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Overcoming Knowledge Retention Issues From the First Principles Course

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Abstract: This study reports the results of a strategy to improve retention of a specific concept from the first Principles of Accounting course. Following research on the effect of retention from the first course to performance in the second course, we explore the effects of a targeted experimental intervention on performance. In prior published research, we found a student's inability to demonstrate understanding of key concepts from the financial accounting course are significantly related to important learning objectives in the second course. Here we report how students predicted to choose incorrect answers performed after the targeted experimental intervention.

Key words: knowledge retention, accounting, principles course, predicting knowledge deficits
JEL codes: M, C

1. Introduction

Most University programs offering a major in Business require students take two Accounting Principles classes, most commonly with Financial Accounting the primary content of the first class and Managerial Accounting the second (Danko K., Duke J. C. & Franz D. P., 1992). Continuing research has connected general academic factors such as prior academic success, often measured using GPA, prior knowledge of accounting (Papageorgiou E. & Carpenter R., 2019; Byrne M. & Flood B., 2008; Pasewark W. R., 2020; Doran B. M. et. al.,1991) and gender on success in accounting courses (Papageorgiou K. & Halabi A. K., 2014; Tan L. M. & Laswad F., 2008). The importance of the first course lies in its ability to both present useful accounting information that can lead to better decision-making for all business majors, and to attract, or discourage, individuals from becoming accounting majors (Kaenzig R & Keller R., 2011). In this paper we look at how to improve retention of a concept from the first Principles of Accounting course, specifically the ability to identify what is an Asset. The study was conducted over six semesters, all courses taught online, including a total of 428 students. The course is the second in the Principles of Accounting sequence, required of all majors in the College of Business. The class is primarily a Managerial accounting class, with the focus on determination of costs and prediction of costs for budgeting purposes. A review is conducted at the beginning of the class, covering Financial Statements (order of preparation; what each statement includes and how it is used); Account types (asset, liability, equity, revenue, and expense: recognize accounts in each category and on which financial statement each is reported); and the use of debits and credits (which accounts have a debit or credit balance).

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2. Prior Literature

Prior literature includes a significant number of studies that have been conducted to address various aspects of the introductory accounting courses (Jordan E. E. & Samuels J. A., 2020) and (Baldwin B. A. & Ingram R. W., 1991) proposed that the content and objectives of the Principles sequence be considered a priority. They ask the question "Have you ever heard anyone describe the objective of the elementary accounting sequence?" They propose that the "elementary accounting courses should be thought of as general education courses, primarily for the business major perhaps, but also of value to a wide variety of students across the campus. We suggest a complete revamping of content and pedagogy to serve the needs of the 80-85% of enrollees that will not become accounting majors, rather than the needs of the 15-20% of students who will."

The literature is rich in studies on the effect of prior content knowledge and prior academic success on student performance. Tan and Lasward (2008) found that prior content knowledge is an important predictor of success. In the context of this study, knowledge from the first principles course would be expected to be a factor in success in the second course. Byrne and Flood (2008) also found a positive effect on performance in the first accounting course in University when students had prior accounting content knowledge from pre-University academic courses. Warren and Young (2012) reflect on the tendency of students to lose much of what they learned in the first Principles course before they begin the second Principles course.

The literature on student performance in online principles courses includes the research of Papageorgiou and Halabi (2014). Looking at determinants of student success in online accounting courses, these authors find academic aptitude and prior content knowledge as strong factors in success. The study included eight courses in accounting over the course of earning a degree, and found that as students progressed, the effect of pre-University content knowledge was reduced. The authors did not directly consider the effect of content in one University Accounting class on success in another University Accounting class.

Etter et al. (2000) report on the effect of supplemental instruction on performance in Principles of Accounting. Although the intervention here is not a full SI program, the effect of any extra help in preparing students seems to be positive.

