Does access to tutorial solutions enhance student performance? Evidence from an accounting course

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Does access to tutorial solutions enhance student performance? Evidence from an accounting course

Abstract:
Whether to release tutorial solutions to students is quite often a dilemma for instructors. This paper provides empirical evidence on the effect of releasing tutorial solutions in a management accounting course at a large Australian university. For this purpose, the paper develops a base model for predicting performance in the course and expands the model to incorporate a variable capturing the release of tutorial solutions. Consistent with prior research (e.g., Doran et al., 1991; Danko-McGhee and Duke, 1992; Kavanagh and Rohde, 1996), in the base model, while performances in an introductory accounting course and the mid-semester test were found to be good predictors of performance in the final examination, evidence on the role of gender and age was weak. In the expanded model, there was no evidence that releasing tutorial solutions improved performance in the final examination. The findings of this paper have policy implications for educators and administrators in education in deciding whether to release tutorial solutions to students.
1. Introduction

The relation between academic ability and performance of students in accounting courses has been widely addressed by researchers (e.g., Miller and Morrison, 1980; Braye and Craig, 1980; Eskew and Faley, 1988; Farley and Ramsay, 1988; Keef, 1988; Lipe, 1989; Tyson, 1989; Buckless, Lipe, and Ravenscroft, 1991; Doran et al., 1991; Auyeung and Sands, 1996; Kavanagh and Rohde, 1996; Rohde and Kavanagh, 1996; Wooten, 1998). One aspect of student learning that is potentially linked to student performance in any course is the issue of students’ access to tutorial solutions. No prior study has addressed this issue. Yet, this is an important research question as the decision to release or withhold tutorial solutions has a wide range of implications for students and instructors. This paper aims to fill this void in the literature by examining whether there is any relationship between releasing tutorial solutions to students and their subsequent performance in an accounting course. In this paper, tutorial solutions are deemed to have been released if students are given access to tutorial answers outside their class time either in print or electronic form, and students can print or download the materials in their own time.

In the wake of recent developments in the business world in terms of technology, globalisation and increased competition, Albrecht and Sack (2000) in their monograph titled “Accounting Education: Charting the Course through a Perilous Future” invite all accounting educators to critically examine the efficacy of pedagogies used in accounting courses. Since there is at least anecdotal evidence that tutorial solutions in accounting courses are distributed to students, this study is a response to Albrecht and Sack’s call. Investigating whether the current practice of releasing tutorial solutions helps students to improve their performance in the course will contribute towards improving pedagogy in accounting courses. For example, if releasing tutorial solutions is shown to

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1 In this paper, the term ‘course’ refers to a subject studied as part of an academic programme.
contribute towards improved student performance, then accounting departments are more likely to adopt a policy of releasing solutions to students as part of an effective pedagogy.

Investigating the impact of releasing tutorial solutions on student performance is also important for several other reasons. First, some of the dilemmas that accounting instructors and administrators face today include issues of uploading lecture slides to the web and releasing tutorial solutions via the web. Second, tutorials play a key role in student learning and assessment. Releasing tutorial solutions on a regular basis may be detrimental to the perception of tutorials in the learning process. Students may perceive attending tutorials as totally redundant, because all the answers they need to know will be available without attending tutorials. Third, instructors and course administrators tend to benefit from releasing tutorial solutions as there is reduced demand on their (consultation) time and greater student satisfaction. Fourth, releasing tutorial solutions has potential implications for resource allocation and staffing requirements.

On investigating the research question, this paper develops a base model for predicting performance in an accounting course. This base model is then expanded to test whether access to tutorial solutions has any effect on student performance. Both the base model and the expanded model are tested on a sample of 411 students comprising test and control groups who studied an introductory management accounting course at undergraduate level at a large Australian university. Consistent with previous research (e.g., Doran et al., 1991; Danko-McGhee and Duke, 1992; Kavanagh and Rohde, 1996), the base model shows that while performances in an introductory accounting course and the mid-semester test are good predictors of performance in the management accounting course, evidence on the role of gender and age is inconclusive. In the expanded

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2 In fact, a casual survey of the introductory management accounting course at seven Australian universities suggests that in four of them tutorial solutions were released to students.
model, empirical results do not support the notion that releasing tutorial solutions to students enhances student performance in the course. Performance in the course is measured by the percentage of marks obtained in the final examination. The empirical results are robust to two alternative specifications of the research models, and potential differences in the level of difficulty or complexity in the examinations between the test group and the control group.

The remainder of the paper is organised as follows. Section 2 provides a brief overview of the prior research on performance in accounting courses. Section 3 develops the hypothesis. Section 4 discusses research design and sample selection procedure. In section 5, results are reported and discussed. Section 6 provides a summary, discusses the limitations of the paper, and provides future research directions.

2. Prior research on performance in accounting courses

Prior research on performance in accounting courses has identified several factors that determine success in tertiary level accounting courses. The key factors that determine success include general academic ability and prior accounting knowledge at secondary school level (Baldwin and Howe, 1982; Bergin, 1983; Schroeder, 1986; Farley and Ramsay, 1988; Eskew and Faley, 1988; Doran et al., 1991; Ramsay and Baines, 1994; Rohde and Kavanagh, 1996), and performance in an entry or diagnostic examination (Danko-McGhee and Duke, 1992; Hicks and Richardson, 1984; Delaney et al., 1979; Buehlmann, 1975; McCormick and Montgomery, 1974).

