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The impact of a computerised consolidation accounting package (CCAP) on student performance

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Purpose – The purpose of this paper is to investigate the association between the use of a computerised learning tool (specifically designed to teach consolidation accounting) and student performance in the final examination of an undergraduate accounting unit on Corporate Accounting.

Design/methodology/approach – A regression model was developed to analyse 1,103 observations of assignment and examination scores, collected over three semesters, to test the central proposition that computer assisted learning enhances student learning outcomes and performance in the exam.

Findings – The results show a positive and significant relationship between the computerised accounting assignment on consolidated accounting (linked to usage of the computerised tool) and the consolidation question in the final examination. The findings suggest that the computerised consolidation accounting package (CCAP) assists students to understand the concepts underpinning consolidation accounting.

Research limitations/implications – The data were collected from a single institution, which may not represent the population of accounting students. Due to ethical obligations, the study lacked a control group that would have allowed meaningful comparison and assessment of student performance. Furthermore, whilst the findings in this study were able to demonstrate a positive association between the CCAP and exam performance, it is unable to determine the quality and depth of the learning experience from using the CCAP.

Practical implications – The present study found that a CCAP and its usage has the potential to positively impact student performance on assessment tasks on subject matter similar to concepts contained the computer package. Such findings may encourage instructors to seek ways of incorporating learning technologies in the pedagogical design.

Originality/value – This is believed to be one the few papers that has exclusively studied the impact of a specific CCAP and a specific segment in accounting education (consolidation accounting) using direct measures, CCAP assignment score and the final examination score for a question dedicated to consolidation accounting.

Introduction

The latter part of the twentieth century has witnessed a surge of computer-based teaching and learning, and assessment tools in the education of accounting students. The popularity of such
tools has been prompted in part by professional accounting bodies and employers who now expect graduates to possess a range of technical skills including computer literacy. A number of reasons have been cited as the motives behind the widespread adaptation of computer-based delivery by universities including the increased availability and affordability of software and hardware (Boyce, 1999); the ability to create a student-centred learning environment (McCourt Larres and Radcliffe, 2000); the ability to enhance the efficiency of teaching thus enabling the handling of large student numbers (Kaye and Nicholson, 1992; Boyce, 1999); and the desire for universities to be seen as “contemporary” (Bromson et al., 1994; Sangster and Mulligan, 1997). Furthermore, institutional developments in the adoption of computer technology and the increasing population of technology-savvy students has placed increased pressure on instructors to utilise available technology in the development and delivery of their courses (Paisey and Paisey, 2005). Similarly, increasing global competition in the tertiary education sector (Nunan et al., 2000) provides further motivations for the university sector to invest in computer-assisted teaching tools.

Rather than face-to-face interaction with a student, computer-assisted learning (CAL) relies on a computer as the primary vehicle for instructional activities. CAL from an institutional viewpoint offers the means to increase flexibility in course delivery and also manage large class sizes (Bork, 1986). Research from the perspective of institutional efficiency is primarily concerned with investigating the potential value of using technology as an alternative to traditional teaching methods (McInnes et al., 1995). An alternative stream of research, in which this study is focused, examines the effect of using computer-based course materials on students’ learning outcomes. This form of research is centred on the learners’ experience by analysing students’ attitudes, motivation and performance in using computer-based course materials (see e.g. Lane and Porch, 2002; McDowall and Jackling, 2006). This study is not focused on institutional issues associated with CAL but the benefits to students who are the recipients of such technologies in their learning. Therefore, the focus of this study is to investigate the effect on learning outcomes where “consolidation accounting concepts” were taught with the aid of a CAL package – computerised consolidation accounting package (CCAP)[1]. More specifically, the purpose of this study is to determine the relationship, if any, between CCAP as a computerised learning tool and student’s performance on the subject of “consolidation accounting” in the final examination. While considering the extent of CCAP usage as the primary variable, this study also considers several control variables (age, gender, prior accounting knowledge, entry path – whether local or international, status – and study mode – whether full- or part-time) which has been professed in the accounting education literature to have an influence over student performance.

Research on computer-based course materials observes students’ attitudes and perceptions towards using CAL in the learning process (Bhattacharjee and Shaw, 2001; Lane and Porch, 2002; McCourt Larres and Radcliffe, 2000). Assessing attitudes is important because it represents a measure of students’ receptiveness and expectations about the topics to be mastered. However, the preponderance of research in CAL is focused on using CAL in its broader application such as online learning (see e.g. Perera and Richardson, 2010; Love and Fry, 2006; Dowling et al., 2003), the application of computer hardware (Becker and Dwyer, 1994). Few studies have investigated the application software packages or self-learning programs in accounting education (see e.g. McDowall and Jackling, 2006; Lane and Porch, 2002; Marriott, 2004). The majority of such research has sought to understand the suitability of CAL by examining the extent to which CAL is associated with student performance measured in terms of overall examination score.
Despite the recognised potential of CAL for helping students, the application of CAL in specific topic areas remain under investigation and warrants further study. This study is focused exclusively on the impact of a specific CCAP, the CCAP application, and student performance based on a question in the final examination dedicated to the subject matter addressed in the CCAP. This study is unique from the viewpoint that it concentrates on one specific topic of accounting education, “consolidation accounting” and uses direct measures of CAL (CCAP assignment score) and the mastery of knowledge of the subject matter (final examination marks for the consolidation accounting question). Rather than make general associations from the broad application technology with overall examination scores, this study facilitates a more precise evaluation of application of the computer-assisted tool and the resulting impact on learning outcomes achieved. The findings of this study, should prove useful in evaluating the suitability of specific applications of CAL in improving student academic performance.