3. Methodology

3.1 Data Sources

This paper uses course performance data from 428 students taking an online managerial accounting course taught by one professor during at a medium size university in the southeastern United States. These students were treated in three distinct subsets: model creation — 231 students from Spring through Summer 2020; model testing — 100 students from Spring and Summer 2021; and Intervention Trial — 97 students from Fall, 2021. The University IRB office treated this as exempt from review because there was minimal student risk and the main intent was to improve instruction. The data include student performance on a Review Quiz, Exam One, Final Exam, and overall course grade. For this study the data on the Final Exam and overall course grade are not analyzed. Nearly all these students received only online instruction. One section of 28 students in the Spring term of 2020 received in-person instruction the first 10 weeks of the term. This section was transitioned to on-line instruction using online lectures and resources in mid-March, 2020 due to university COVID safeguards. These students were not significantly different on key independent variables from those who received only on-line

instruction. The exams were all multiple choice and done online with randomized question presentation.

The preliminary findings on knowledge retention from the first course of Accounting Principles were presented at the May, 2021 Southeast Regional meeting of the American Accounting Association. Based on feedback from our presentation, we felt encouraged to integrate more student background data into our research. Our University Institutional Research office generously provided key data including student transfer status, transfer institution, transfer credits, GPA as of the end of the prior term, the grade received in the first principles course, high school GPA, high school graduation date, birth date, and other items. Trowler et al. (2021) extensively review the literature and evidence regarding student engagement generally and Aldamen et al. (2018) explore the relationship of student engagement to student performance specifically in accounting courses. To include elements of student engagement we extracted data from the online course logs for the period prior to Exam One. From these logs, we determined the frequency of accessing the online course materials overall as well as specific aspects of the course for each student.

4. Analysis

4.1 Predicting Knowledge Retention Deficit

The focus of this paper is on the impact of an intervention on knowledge retention. To provide a bit more depth we will discuss the prediction of inadequate knowledge retention. Using the data from the 231 students in the model creation subset, we applied logistic regression to create a predictive model regarding the likelihood a student would respond correctly or incorrectly to the asset question on Exam One. The model was built using data from students in online courses Spring, Summer, and Fall of 2020. These were the same students used in our JHETP paper (Hutchins R. & Hutchins G., 2021).

The predictive measure suggested by the initial regression was highly predictive for correct response on the low end of the measure as well as on its high end. On the low end, 94.6% of 148 students were correctly predicted. On the high end, 90.6% of 32 students were correctly predicted to miss the asset question.

The remaining 35 students in the middle range split with about 46% answering correctly and 54% giving an incorrect response. Another logistic regression was conducted on these 35 students. Variables that had low significance to the overall equation were eliminated because there were too many variables to conduct the regression with so few students. For these students, the predicted response from the second regression was substituted for the prediction from the first regression to yield the final predictor. On the final predictor, about 95% of students predicted to respond correctly to the question did in fact respond correctly. The prediction of incorrect responses was also strong with about 94% of students predicted to respond incorrectly being incorrect. The combined correct responses and incorrect responses were correctly predicted for 94.9% of the students.

To test the model, we applied it to students in the model testing subset who took the course during the Spring and Summer terms of 2021. Among the students in model testing subset, 80.3% who were predicted to give a correct response to the asset question, did respond correctly. Of those who were predicted to give an incorrect response to the question, 39.3% were incorrect. This yielded an overall level of 68.1% correct prediction. These results suggest the regression model developed is over specified. However, the prediction still appears to be of value in distinguishing between those students likely to get the asset question correct without any intervention.

The predictor variables may be categorized according to their conceptual influence on student performance. The categories were developed ad hoc and included academic path, academic success, engagement, knowledge

retention, personal, and summary measures. We categorized 14 measures as representing the academic path the student had followed prior to the course. The academic path included measures related to transfer status, transfer institution, the number of days since high school graduation, the days since taking the first accounting course, hours transferred (if any), hours earned prior to the course, and so forth. Academic success included 9 measures such as ACT and SAT scores, high school and college GPA's, and final grade in the first Principles course. Engagement included 10 measures of the frequency with which the student accessed various portions of the online course prior to Exam One. Knowledge retention included 5 measures of correct or incorrect response to specific questions from the review quiz and the overall review quiz percent correct. The personal category included 4 measures including the student's age, gender, the department of their major, and the proximity of the state of their transfer college to the university.