In relation to age, some studies argue that age should have a positive effect on performance because mature age students have higher level of motivation, sometimes have practical experience, and are able to adopt a more solid approach to their learning (e.g., Jackling and Anderson, 1998; Moses, 1987). On the contrary, Koh and Koh (1999) find that age has a consistently negative effect on performance.

In summary, while the evidence on age, gender and ethnic background is varied, there is strong evidence that performance in an introductory accounting course is influenced by general academic ability, and prior accounting knowledge at school level. Further, general academic ability, performance in an introductory accounting course, and score in a diagnostic entry examination have a positive effect on performance in higher-level courses.\(^3\) Table 1 provides a summary of the relevant literature on the factors influencing student performance in accounting courses. The next section proposes a hypothesis on the association between tutorial solutions and student performance.

3. **Hypothesis**

3.1 **Role of tutorials**

In recent times, the practice of teaching students in small groups at universities or schools has emanated from the ancient practice of philosopher-tutors (Gordon and Gordon, 1990). The educational principle of these philosopher-tutors was to recognise the individual differences of students and focus on developing an individual student’s thinking process (Gordon et al., 2004). In the 20\(^{th}\) century, this form of tutoring has been adopted for the common form of schooling with some modification. Perhaps due to economies of scale, students are taught in small groups rather than individually.

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\(^3\) Prior research has also investigated a variety of other factors that potentially influence student performance in tertiary education. These include the use of PowerPoint presentation (Rankin and Hoaas, 2001), the effect of multimedia instruction (Luna and McKenzie, 1997), the effect of
Gordon et al. (2004) summarised the benefits of tutoring as a form of education. These include the personal attention given to students, providing continuous feedback on student progress, mentoring students on learning how to learn, and using students’ academic strengths to overcome weaknesses. Research suggests that tutoring results in positive outcomes in terms of measures of achievement, measures of self-esteem, and intrinsic interest in the subject (Cohen et al., 1982; Gage and Berliner, 1992).

In the current twin pedagogical structure of lectures followed by tutorials, tutorials play a pivotal role in reinforcing and extending the knowledge disseminated to students via lectures. Typically, students attend lectures for a first exposure to the course materials and tutorials provide a platform for consolidating student learning through more interactive discussion and problem-solving activities. Lectures, especially in large undergraduate classes, are typically a one-way communication from the lecturer to the students. In contrast, tutorials provide the appropriate forum for a two-way communication between the instructor and students. As tutorials permit interactive discussion on course topics via tutorial questions and problem-solving activities, tutorials play a key role in consolidating students’ course-specific knowledge. Further, in traditional accounting courses where student assessment comprises mainly closed-book examinations during and at the end of the semester, questions on the examination may largely follow the format of tutorial questions. In such an environment, students would be keen to access tutorial solutions. However, there are arguments both for and against releasing tutorial solutions.

3.2 Arguments for and against releasing tutorial solutions

Anecdotal evidence from course evaluation and feedback from tutors suggests that there are several arguments in favour of releasing tutorial solutions to students. One of the key arguments in favour of releasing tutorial solutions is attendance policy and class size (Caviglia-Harris, 2004), test design (Czaja and Barty, 2004), and the choice of textbook (Pyne, 2004).
that students learn better if they have solutions that they can refer to as the “perfect” or “model” answers in their own time. If the set of tutorial solutions is perceived as an additional resource available to students, the students are expected to benefit from it. In particular, students can use the tutorial solutions in developing skills on how to frame their answers to particular questions and consequently, they will be expected to perform better in the examinations.

Further, valuable tutorial time can be saved as students will not engage in copying down answers. Student comments in course evaluations often point to the sheer amount of writing involved for copying down solutions. They perceive this as a serious barrier to paying attention to the discussions or participating in the class. Thus, it is often argued that tutorials could be made more interactive and “lively” by reducing the amount of writing involved in each tutorial by releasing solutions to students.

One of the key arguments against releasing tutorial solutions surrounds the fear that students may suffer from “false complacency” regarding their command over the course materials. They might think that since they have solutions, they are able to understand the course materials faster and grasp difficult materials on their own. This false complacency may lead to poor learning and higher failing rate in the class. Further, there is a fear that tutorial attendance may drastically drop as students can have access to solutions without attending tutorials. Prior research suggests that class attendance is positively correlated to the perceived value added during the class (Marburger, 2001). If tutorial solutions are available to all students regardless of tutorial attendance, then students may perceive that attending tutorials adds little value to their learning experience. In contrast, instructors may perceive tutorials as an important part of the overall learning experience. This apparent incongruity of perceptions between students and instructors about the value of tutorials may defeat the objectives of the course in terms of learning outcome.
On balance, if students are given access to tutorial solutions, one of the 
overriding reasons would be to facilitate student learning and thereby, enhance 
student performance in the course. Thus, the proposition that is tested in this 
paper is whether access to tutorial solutions does improve student performance in 
the course. In the alternative form:

\[ H_1: \text{Releasing tutorial solutions leads to better student performance in the course.} \]

4. Research design and sample selection

4.1 Research design

A quasi-experimental design with a control group is used to test the 
hypothesis. The test group is a large class of 274 students who studied an 
introductory management accounting course at undergraduate level in the second 
semester of 2001 in a major Australian university. The control group is a class of 
249 students who studied the same course one year earlier at the same 
university. A model for predicting performance in this course is developed based 
on prior literature (Doran \textit{et al.}, 1991; Danko-McGhee and Duke, 1992; 
Carpenter \textit{et al.}, 1993; Rohde and Kavanagh, 1996; Keef and Roush, 1997; 
The control and the test groups were compared in terms of their performance in 
the final examination. Tutorial solutions in the course were released to the test 
group only after the mid-semester examination whereas solutions were not 
released to the control group.