The remainder of the paper is organised as follows. The next section presents the background to the study as well as the hypotheses and regression model developed to analyse the data. The third section presents the findings of the study, penultimate section presents a discussion of the findings, and the final section concludes the paper with a discussion of the limitations and future research.

**Literature review and hypothesis development**

**CAL**

The phrase computer assisted learning (CAL) appears in accounting education research with little reflection and its meaning is often assumed, therefore, little attention has been paid to defining this phrase. In its broadest terms, CAL is defined as a computer program developed specifically for educational purposes. The term CAL covers a range of computer-based packages, which aim to provide interactive instruction usually in a specific subject area. These can range from sophisticated and expensive commercial packages to simple solutions that include a combination of text, audio and video to help students understand and test new concepts. CAL is used to construct examples in order to understand the concepts and techniques of the subject matter and to provide hands-on experience in dealing with such concepts. CAL is useful for introducing students to new or difficult concepts and is advantageous in high-growth disciplines, such as accounting, where students enter the discipline with diverse backgrounds and assorted levels of prior knowledge (Boyce, 1999; Bork, 1986; Kaye and Nicholson, 1992).

In its most basic, CAL serves two interrelated purposes: it features individualised learning; and provides hands-on experience. One of the main promises of CAL is the ability to individualise student learning. CAL puts a strong emphasis on student-centred learning that allows students to learn at their own pace producing their own learning paths and outcomes, while using structured and/or unstructured interactive lessons (see e.g. McCourt Larres and Radcliffe, 2000). Consistent with the notion of self-centred learning, CAL shifts the responsibility of learning from the teacher to the student. However, rather than negate the instructor in the learning process, CAL supplements face-to-face instruction by allowing students to manage their learning independently while simultaneously having access to staff for assistance. In relation to its second purpose, CAL is consistent with the experiential model of learning developed by Kolb (1984) where students learn by immersing themselves in the problem and actively participating in the solution. By redistributing the emphasis on learning
away from the instructor, students must become more active participants in their learning because interaction with staff is limited. So rather than passively absorb information that may occur from traditional classroom delivery, students must assimilate new information and “construct” new knowledge through interaction with the CAL program.

CAL has proliferated in recent times with advances in multimedia technology and the development of the internet (Motivalla, 2007). Introducing the CCAP to the learning process represented an attempt by the researchers to add value to the teaching and learning environment in dealing with a traditionally difficult topic in accounting. The results of this study thereby provide evidence on the effectiveness of introducing CAL in accounting education. In terms of prior research, CAL is a relatively recent phenomenon that has emerged from its gradual integration to the classroom. Whilst CAL has been growing in a variety of learning environments, its use in accounting education has been sporadic (McCourt Larres and Radcliffe, 2000; Lane and Porch, 2002). In terms of student performance, the findings from such studies have yielded mixed results (Lane and Porch, 2002). Early research on student performance has reported either: ambiguous results, indifferent performance or even a decline in performance (McInnes et al., 1995; Marriott and Mellett, 1994; Sangster, 1992). However, a higher proportion of more recent studies are indicating an improvement in students’ performance as a result of using computer-assisted applications (Potter and Johnston, 2006; Davidson, 2002; Fetters et al., 1986; Friedman, 1981; Groomer, 1981; Perera and Richardson, 2010).

The focus of previous studies in assessing student performance is measured by examining total examination score. Total exam score, as a measure of performance is not without limitations, as the score could be the result of many individual and contextual factors (Potter and Johnston, 2006). So rather than examine relationships between the application of CAL and overall student performance measured by the total exam score, this study measures students’ performance on a single examination question that was dedicated to the concepts addressed in the CCAP. Therefore, the findings of this study provide evidence on the potential of CAL to enhance learning and performance on a specific area of knowledge. The extent to which CAL has enhanced students’ body of knowledge on consolidated accounting will be measured by examining the relationship between the students’ assignment score that relied exclusively on using the CCAP and the examination score for only one question (rather than total examination score) dedicated to the topic of consolidated accounting. The main hypothesis in this study is thus expressed:

\[ H1. \text{ Students’ performance on the CCAP assignment is positively associated with their performance on the examination question dedicated to consolidated accounting.} \]

**Background variables**

The results that may link CCAP with exam performance could possibly be explained by subgroups or characteristics within the student cohort. Therefore, in addition to CCAP usage, this study explores the impact of age, gender, prior knowledge and international status in determining the effect on student performance. An array of past studies have analysed various demographic factors perceived to have an influence on student performance (typically in an assignment or an examination) and achievement of learning outcomes. The most commonly observed variables include gender, age and prior knowledge (see e.g. Becker and Dwyer, 1994; Dowling et al., 2003; Kubey et al., 2001). In addition to this, some studies have also investigated “status” (whether the students are “full-time” or “part-time”) and the “entry
path” (whether the students are “local” or “overseas”). This study attempts to add to the existing literature by examining such factors and the effect on a computer-assisted tool designed to achieve specific learning objectives on consolidation accounting.