The variables in the regression were all standardized allowing the beta weights to indicate the importance of each measure in the overall prediction (Johnson J. W. & LeBreton J. M., 2004). The table below presents the average of the absolute beta weights for each category. The higher the average weight, the more important that category is in predicting knowledge retention. Focusing on the weights from the initial regression, the engagement category had the highest average weight and may reflect the efforts of students to overcome deficiencies they identified from other work in the course. The academic path variables had the next highest average and prior academic success had the lowest average weight. The initial regression was particularly accurate for about 84% of students on either end of the resulting measures.

Table 1 Average Beta Weights

Category	Initial Predictor Equation	Middle Section Predictor Equation
Engagement	1.286	30.608
Academic Path	1.132	33.026
Knowledge Retention	0.976	17.026
Personal	0.910	29.013
Academic Success	0.689	83.747

Shifting the focus to the remaining 16% of students, a different pattern emerges. Prior academic success was considerably more important than the other categories with engagement, academic path, and personal variables being roughly equal. Knowledge retention was the least important with these students.

4.2 Weaknesses Identified

To help students self-identify possible weaknesses in the knowledge and understandings of important concepts they had retained from basic accounting principles, they were required to complete a Review Quiz of thirty-four questions. After they received their quiz results, online resources were provided to help them better understand the items on which they had difficulty and to overcome deficits in their retention. They were able to retake the quiz a second time to confirm their mastery of the material. Students during 2020 taking the quiz only once had higher scores (median 91.2% correct) than those who retook the quiz. The median correct score for the 56.3% of students who retook the quiz rose from 73.5% on the first try to 97.1% on the second try. This suggests students did benefit from reviewing their errors and used the online resources. A student's highest grade was worth up to 10 points out of 1,000 toward their final course grade.

We found (Hutchins R. & Hutchins G., 2021) that gaps in concept mastery persisting well into the course reflect negatively on course performance. The inability to give correct responses to review questions on Exam

One given in the 5th week of the term suggests that the lack of concept retention has continued beyond any initial time when students might begin to think in accounting terms. Specifically, these results suggest that understanding basic accounting concepts such as "What are assets?", "What are debits and credits?", and "What does an income statement show?" are significantly related to the percentage of correct responses on the comprehensive final and to the final course grade. For example, students able to correctly identify and total asset accounts received final course grades that were two thirds of a letter grade higher than those who were unable to do so correctly.

4.3 Can Knowledge Deficits Be Rectified?

Rather than trying to rectify these knowledge deficits through changes in the curriculum preceding the second course, we developed an experiment to provide focused instruction on areas of weakness. During Fall 2021 we provided two PowerPoints on these areas the day before Exam One. Students were encouraged to use the PowerPoints to bolster weaknesses they might have. One PowerPoint was somewhat more focused on identifying assets (a key weakness we had identified) and the other had more content on accounting statements. There was considerable overlap between the two.

The students were randomly assigned to one or the other of the PowerPoints. Students who accessed their assigned PowerPoint and submitted an online statement that they were "DONE" with the assignment were given 5 bonus points toward their 150 point quiz total. Students were able to self-select to forgo the small number of points if they felt confident in their mastery of the material. There was evidence the 25% of students who did not do the PowerPoint were correct in their judgement of mastery. Only 8.7% of them missed the asset question compared to an error rate of 38% for the 58 students who did the PowerPoint before the exam.

Our original intent was to compare students accessing the two PowerPoints. We found there was no significant difference between the two groups. Considering the similarities between the two PowerPoints, we elected to look for effects based on the time spent on the PowerPoints. Using the time and date stamps on the course logs we took the difference between their initial access of the PowerPoints and the submission of "DONE" as a surrogate for how much time they spent studying the PowerPoint.

Table 2 shows the overall impact of the experimental intervention on student response to the asset question on Exam One. Of those who spent two minutes or less on the PowerPoint, 50% missed the asset question. While, of those who spent three or more minutes on it only 26.7% missed the question. Table Three presents the T-Test on these data indicating a significant difference between the two groups and a mean difference of 23.3%.