This study focussed on an introductory management accounting course. 
The course dealt with basic cost concepts, cost behaviour analysis, cost-volume- 
profit analysis, job costing, process costing, activity-based costing, cost planning 
and control via budgets and responsibility accounting, and analysis of input 
variances. The course was built on 13 weekly 2-hour lectures followed by 2-hour 
weekly tutorials. There was no assessment component attached to the tutorials 
and tutorial attendance was voluntary. Tutorial questions were set to demonstrate 
the practical applications of the concepts discussed during the lecture. For the
test group, beginning with week 7 (one week after the mid-semester examination was held), detailed tutorial solutions were released on a week by week basis. Solutions for each week were released via posting to the course website on Friday afternoon following the completion of all tutorials in that week. Solutions were detailed to the level that was required by students in answering examination questions. All tutorial questions listed for each week were discussed in detail during the tutorials. Solutions on topics covered before the mid-semester examination were not released. This was done intentionally to use the mid-semester results as pre-test scores for both groups.

Both the mid-semester and the final examinations closely followed the pattern of questions covered in the tutorials and required the same skills that were developed through tutorial discussions. Neither the mid-semester nor the final examination overlapped in topic content. The control sample studied the same syllabus except for one topic, used the same textbook as the test sample, and had similar assessment schemes. Neither the test group nor the control group was aware of the study undertaken. Both the final and mid-semester examinations were set by a team of two instructors. In addition, the final examination questions were vetted by a moderator. All these factors contributed to creating the best possible conditions for the basis of comparison of performance between the two groups.

4.2 Sample selection

From the initial test sample of 274 students, 39 students were excluded from the sample as they did not sit the regular final examination and applied for a special or supplementary examination. The control sample had initially 249 enrolled students of which seven did not sit the final examination and were therefore excluded from the sample. Dates of birth were missing for six students in the control group and eight students in the test group. Further, 31 students in the control group and 21 students in the test group were excluded from the sample because these students were exempted from taking the introductory
accounting course at the present university due to their study at other universities. The final sample had 206 students in the test group and 205 students in the control group. Data on all the variables were collected from university records. The sample breakdown is shown in Table 2.

| INSERT TABLE 2 HERE |

4.3 **Research model**

Spearman (1904, 1927) proposes that student performance in an academic subject is a function of the student’s general ability and specific ability in the subject. Spearman’s model has been directly or indirectly used in accounting education research. In particular, general academic ability has been measured by high school grade point average (HSGPA), overall performance (OP) score, or in university courses the overall grade point average (GPA) (e.g., Doran et al., 1991; Danko-McGhee and Duke, 1992; Carpenter et al., 1993; Rohde and Kavanagh, 1996; Keef and Roush, 1997; Jackling and Anderson, 1998; Hartnett et al., 2004). Proxies used for specific ability in accounting courses are performance in an introductory accounting course, performance on a mid-term test in the same course or performance in a diagnostic entrance examination (e.g., Doran et al., 1991; Danko-McGhee and Duke, 1992; Keef and Roush, 1997; Drennan and Rohde, 2002).

Based on Spearman’s (1904, 1927) model and prior research on accounting education, the following model is proposed for predicting performance of students in the introductory management accounting course:

\[
FINAL_i = b_0 + b_1MID_i + b_2INTRO_i + b_3GENDER_i + b_4AGE_i + e_i
\]  

where \(FINAL_i\) is the percentage of marks obtained by student \(i\) in the final examination; \(MID_i\) is the percentage of marks obtained by student \(i\) in the mid-semester examination; \(INTRO_i\) is the grade obtained by student \(i\) (on a 7-point scale) for the introductory accounting course; \(GENDER_i\) is a dummy variable which takes a value of one for male students and zero for female students; \(AGE_i\) is the age of student \(i\) (measured in years at the beginning of the semester in
which the student studied the course) and $e_i$ is the error term. The variables $MID_i$ and $INTRO_i$ are expected to have positive coefficients whereas the direction is not clear for the coefficients of $GENDER_i$ and $AGE_i$. In model (1), $MID_i$ is a proxy for the student's specific ability in the course because the mid-semester examination was held just prior to releasing the tutorial solutions. Although the variable $INTRO_i$ can be interpreted as a measure of specific ability, it at least partly captures general academic ability of students to the extent that general ability influences specific ability.\(^4\)

In testing whether access to tutorial solutions has any positive effect on student performance in the final examination, model (1) is expanded as follows:

$$\text{FINAL}_i = b_0 + b_1MID_i + b_2INTRO_i + b_3GENDER_i + b_4AGE_i + b_5\text{RELEASE}_i + b_6\text{RELEASE}^*MID_i + b_7\text{RELEASE}^*INTRO_i + b_8\text{RELEASE}^*\text{GENDER}_i + b_9\text{RELEASE}^*\text{AGE}_i + e_i$$

(2)

where $\text{RELEASE}_i$ is a dummy variable introduced for testing $H_1$ and takes a value of one for the test group and zero for the control group. $\text{RELEASE}^*\text{MID}$, $\text{RELEASE}^*\text{INTRO}$, $\text{RELEASE}^*\text{GENDER}$ and $\text{RELEASE}^*\text{AGE}$ are all interaction variables incorporated to test whether the test and the control groups differ systematically in terms of performance in the mid-semester examination, introductory accounting course, gender composition, and age distribution. As per $H_1$, the predicted sign for the variable $\text{RELEASE}$ is positive. Model (2) is estimated on the total sample combining the test and control samples.

