with a statewide emphasis on improving high school math preparation. The difference between Spring 2005 and Fall 2008 SAT Math scores was significant (F = 13.307, p = 0.01). Differences in
H1: Participation

For Fall 2008, the last of the six-term sequence, there were 9,545 tutorial views by 568 students (average of 16.8 per student), which were down from the 9,726 views in Spring 2007 for 426 students (average 22.8 per student). Although the average was down from Spring 2007, average use rates were still high compared to published rates for supplemental instruction (Etter et al. 2000).

H2: Retention

The withdrawal rate of 18.4 percent prior to implementation was significantly higher than the withdrawal rate of 11.3 percent after implementation (Table 6) ($\chi^2[1, n = 5,787] = 58.71, p < 0.001$). The pre-implementation pass rate of 57.2 percent was significantly lower than the post-
implementation pass rate of 79.8 percent (Table 6) ($\chi^2[1, n = 5,787] = 104.57, p < 0.001$). The grade distributions before and after tutorial implementation are shown in Figure 3, and the numbers of students receiving D, W, or F grades before and after tutorial availability are shown in Figure 4.

Tutorial availability was significantly associated with passing ($t = 8.53, p < 0.001$) in a regression with pass (yes/no) as the outcome variable, GPA as a variable to control for motivation, Math SAT to control for aptitude, and tutorial availability as the predictor. Excluding Math SAT scores in order to include transfer students in the analysis gave similar results ($t = 10.39, p < 0.001$).

<table>
<thead>
<tr>
<th>Grade</th>
<th>Before Implementation</th>
<th>After Implementation</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
</tr>
<tr>
<td>A</td>
<td>192</td>
<td>7.1</td>
<td>407</td>
</tr>
<tr>
<td>B</td>
<td>526</td>
<td>19.6</td>
<td>821</td>
</tr>
<tr>
<td>C</td>
<td>819</td>
<td>30.5</td>
<td>946</td>
</tr>
<tr>
<td>D</td>
<td>373</td>
<td>13.9</td>
<td>298</td>
</tr>
<tr>
<td>F</td>
<td>282</td>
<td>10.5</td>
<td>278</td>
</tr>
<tr>
<td>W</td>
<td>495</td>
<td>18.4</td>
<td>350</td>
</tr>
<tr>
<td>Total</td>
<td>2687</td>
<td>100.0</td>
<td>3100</td>
</tr>
<tr>
<td>Pass rate (C− or better)</td>
<td>57.2%</td>
<td>79.8%</td>
<td>22.6%</td>
</tr>
</tbody>
</table>

*Plus and minus grades were consolidated into whole letter grades.

FIGURE 3
Grade Distribution Before and After Tutorial Implementation
Repeating these tests on only low-GPA students (GPA below 2.5) revealed that significantly more low-achieving pre-implementation students dropped the course (27.1 percent) than low-achieving post-implementation students (16.3 percent) ($\chi^2[1, n = 1,871] = 31.81, p < 0.001$). Significantly more low-achieving post-implementation students passed the course (43.8 percent) than low-achieving pre-implementation students (30 percent) ($\chi^2[1, n = 1,871] = 38.24, p < 0.001$). Tutorial use was significantly associated with passing ($t = 5.60, p < 0.001$) in a regression on the low achievers with pass (yes/no) as the outcome variable, GPA to control for motivation and achievement, Math SAT to control for aptitude, and tutorial availability as the predictor. Leaving Math SAT out to include transfer students gave similar results ($t = 6.77, p < 0.001$).

**H3: Exam Grades**

Tutorial availability was significant in explaining variance in course grades in a regression with course grades as the dependent variable, tutorial availability as the independent variable, GPA as a control for motivation and achievement, and Math SAT as a control for aptitude (Table 7, Panel A). Leaving Math SAT out to include transfer students gave similar results (Table 7, Panel B). The low correlation between Math SAT and GPA allowed both covariates to be included in the analysis (Pearson correlation = 0.246).