Table 2 Percent Incorrect Response To Asset Question on Exam One by Time on Powerpoint

		N	Mean	Std. Deviation	Std. Error Mean
Time on PowerPoint	Two Minutes or Less	28	50.0%	0.509	0.096
	Three Minutes or More	30	26.7%	0.450	0.082

Table 3 T-Tests: Asset Question on Exam One by Two Vs. Three Minutes on Powerpoint

		F	Sig.	t	df	One-Sided p	Mean Difference
Identify and Total Assets	Equal variances not assumed	7.527	0.008	1.845	53.988	0.035	23.3%

Tables 2 and 3 show the overall impact of this intervention. Does the intervention differentially impact the students who we would expect to do well on the question or worse on it? Tables Four through Seven explore these questions. Among students who were predicted to get the asset question correct, there was not a significant difference between their performance based on how much time they spent on the PowerPoint. Conversely, among students who were predicted to get the asset question incorrect, the reverse was true. Those taking three or more minutes on the PowerPoint were significantly more likely to get the asset question correct than those who spent only two or fewer minutes on it. Their mean difference was a substantial 54.9%.

Table 4 Asset Question by Time on PowerPoint for Students Predicted to Give the Correct Response

		N	Mean	Std. Deviation	Std. Error Mean
Time on PowerPoint	Two Minutes or Less	15	33.3%	0.488	0.126
	Three Minutes or More	16	37.5%	0.500	0.125

Table 5 T-Tests: Asset Question on Exam One by Two vs. Three Minutes on PowerPoint for Students Predicted to Give the Correct Response

		F	Sig.	t	df	One-Sided p	Mean Difference
Identify and Total Assets	Equal variances assumed	0.219	0.643	-0.235	29	0.408	-4.2%

Table 6 Asset Question by Time on PowerPoint for Students Predicted to Give the Incorrect Response

		N	Mean	Std. Deviation	Std. Error Mean
Time on PowerPoint	Two Minutes or Less	13	69.2%	0.480	0.133
	Three Minutes or More	14	14.3%	0.363	0.097

Table 7 T-Tests: Asset Question on Exam One by Two vs. Three Minutes on PowerPoint for Students Predicted to Give the Incorrect Response

		F	Sig.	t	df	One-Sided p	Mean Difference
Identify and Total Assets	Equal variances assumed	4.305	0.048	3.333	22.314	0.001	54.9%

How might these impacts compare with knowledge retention among the prediction groups in the model test subset (Spring or Summer 2021)? Tables Eight and Nine address this question. Students in the test subset who were predicted to give the correct response to the asset question were not significantly different from Fall 2021 students who spent three minutes or more on the PowerPoint. Conversely, those students in Spring or Summer 2021 who were predicted to give an incorrect response were significantly more likely to miss the asset question than Fall 2021 students who spent three minutes or more on it.

Table 8 Asset Question – Fall 2021 Students with Three Minutes or More on PowerPoint vs. Spring or Summer Students Without PowerPoint by Predicted to Give the Correct or Incorrect Response to the Question

Prediction	Term	N	Mean	Std. Deviation	Std. Error Mean
Predicted to be **correct**	Spring Summer 2021	66	19.7%	0.401	0.049
	Fall 2021	16	37.5%	0.500	0.125
Predicted to be **incorrect**	Spring Summer 2021	28	39.3%	0.497	0.094
	Fall 2021	14	14.3%	0.363	0.097

Table 9 T-Tests: Fall 2021 Students With Three Minutes or More on PowerPoint vs. Spring or Summer Students Without PowerPoint by Predicted to Give the Correct or Incorrect Response to the Question

		F	Sig.	t	df	One-Sided p	Mean Difference
Predicted to be **correct**	Equal variances not assumed	5.881	0.018	-1.325	19.924	0.100	-17.8%
Predicted to be **incorrect**	Equal variances not assumed	17.031	0.000	1.850	34.295	0.036	25.0%

5. Discussion

A student's ability to correctly identify and total the balances of asset accounts is a knowledge and skill which should carry over from an entry accounting course to managerial accounting. W show (Hutchins R. & Hutchins G., 2021) evidence that students who are unable to demonstrate this skill by the first exam of the managerial course are less successful on their final exam and in their final course grade. To address these deficiencies in knowledge retention we implemented an experimental intervention to bolster their retention. Students who spent at least three minutes on the intervention had improved performance on the asset question on Exam One. Particularly, the intervention appears to have been more helpful for those predicted to miss the question. We also found that of the five categories of predictor variables engagement had the highest beta weights for the first and most important part of the predictor equation. The measures of knowledge retention were at the middle level of importance.