5. Results and discussion

5.1 Descriptive statistics

Table 3 shows descriptive statistics for the variables in the study. As Panel A of Table 3 shows, the mean (median) score for the test sample in the mid-semester examination is 61.09 per cent (61.43 per cent) compared to 50.86 per cent...\(^{11}\)

\(^{4}\) Although some previous studies have used overall GPA as a proxy for general academic ability, using overall GPA is problematic to the extent that it will include courses which are totally unrelated to management accounting and students’ performance in unrelated courses could be very different from that of accounting courses (Drennan and Rohde, 2002). Further, inclusion of GPA as a predictor may...
cent (49.50 per cent) in the final examination. Thus, it appears that students in the test group performed better in the mid-semester examination than in their final examination. Panel B of Table 3 suggests that the control sample performed better in the final examination than in the mid-semester examination. The mean (median) score of 62.98 per cent (65.45 per cent) in the final examination is higher than that of 57.27 per cent (56.67 per cent) in the mid-semester examination.

The test and control samples appear to be equivalent in other key aspects such as distribution of grades in the introductory accounting course (mean grades of 4.82 and 4.70), gender composition (51 per cent and 50 per cent), and age distribution (mean ages of 20.35 and 20.25 years, respectively).

5.2 Univariate tests

Table 4 reports the results of the independent samples t-test, the Mann-Whitney U-test, and the Kolmogorov-Smirnov Z test on the differences between the test group and the control group. While the two groups do not differ in terms of their performance in the introductory accounting course (t-statistic = 1.077), they differ significantly in terms of their performance in the final examination (t-statistic = -6.214, p-value = .000) and the mid-semester examination (t-statistic = 2.222, p-value = .027).

5.3 Regression analysis

As Table 5 suggests, the variables MID (r = .590, p-value = .000) and INTRO (r = .560, p-value = .000) are significantly positively correlated to the dependent variable FINAL. AGE is significantly negatively correlated to both MID (r = -.179, p-value = .000) and FINAL (r = -.176, p-value = .000).
OLS estimates of models (1) and (2) on the total sample of 411 students are reported in Table 6. Overall, models (1) and (2) explain 40.36 per cent and 53.61 per cent of the variability in the dependent variable, respectively. This compares favourably against some other studies which investigated student performance in accounting courses. Adjusted $R^2$ reported by some studies are as follows: Rohde and Kavanagh (1996) 28 per cent and 28.7 per cent; Hartnett et al., (2004) 36.1 per cent and 41.8 per cent.

As Table 6 suggests, in both models, the variables $MID$ (t-statistic = 7.891 in model (1), 6.358 in model (2)) and $INTRO$ (t-statistic = 6.192 in model (1), 6.054 in model (2)) have the predicted positive sign and are statistically significant with a $p$-value of .000. The variable $GENDER$ is insignificant in model (1), but weakly significant (t-statistic = 1.946, $p$-value = .052) in model (2) suggesting that male students marginally outperform females in the course. The variable $AGE$ is not significant in either model. The variable for testing hypothesis 1, $RELEASE$ is insignificant with a t-statistic of -.814 ($p$-value = .416). Thus, releasing tutorial solutions to students appears to have no impact on student performance in the final examination.

All the interaction variables except $RELEASE*INTRO$ have insignificant t-statistics. This implies that the test and control groups do not differ statistically from each other in terms of performance in the mid-semester examination, gender or age. The coefficient of $RELEASE*INTRO$ has a negative sign and is weakly significant (t-statistic = -1.747, $p$-value = .081). Thus, there is weak evidence that the test group performed poorly in the introductory accounting course relative to the control group. Diagnostic tests were undertaken to ensure that the key assumptions underlying the linear regression model were not violated by the data.5

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5 The dependent variable $FINAL$ does not depart from the normal distribution (Kolmogorov-Smirnov $Z$ statistic = 1.019 (2-tailed exact significance = .276)). Diagnostic tests were also undertaken for multicollinearity, heteroscedasticity and first-order serial correlation. The estimated Durbin-Watson statistic of 1.4975 in model (1) (1.819 in model (2)) suggests that first-order serial correlation in error systematically related to gender (Keef and Roush, 1997).
5.4 Sensitivity tests

5.4.1 Differences in the level of difficulty among examinations

There is a possibility that there are differences between the test and control group’s final and mid-semester examination. To address these issues, the distributions of the examination scores were adjusted as follows.

Both the test and control group’s final examination scores were adjusted by adding the median score in the mid-semester examination of the control group and subtracting the respective group’s median score in the final examination. The mid-semester examination scores for the test group were adjusted by subtracting the group’s median score in that examination and adding the control group’s median score in the respective examination.