**DISCUSSION**

**Participation Rates**

The tutorials elicited remarkable participation rates during Spring 2007, the initial implementation. In Spring 2007, 71.4 percent of Principles of Accounting II students used the tutorials three or more times, which is comparable to mandatory supplemental instruction of 70...
percent (Jones and Fields 2001), and higher than the average of 27 percent for voluntary participation in supplemental instruction with Principles of Accounting (Etter et al. 2000). While some studies suggest that stronger students self-select into voluntary supplemental instruction (Simpson et al. 1997; Xu et al. 2001; Moore and LeDee 2006; Moore 2008), 61.0 percent of low achievers in this study used the tutorials. Furthermore, the low achievers, who viewed the tutorials on average 31.30 times, were just as active as higher achievers, who averaged 31.05 tutorial views. Their use being on par with that of high achievers is consistent with other work showing that low achievers are willing to exert effort with novel resources (Greer 2001; De Lange et al. 2003; Marriott and Lau 2008).

A relatively small effort, three minutes of instruction, may have triggered students to recognize that a series of small actions can accumulate to success (Gee 2003; Maurer 2004), a message that may have improved weaker students’ studying habits enough to get them up to passing. Or, the discrete nature of working this tutorial in private as many times as needed may have preserved self-esteem and made this resource comfortable to use for all, especially low achievers (Karabenick and Knapp 1988, 1991). This study refutes the notion that students will not complete extra work voluntarily (Elikai and Baker 1988), and supports findings that accounting students embrace virtual learning (Martin et al. 1995; Wells et al. 2008).

Total tutorial use by topic (Figure 2) suggests that users were somewhat strategic, viewing certain topics more than others. It is unclear if consistent users (looking at the full set) have different outcomes than users that are more strategic (select only certain chapters to view), or whether low achievers use the tutorials differently than high achievers.

Although total use was down five terms after implementation, the use rates are still remarkable compared to published rates for other supplemental instruction (Etter et al. 2000). It is even more remarkable that this level of use continued without instructors encouraging use during each class session.
Retention Rates

Tutorial users, including those at most risk of failing, were more likely to persist with the course (not drop it), thereby exerting enough effort to pass it. In the implementation term, users withdrew one-third less often than non-users (Table 3) and had a pass rate of 81.9 percent versus 59.2 percent for non-users. Low-achieving users were less likely to withdraw and more likely to pass than low-achieving non-users. Further, Table 6 reveals that the proportion of As and Bs increased, suggesting that tutorials may have improved learning for students across the full grade range.

Over 12 terms (Table 5) with different instructors, student types, and course formats, terms without tutorials available had higher drop rates and lower pass rates compared to terms with tutorials. The pattern over 12 terms of higher grades and better pass rates after implementation suggests that the tutorial availability affords benefits across class sizes (large lecture sections in spring and fall terms, small classes in summer term), a wide range of instructor types (graduate student, adjunct, and full-time faculty), student types (traditional full-time, part-time, repeaters, and transient), and exam content. This result confirms the increasing body of literature showing that supplemental instruction can improve retention, especially for students in high-risk courses or who are underprepared or poorly motivated (Congo and Schoeps 1993; Ramirez 1997; Xu et al. 2001; Moore and LeDee 2006; Moore 2008).

The improved grades and pass rates for the six terms after implementation may have included factors other than the tutorials. The faculty course coordinator changed in the second year of implementation, and grades and pass rates did worsen slightly following this change (Figure 4). The departmental exams were intentionally changed in minor ways each term so repeating students would not have the same exams in the next term. The only other known change after the tutorial implementation was the addition of class activities by the large lecture instructors, which affected about 75 percent of the spring and fall students.

Exam Scores

Cumulative GPA represents a host of student habit and trait variables, and was the largest predictor of exam scores. Tutorial use, however, was associated with improved exam scores above and beyond the impact of prior academic achievement. The model (Table 4) indicates that the tutorials were associated with an improvement from Exam 1 to the Final Exam of 0.096 points per view, just under three exam points (out of 100) for the average tutorial user. This finding is consistent with low effect sizes reported for supplemental instruction in accounting (Etter et al. 2000; Jones and Fields 2001; Potter and Johnston 2006). While the learning effect was small, the effect size is likely suppressed by the models’ use of the first exam for a baseline score. Substantial tutorial use before the first exam (Figure 2) may have elevated the baseline (Exam 1 scores), reducing the computed gain in scores (effect size).