How might we use these findings to improve student success? Focusing on the introductory course seems unlikely to yield a strong result because of the length of time between courses and the different institutions where the introductory course may have been taken. We believe stronger student performance may come from interventions that increase engagement. (The intervention in our experiment focused more directly on knowledge retention.) Among the intervention possibilities may be small group mentoring sessions, holding required review sessions, and a more extended period for them to work with additional review material.

References

Aldamen H., Duncan K., and Ziegelmayer J. L. (2018). "Cumulative learning and sustained engagement in an introduction to accounting course", *Asian Review of Accounting*, Vol. 26, No. 1, pp. 19-38.

Baldwin B. A. and Ingram R. W. (1991). "Rethinking the objectives and content of elementary accounting", *Journal of Accounting Education*, Vol. 9, No. 1, pp. 1-14.

Byrne M. and Flood B. (2008). "Examining the relationships among background variables and academic performance of first year accounting students at an Irish University", *Journal of Accounting Education*, Vol. 26, No. 4, pp. 202-212.

Danko K., Duke J. C., and Franz D. P. (1992). "Predicting student performance in accounting classes", *Journal of Education for Business*, Vol. 67, No. 5, pp. 270-274.

Doran B. M. et. al. (1991). "Determinants of student performance in accounting principles I and II", *Issues in Accounting Education*, Vol. 6, No. 1, pp. 74-84.

Etter E. R., Burmeister S. A., and Elder R. J. (2000). "Improving student performance and retention via supplemental instruction", *Journal of Accounting Education,* Vol. 18, No. 4, pp. 355-368.

Hutchins R. and Hutchins G. (2021). "Effect of retention of knowledge from the first principles course on performance in the second principles course", *Journal of Higher Education Theory and Practice*, Vol. 21, No. 11, doi: https://doi.org/10.33423/jhetp.v21i11.4674.

Johnson J. W. and LeBreton J. M. (2004). "History and use of relative importance indices in organizational research", *Organizational Research Methods,* Vol. 7, No. 3, pp. 238-257.

Jordan E. E. and Samuels J. A. (2020). "Research initiatives in accounting education: Improving learning effectiveness", *Issues in Accounting Education*, Vol. 35, No. 4, pp. 9-24.

Kaenzig R. and Keller R. (2011). "A comprehensive effort to recruit and retain accounting students", *Journal of Accounting Education*, Vol. 29, pp. 63-78.

Pasewark W. R. (2020). "Research initiatives in accounting education: A proposed agenda for accounting education research", *Issues in Accounting Education*, Vol. 35, No. 4, pp. 3-7.

Papageorgiou E. and Carpenter R. (2019). "Prior accounting knowledge of first-year students at two south African Universities: Contributing factor to academic performance or not?", *South African Journal of Higher Education*, Vol. 33, No. 6, pp. 249-264.

Papageorgiou K. and Halabi A. K. (2014). "Factors contributing toward student performance in a distance education accounting degree", *Meditari Accountancy Research*, Vol. 22, No. 2, pp. 211-223.

Tan L. M. and Laswad F. (2008). "Impact of prior content and meta - cognitive knowledge on students' performance in an introductory accounting course", *Pacific Accounting Review,* pp. 63-74.

Trowler V., Allan R. L., Bryk J., and Din R. R**. (**2021). "Pathways to student engagement: Beyond triggers and mechanisms at the engagement interface", The Higher Education Academy. https://doi.org/10.1007/s10734-021-00798-1.

Warren D. L. and Young M. N. (2012). "Integrated accounting principles: A best practices course for introductory accounting", *Issues in Accounting Education*, Vol. 27, No. 1, pp. 247-266.