Results, not tabled in the paper, of re-estimating model (2) after adjusting the mid-semester and final examination scores remain quantitatively similar to the results reported in Table 6. The adjusted $R^2$ of the re-estimated model is 49.8 per cent. Hypothesis 1 is not supported due to the insignificant $t$-statistic of the variable $RELEASE$ ($t$-statistic = .395, $p$-value = .693).

5.4.2 Alternative specification of model (2)

Because the variables $MID$ and $INTRO$ are highly correlated ($r = .631$, $p$-value = .000), model (2) was re-estimated after excluding the variable $INTRO$. Results not tabled suggest that adjusted $R^2$ would decrease to 48.3 per cent from 53.6 per cent as reported in Table 6. Results for all the variables remain quantitatively similar to that reported in Table 6 except for $AGE$ and $RELEASE*MID$. $AGE$ is now weakly significant ($t$-statistic = -1.691, $p$-value = .092) and $RELEASE*MID$ is significant ($t$-statistic = -2.445, $p$-value = .015).

Multicollinearity terms is unlikely to be a serious threat. The multicollinearity test using the variance inflation factor (VIF) suggests that variables $MID$ and $INTRO$ have VIF of 4.477 and 3.470, respectively, compared to the benchmark VIF of one (in the absence of any relationship). Thus, multicollinearity does not appear to be a serious problem in the data.
These results suggest that when performance in the introductory accounting course (INTRO) is excluded, age has a negative effect on performance in the course and the test group performed poorly relative to the control group in the mid-semester examination.

5.4.3 **Did student performance improve in the final examination?**

So far, all empirical tests suggest that releasing the tutorial solutions to the students has no effect on their performance. Remember that tutorial solutions in this course were released after the mid-semester examination. Hence, an alternative test for detecting the potential impact of releasing the solutions would be to examine whether the test group was more likely to show improvement in the final examination than the control group. All else being equal, any significant improvement in performance in the final examination for the test group (relative to the control group) could be associated with the release of solutions. To implement this test, a gain score is computed by subtracting the adjusted standardised mid-semester examination score from the adjusted standardised final examination score for each student.\(^6\) If the gain score is positive (negative)\(^7\), the individual student is considered to have (have not) made an improvement and the positive (negative) gain score is assigned a value of one (zero). Following this procedure, a binary logistic model is employed to test the proposition.

\[
\ln \left( \frac{P_i}{1 - P_i} \right) = \alpha + \beta_1 \text{MID}_i + \beta_2 \text{INTRO}_i + \beta_3 \text{GENDER}_i + \beta_4 \text{AGE}_i + \beta_5 \text{RELEASE}_i + \xi_i \quad (3)
\]

where \(P_i\) is the probability of improving performance in the final examination relative to the performance in the mid-semester examination. Definitions for all other variables remain as in model (2).\(^8\) Model (3) is tested both on the total

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\(^6\) Adjusted scores were used instead of raw scores to address the concerns raised earlier that examinations within the same group and between the two groups could be of different complexity/difficulty.

\(^7\) There was no case where gain score was equal to zero.

\(^8\) In model (3), the coefficient for MID is expected to be negative because the higher the score in the mid-semester examination, the lower the probability of making an improvement in the final examination. However, the variable INTRO should still have a positive sign because for a given score in the mid-semester examination, the likelihood of improving the score in the final would depend on the student’s general proficiency in the accounting area.
sample of 411 students and a sub-sample of 301 students who passed the course with a grade of four or more.

As Table 7 shows, based on the Hosmer and Lemeshow test, model (3) fits well both with the full sample and the sub-sample ($\chi^2$ statistic with 8 degrees of freedom = 5.76 and 8.25 with $p$-values of .674 and .409, respectively). In both samples, results for the variables $MID$ and $INTRO$ are qualitatively similar to that reported in Table 6. While $GENDER$ is an insignificant variable in both samples, there is weak evidence that $AGE$ has a negative effect on the likelihood of improving performance in the final examination ($Wald$ statistics for the total sample and sub-sample are 2.712 and 3.388 with $p$-values of .100 and .066, respectively, (two-tailed test)). Although the variable $RELEASE$ is weakly significant with a negative sign in the total sample ($Wald$ statistic = 2.888, $p$-value = .089), it is insignificant in the sub-sample ($Wald$ statistic = .157, $p$-value = .692). Thus, while access to tutorial solutions has a weak negative effect in general on the chances of improving performance in the final examination, it has no effect on the students with better academic ability (those who passed the course with a grade of four or more). This is consistent with the notion of “false complacency” induced by access to tutorial solutions among the weaker students in the class.9

INSERT TABLE 7 HERE

In summary, several tests in this paper suggest that performances in the mid-semester examination and the introductory accounting course are strong predictors of performance in the final examination of the introductory management accounting course. However, it is not surprising that gender and age have mixed or little explanatory power because prior research provides varied

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9 The notion of false complacency is also consistent with ever declining tutorial attendance in the test group. In the test group, the mean (median) attendance of 88.15 per cent (87.50 per cent) of the enrolled students across 13 tutorial groups in week 1 gradually dropped to 67.24 per cent (68.42 per
evidence on these two variables. The dummy variable \textit{RELEASE} produces weak negative or insignificant results. Thus, the hypothesis that releasing tutorial solutions improves student performance is not supported. To the contrary, the balance of evidence suggests that performance in the course may suffer due to “false complacency”. This is true, at least, for the weaker students in the class.