A modest learning effect may be attributable to the emphasis on just core concepts. While affording a solid foundation, the low level of difficulty of the basic ideas in the tutorials, while enough to dramatically alter pass rates, may not have brought students up to the high competency required to perform at a level above passing.

Tutorial quality would affect learning. Students indicated on an end-of-course survey, as well as by their high level of use, that they believed the tutorials were effective resources for learning accounting. On end-of-course surveys, over 95 percent of the students cited the tutorials as more useful in achievement than any other course resource. Further, the high use level (Table 2) suggests that the students found the tutorials helpful enough to spend time viewing them, even without course credit for the effort.
The low to moderate size exam score increase from using tutorials may be due to a ceiling effect based on student goals. Students may not have used the tutorials to maximize their grade, but instead ceased work when they reached their typical grade goal or did not start using tutorials until after they failed an exam. This satisficing effect (stopping when the grade was sufficient rather than maximized) has been referred to in the problem-solving literature as a typical adaptation given limits on time, knowledge, and resources (Simon 1956; Starbuck 1963). According to Simon’s theory, students would resolve competing goals of varying importance, recognizing that all outcomes need not be maximized. The student’s personal level of aspiration would constitute a grade ceiling based on the learner’s grade objective rather than the maximum possible score. Because this study used cumulative GPA in the model, the effect of the learning innovation would disappear if the learner ceased learning once the grade approached the learner’s historical grade objective. To our knowledge, a satisficing effect for grades has not been investigated in the literature, although studies have reported that supplemental instruction seems to help students get a “C” and avoid “D”s or “F”s more than it propels them to earn higher grades (Moore and LeDee 2006).

Another possible reason for the small learning effect is the pattern of practice in the tutorials. While blocked practice, where similar problems are presented together, reduces errors during learning, random practice leads to better retention and transfer (Carlson and Yaure 1990). Although the tutorials were intended to make initial learning faster for weak or tentative students, the learning effect might be stronger if the tutorials included some mixed practice sets and cumulative problems. This would extend the level of difficulty and help students learn to switch among course topics on a cumulative final exam.

The tutorial set contained three tutorials per chapter, a total of 27, or approximately 81 minutes of instruction and about 100 minutes of worked examples. The length of the entire tutorial set was comparable to about two lectures. If students paused the video while they worked the problems (as they were encouraged to do) and then viewed the worked solutions, their time on task would be longer. It is not clear whether more tutorials would have yielded stronger learning effects. Given the high average use rates (more than 30 views per student), students may well have benefitted from more tutorials.

### WEAKNESSES AND FUTURE WORK

Future studies could improve on Study 1 by using a randomized experimental design with a control group. Tutorial users were likely more motivated than non-users, resulting in learning effects potentially being confounded with motivation level. Prior research suggests using GPA as a covariate to isolate the impact of motivation and other academically relevant variables on the exam scores diminishes the impact of self-selection bias (Fayowski and MacMillan 2008). Our use of HLM modeling further reduces this design limitation because, in addition to comparing students to each other (between differences), HLM tracks changes in scores by each individual student over time as a function of the intervention (within differences), using the student’s first score as his/her own baseline measure. This coefficient for the tutorial in the model is in essence a “gain score” for each student, similar to a repeated measure analysis.

While the 71 percent participation rate was remarkable, especially without course credit for tutorial use, students in Study 1 were not asked which aspects of the tutorials were most appealing or most useful. Teasing out the motivational aspects from the instructionally effective aspects would inform the design of future tutorials. Another tutorial design objective was to help math-anxious students. A study testing whether students that used the tutorials became more confident and less anxious may indicate whether tutorial use reduces the intimidation associated with accounting topics and whether tutorial use prompts other academically productive behaviors.
Another design objective for the tutors was to break down complex ideas into smaller pieces, making learning easier for lower aptitude students. The tutorials may have been too easy to affect exam grades appreciably. A future study could improve on this design by offering tutorials at two different levels of difficulty. This would give novices a chance to build skill at the easy level, but also develop skills for responding to more complex exam questions.