6. Conclusion and future directions for research

Whether or not to release tutorial solutions is always a dilemma for university instructors. Anecdotal evidence suggests that instructors sometimes release tutorial solutions due to popular student demand. However, there is no empirical evidence on whether releasing tutorial solutions does improve student performance. This paper empirically tests this issue.

Using a sample comprising test and control groups of 411 students in a management accounting course at a large Australian university, this study provides evidence that releasing tutorial solutions does not improve student performance in the final examination relative to performance in the mid-semester examination. To the contrary, student performance may decline due to “false complacency”. The threats of spurious test results are eliminated by carefully choosing the timing of releasing tutorial solutions and by employing an appropriate control group.

The results of this study have policy implications for instructors and academic administrators. Instructors who decide to release solutions need to find a justification for doing so since such a decision is not free of costs. Further, routine distribution of tutorial solutions may change the perception of the role of tutorials and the attitude of students towards tutorials. If learning is measured by performance in the final examination, then the empirical evidence in this paper suggests that releasing tutorial solutions does not improve students’ learning.

cent) by week 6. These attendance rates further dropped to 53.27 per cent and 54.84 per cent, respectively, by week 12.
Consequently, improved student performance cannot be used as a justification for releasing tutorial solutions.

Although several key factors that affect student performance have been isolated, several other influential factors could not be addressed in the study. These factors include difficulty level of the course (e.g., introductory or advanced), the structure of the course (e.g., types of assessment used, mode of course delivery), quality and experience of tutors, timing of the release of solutions, and coverage of solutions in the tutorials. This study did not consider the influence of the learning environment on students’ learning approaches. Thus, the learning approaches used by students in the course studied remain as an omitted variable to the extent that learning approaches influence learning outcomes (English et al., 2004; Hall et al., 2004). Another limitation of the present study is that identical examinations were not used for the two groups. Using identical examinations could control for any potential difference in performance between the two groups due to differences in the examinations.

All these factors offer opportunities for future research that would enhance the external validity of this study. Further, the research question in this paper may be investigated in the future using multiple courses, across multiple campuses or in a multi-year setting. Future research may also investigate whether releasing solutions prior to tutorials has any positive effect on student performance. Other potential avenues for research include examining the impact of the quality of teaching or student absenteeism on the relation between the release of tutorial solutions and student performance, and examining the impact of compulsory tutorial attendance where tutorials are part of the assessment.

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References


Table 1

Summary of prior research investigating student performance in accounting courses

<table>
<thead>
<tr>
<th>Issue investigated</th>
<th>Studies investigating this issue</th>
<th>Evidence</th>
</tr>
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<tbody>
<tr>
<td>Performance in introductory accounting course</td>
<td>Baldwin and Howe (1982); Bergin (1983); Schroeder (1986); Farley and Ramsay (1988); Eskew and Faley (1988); Doran et al., (1991); Ramsay and Baines (1994); Rohde and Kavanagh (1996)</td>
<td>General academic ability and prior accounting knowledge at school level have a significantly positive effect on performance</td>
</tr>
<tr>
<td>Effect of prior accounting knowledge at school level on tertiary-level accounting courses</td>
<td>Eskew and Faley (1988); Farley and Ramsay (1988); Keef and Hooper (1991)</td>
<td>Prior accounting knowledge has a significantly positive effect until the end of first year at university</td>
</tr>
<tr>
<td></td>
<td>Kavanagh and Rohde and (1996); Drennan and Rohde (2002)</td>
<td>Significantly positive effect</td>
</tr>
<tr>
<td>Effect of performance in an entry examination on subsequent courses</td>
<td>Danko-McGhee and Duke (1992); Hicks and Richardson (1984); Delaney et al., (1979); Buehlmann (1975); McCormick and Montogomery (1974)</td>
<td>Performance in an entry or a diagnostic examination has a significantly positive effect</td>
</tr>
</tbody>
</table>

(Table 1 continued on next page)
<table>
<thead>
<tr>
<th>Issue investigated</th>
<th>Studies investigating this issue</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role of gender and ethnic background on performance in accounting courses</td>
<td>Carpenter et al., (1993); Keef and Roush (1997)</td>
<td>Performance varies across different ethnic backgrounds; male and female students perform equally well. No evidence of gender or ethnicity-based differences in examination performance.</td>
</tr>
<tr>
<td>Effect of PowerPoint presentations on performance</td>
<td>Rankin and Hoaas (2001)</td>
<td>No significant effect on student performance.</td>
</tr>
<tr>
<td>Impact of test design and administration on student performance</td>
<td>Czaja and Barty (2004)</td>
<td>Performance is significantly negatively related to the level of difficulty of a test design and the materials that are hard to recall.</td>
</tr>
<tr>
<td>Effect of attendance policies and class size on student performance</td>
<td>Caviglia-Harris (2004)</td>
<td>Performance is not influenced by class size and attendance policy.</td>
</tr>
</tbody>
</table>
Table 2  
Determination of sample

<table>
<thead>
<tr>
<th></th>
<th>Test group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students enrolled in the course</td>
<td>274</td>
<td>249</td>
</tr>
<tr>
<td>Less students who did not sit the regular exam</td>
<td>39</td>
<td>7</td>
</tr>
<tr>
<td>Less students whose birth dates were unavailable</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Less students who were exempted from taking the introductory accounting course</td>
<td>21</td>
<td>31</td>
</tr>
<tr>
<td>Final sample</td>
<td>206</td>
<td>205</td>
</tr>
</tbody>
</table>
Table 3
Descriptive statistics for the variables