Future tutorials may be able to increase the learning effect by changing the practice pattern. The basic-level tutorials could retain the blocked practice to make initial learning easy, and a second set of tutorials could afford practice on more advanced cumulative problems over randomized topics. This would respond not only to the need for novices to transition to more difficult work after initial learning, but might also shed light on the satisficing effect. If students only study until their grade objective is met (satisficing effect), the advanced set might not be viewed as frequently as the basic set.

Prior work suggests that failing students are caught in a paradox—they need the structure of lectures and deadlines to stay motivated, yet they resist instructor control (Gracia and Jenkins 2002). Future work might reveal whether learner control and structured content in the tutorials helps meet these contrasting needs.

Many studies of supplemental instruction find that participating students have higher re-enrollment rates than non-participants (Congo and Schoeps 1993). It would be worthwhile to track participants to future terms to see if momentum gained from self-regulated learning (voluntarily working through a series of learning steps in the tutorials) improved academic success.

CONCLUSION

This research offers good news for students, instructors, and administrators about the power of three-minute online tutorials to improve pass rates in principles of accounting courses. Students, especially poorly motivated ones, can appreciate that with 24/7 convenience and relatively modest effort (viewing 30 or so three-minute tutorials and working problems), they can improve their probability of passing significantly. Furthermore, for weak students, who often do not seek help, the tutorials offer as many repeated views as needed without stigma and without having to ask for them (Yates 2005). This study confirms that student effort in principles of accounting courses can improve pass rates even with low ability (Wooten 1996) and that a modest set of online tutorials can contribute to achieving that objective.

Instructors will be encouraged that principles of accounting students are willing to work harder, even without course credit, and that once tutorials are in place, they do not add to instructor workload each term. Furthermore, the innovation works across student type (full-time, part-time, and transient) and student ability (low, middle, and high achievers), relieving them from having to customize the set.

For administrators, once created, tutorials can be a perennial resource used year after year to improve retention in large enrollment courses regardless of class format, instructor type, or student achievement level, and without adding to the workload of faculty. Creating the initial set of tutorials requires faculty labor, but compared to other tutoring options—including hiring, training, and compensating human tutors, scheduling space, and coordinating tutoring sessions with courses—investing in the creation of a set of basic tutorials looks very appealing. This work brings into question the notion that supplemental instruction that improves student retention needs to be a full-featured program with term-long schedules, two-way communication, and individualized scaffolding (Congo and Schoeps 1993; Martin and Blanc 2001; Fayowski and MacMillan 2008).

The innovation’s success across many instructors each term and persisting for six terms without coordinated promotion sends a strong message that these tutorials make a difference to all stakeholders: those needing to pass and those wishing they would.
REFERENCES


APPENDIX A
Tutorial Topics by Chapter

Time Value of Money
1. How to solve a lump-sum present or future-value problem
2. How to distinguish between lump-sum and annuity problems
3. How to solve an annuity present or future value problem

Planning for Investing
4. Cost of capital
5. Rate of return, internal rate of return, and net present value
6. Using net present value to compute the value of a long-term asset

Planning for Equity Financing
7. Partnership accounting
8. Accounting for issuing stock
9. Accounting for cash and stock dividends
Planning for Debt Financing

10. Lump-sum notes (interest and principal paid at end)
11. Periodic notes (mortgages or installment notes)
12. Interest-only notes

Recording and Communicating Operational Investing Activity

13. Computing asset costs (basket purchases, items excluded from cost)
14. Depreciation methods
15. Asset disposals

Firm Performance: Profitability

16. Operating earnings
17. Extraordinary items
18. Earnings per share

Firm Performance: Financial Position

19. Classified balance sheet basics
20. Using adjunct and contra accounts
21. How to diagnose and solve when you are out of balance

Firm Performance: Cash Flows

22. Classifying by operating, investing, and financing
23. Distinguishing between cash and accrual basis items
24. Indirect method of presenting operating cash flows

Firm Performance: A Comprehensive Evaluation

25. Profitability ratios
26. Liquidity and solvency ratios
27. Productivity ratios

Source: Ainsworth et al. (2003).