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>25th percentile</th>
<th>Median</th>
<th>75th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>25th per cent</td>
<td></td>
<td>75th per cent</td>
</tr>
<tr>
<td>Panel A: Test sample (N = 206)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FINAL</td>
<td>50.86</td>
<td>17.15</td>
<td>39.50</td>
<td>49.50</td>
<td>64.00</td>
</tr>
<tr>
<td>MID</td>
<td>61.09</td>
<td>19.05</td>
<td>47.85</td>
<td>61.43</td>
<td>74.28</td>
</tr>
<tr>
<td>INTRO</td>
<td>4.82</td>
<td>1.12</td>
<td>4.00</td>
<td>5.00</td>
<td>6.00</td>
</tr>
<tr>
<td>GENDER</td>
<td>.51</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>AGE</td>
<td>20.35</td>
<td>2.18</td>
<td>19.06</td>
<td>19.61</td>
<td>20.96</td>
</tr>
<tr>
<td>Panel B: Control sample (N = 205)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FINAL</td>
<td>62.98</td>
<td>22.08</td>
<td>45.45</td>
<td>65.45</td>
<td>80.00</td>
</tr>
<tr>
<td>MID</td>
<td>57.27</td>
<td>15.68</td>
<td>46.67</td>
<td>56.67</td>
<td>66.25</td>
</tr>
<tr>
<td>INTRO</td>
<td>4.70</td>
<td>1.18</td>
<td>4.00</td>
<td>5.00</td>
<td>6.00</td>
</tr>
<tr>
<td>GENDER</td>
<td>.50</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>AGE</td>
<td>20.25</td>
<td>2.66</td>
<td>18.76</td>
<td>19.58</td>
<td>21.02</td>
</tr>
</tbody>
</table>

Note: Because of differential length and weight between the mid-semester and the final examinations, all examination scores have been standardised on a scale of 100.

Variable definition:

FINAL = Percentage of marks in the final examination
MID = Percentage of marks in the mid-semester examination
INTRO = Grade obtained in the introductory accounting course (on a scale of 1 to 7)
GENDER = Dummy variable which takes a value of 1 for males and 0 for females
AGE = Age of students measured in years at the start of the semester when they undertook the management accounting course
Table 4
Results of Independent Samples t-test, Mann-Whitney U test, and Kolmogorov-Smirnov Z test: The test group vs. the control group

<table>
<thead>
<tr>
<th>Variable</th>
<th>t-statistic</th>
<th>Sig. (2-tailed)</th>
<th>Z-statistic</th>
<th>Asymp. Sig. (2-tailed)</th>
<th>Kolmogorov-Smirnov Z</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FINAL</td>
<td>-6.214</td>
<td>.000</td>
<td>-5.775</td>
<td>.000</td>
<td>3.022</td>
<td>.000</td>
</tr>
<tr>
<td>MID</td>
<td>2.222</td>
<td>.027</td>
<td>-2.434</td>
<td>.015</td>
<td>1.908</td>
<td>.001</td>
</tr>
<tr>
<td>INTRO</td>
<td>1.077</td>
<td>.282</td>
<td>-1.199</td>
<td>.230</td>
<td>.664</td>
<td>.770</td>
</tr>
<tr>
<td>GENDER</td>
<td>.147</td>
<td>.883</td>
<td>-.147</td>
<td>.883</td>
<td>.074</td>
<td>1.00</td>
</tr>
<tr>
<td>AGE</td>
<td>.418</td>
<td>.676</td>
<td>-1.651</td>
<td>.099</td>
<td>1.683</td>
<td>.007</td>
</tr>
</tbody>
</table>

Variable definitions appear in Table 3.
Table 5
Pearson’s bi-variate correlation matrix

<table>
<thead>
<tr>
<th></th>
<th>FINAL</th>
<th>MID</th>
<th>INTRO</th>
<th>GENDER</th>
<th>AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MID</td>
<td>.590**</td>
<td>.560**</td>
<td>.631**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.000)</td>
<td>(.000)</td>
<td>(.000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INTRO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GENDER</td>
<td>.016</td>
<td>-.014</td>
<td>-.067</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.751)</td>
<td>(.779)</td>
<td>(.175)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGE</td>
<td>-.176**</td>
<td>-.179**</td>
<td>-.243**</td>
<td>.085</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.000)</td>
<td>(.000)</td>
<td>(.000)</td>
<td>(.085)</td>
<td></td>
</tr>
<tr>
<td>RELEASE</td>
<td>-.294**</td>
<td>.109*</td>
<td>.053</td>
<td>.007</td>
<td>.021</td>
</tr>
<tr>
<td></td>
<td>(.000)</td>
<td>(.027)</td>
<td>(.282)</td>
<td>(.883)</td>
<td>(.676)</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
N = 411

Variable definitions appear in Table 3.
Table 6
OLS estimates of models (1) and (2) on the full sample of 411 students

Model 1: \( \text{FINAL}_i = b_0 + b_1 \text{MID}_i + b_2 \text{INTRO}_i + b_3 \text{GENDER}_i + b_4 \text{AGE}_i + e_i \)

Model 2: \( \text{FINAL}_i = b_0 + b_1 \text{MID}_i + b_2 \text{INTRO}_i + b_3 \text{GENDER}_i + b_4 \text{AGE}_i + b_5 \text{RELEASE}_i + b_6 \text{RELEASE}^*\text{MID}_i + b_7 \text{RELEASE}^*\text{INTRO}_i + b_8 \text{RELEASE}^*\text{GENDER}_i + b_9 \text{RELEASE}^*\text{AGE}_i + e_i \)

<table>
<thead>
<tr>
<th>Expected sign</th>
<th>Standardised Coefficient (t-statistic)</th>
<th>Standardised Coefficient (t-statistic)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[p-value]</td>
<td>[p-value]</td>
</tr>
<tr>
<td>Intercept</td>
<td>?</td>
<td>(1.018)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[.309]</td>
</tr>
<tr>
<td>MID</td>
<td>+</td>
<td>.388</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(7.891)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[.000]</td>
</tr>
<tr>
<td>INTRO</td>
<td>+</td>
<td>.309</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6.192)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[.000]</td>
</tr>
<tr>
<td>GENDER</td>
<td>?</td>
<td>.045</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.169)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[.243]</td>
</tr>
<tr>
<td>AGE</td>
<td>?</td>
<td>-.035</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-.878)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[.380]</td>
</tr>
<tr>
<td>RELEASE</td>
<td>+</td>
<td>-.300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-.814)</td>
</tr>
<tr>
<td>RELEASE*MID</td>
<td>+</td>
<td>-.039</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-.229)</td>
</tr>
<tr>
<td>RELEASE*INTRO</td>
<td>+</td>
<td>-.344</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-1.747)</td>
</tr>
<tr>
<td>RELEASE*GENDER</td>
<td>?</td>
<td>-.076</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-1.289)</td>
</tr>
<tr>
<td>RELEASE*AGE</td>
<td>?</td>
<td>.348</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.147)</td>
</tr>
</tbody>
</table>

F-statistic [p-value] 70.367 [.000] 53.777 [.000]

Adjusted \( R^2 \) 40.36% 53.61%

Durbin-Watson statistic 1.4957 1.819

\( \text{FINAL} \) = Percentage of marks in the final examination
\( \text{MID} \) = Percentage of marks in the mid-semester examination
\( \text{INTRO} \) = Grade obtained in the introductory accounting course (on a scale of 1 to 7)
\( \text{GENDER} \) = Dummy variable which takes a value of 1 for males and 0 for females
\( \text{AGE} \) = Age of students measured in years at the start of the semester when they undertook the management accounting course
\( \text{RELEASE} \) = dummy variable which takes a value of 1 for the test group and 0 for the control group
Table 7
Results of Binary Logistic Regression using Model (3):

\[
\ln \left( \frac{P_i}{1 - P_i} \right) = \alpha + \beta_1 \text{MID}_i + \beta_2 \text{INTRO}_i + \beta_3 \text{GENDER}_i + \beta_4 \text{AGE}_i + \beta_5 \text{RELEASE}_i + \xi
\]

<table>
<thead>
<tr>
<th>Expected Sign</th>
<th>Full sample (N = 411)</th>
<th>Sub-sample where Grade≥4 (N = 301)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient (p-value)</td>
<td>Coefficient (p-value)</td>
</tr>
<tr>
<td>Intercept</td>
<td>?</td>
<td>1.974 (2.663, .103)</td>
</tr>
<tr>
<td>MID</td>
<td>-</td>
<td>-.056 (39.239, .000)</td>
</tr>
<tr>
<td>INTRO</td>
<td>+</td>
<td>.617 (.000)</td>
</tr>
<tr>
<td>GENDER</td>
<td>?</td>
<td>.043 (.041)</td>
</tr>
<tr>
<td>AGE</td>
<td>?</td>
<td>-.079 (.839)</td>
</tr>
<tr>
<td>RELEASE</td>
<td>+</td>
<td>-.360 (.326)</td>
</tr>
</tbody>
</table>

Hosmer and Lemeshow test:
\[ \chi^2 \text{ statistic (8 degrees of freedom) [p-value]} \]
Correct classification per cent by model: 63.7% 68.8%

-2 Log Likelihood of model
(Initial -2 Log Likelihood)
Nagelkerke (1991) \( R^2 \)

\[ 514.392 \] 336.289
\[ 569.219 \] 415.196
\[ 16.7\% \] 30.8%

\( P_i \) is the probability of improvement in the final examination over the performance in the mid-semester examination by student \( i \). Improvement is a dummy variable which takes a value of one if the percentage of marks in the final examination exceeds the percentage of marks obtained in the mid-semester examination, zero otherwise. \( \text{MID}_i \) is the percentage of marks obtained by student \( i \) in the mid-semester examination. Final examination scores for both the test and control group, and the mid-semester examination scores for the test group have been adjusted so that each distribution of examination scores has the same median as the mid-semester examination of the control group. \( \text{INTRO} = \) Grade obtained in the introductory accounting course (on a scale of 1 to 7). \( \text{GENDER} = \) Dummy variable which takes a value of 1 for males and 0 for females. \( \text{AGE} = \) Age of students measured in years at the start of the semester when they undertook the management accounting course. \( \text{RELEASE} = \) Dummy variable which takes a value of 1 for the test group and 0 for the control group.