Research on gender had produced mixed or inconclusive results. Only a few studies have presented evidence that show that female students perform better than their male counterparts (Gammie et al., 2003; Gracia and Jenkins, 2003; Tho, 1994; Tyson, 1989), with the exception of one study (Koh and Koh, 1999). The majority of research has concluded that gender has no systematic impact on performance (McDowall and Jackling, 2006; Tickell and Smyrnios, 2005; Jackling and Anderson, 1998; Auyeung and Sands, 1994; Buckless et al., 1991; Lipe, 1989; Eskew and Faley, 1988). The evidence pertaining to age and performance is equally inconclusive. Some studies revealed that mature students demonstrated superior performance compared with their younger counterparts (Gracia and Jenkins, 2003; Lane and Porch, 2002; Dockweiler and Willis, 1984) with the exception of one study (Koh and Koh, 1999). Based on the discussion above the following hypotheses are expressed in the null form:

**H2.** Age is not significantly related to student's performance on the final examination.

**H3.** Gender is not significantly related to student's performance on the final examination.

Prior accounting knowledge – typically measured in terms of performance in prerequisite or preceding course(s) – is generally perceived to have a positive influence on student performance and indeed is well supported in accounting education literature. Several studies found a strong positive correlation between prior accounting knowledge and exam performance (Tho, 1994; Auyeung and Sands, 1994; Gul and Fong, 1993; Eskew and Faley, 1988). Doran et al. (1991) reported a negative relationship between prior accounting knowledge and examination performance. The authors partly attributed this finding to students’ overconfidence resulting in a lower commitment to their studies. This was particularly the case where students had obtained prior knowledge from secondary education. Research by Baldwin and Howe (1982) and Bergin (1983) contradicts such findings and suggests that student performance in accounting had no bearing on previous exposure to accounting in secondary education. Given the preponderance of research that supports a relationship between prior accounting knowledge and academic performance, the following hypothesis is proposed:

**H4.** Prior accounting knowledge is not significantly related to student's performance on the final examination.

There is limited evidence outlining the impact of study mode (full- or part-time status) on student performance. The performance of part-time students in accounting was reported by Jackling and Anderson (1998) who discovered that students studying in part-time mode performed better than full-time students. The fact that most of the part-time students who took part in the study were employed in an accounting related environment was cited as an explanation for this finding. A similar finding was noted by Moses (1987) who reported that student’ performance was positively influenced by exposure work experience in accounting and finance. In a later study, Hartnett et al. (2004) found evidence that suggests a negative relationship between students enrolled full-time and performance. In terms of entry path, McDowall and Jackling (2006) reported that the performance of international students was inferior in a CAL environment. Hartnett et al. (2004) concluded there was no indication to suggest that the performance of international students’ was inferior to local students. In fact
they found, after controlling for key variables, international students actually achieved superior performance. However, the authors’ acknowledged that the relative performance of international students did not clearly improve with the passage of time. The following hypotheses are expressed in the null form:

\[H_5.\] Study mode is not significantly related to student's performance on the final examination.

\[H_6.\] Entry path is not significantly related to student's performance on the final examination.

**Model development**

In developing the model for this study, the perceived positive and negative associations between students’ performance and the variables affecting such outcomes were considered. Consolidation concepts are taught in a course dedicated to “corporate accounting” and offered to students in the second year of the degree program. In this course, “consolidation accounting” concepts were taught using the traditional mode of delivery (lecture and tutorials) as well as the CCAP with students having the opportunity for unlimited practice using the CCAP in order to fine tune their knowledge in consolidation accounting. Prior to submitting the graded assignment, students may attempt unrestricted practice assessments with feedback provided by the CCAP. As such, the more extensively the CCAP was used, the greater the potential for students to obtain a higher score for the graded CCAP assignment. To the extent that students’ performance on the graded CCAP assignment reflects their commitment of time and application of the CCAP, then the scores awarded to students for their assignment were regarded by the researchers as a proxy for the extent to which students used the CCAP.

In order to be consistent with prior studies, student performance was based on the score obtained in the final examination (see e.g. Potter and Johnston, 2006; Dowling et al., 2003; Michlitsch and Sidle, 2002). However, this study extends the existing literature by focusing on a more refined measure of performance that examines the score obtained for the question dedicated to consolidation accounting, thus directly linking the concepts learned through the CCAP with exam performance. A regression model was developed to predict the relationship between student performance on the final examination and their performance on the CCAP assignment as well as background variables that includes age, gender, prior knowledge, study mode and nationality. The acronym “FINALEXAM” is used to represent the dependant variable, which is the raw score for the exam question on consolidation accounting. CCAP usage is the primary independent variable – denoted by the acronym “CCAPUSAGE” – measured in terms of the score awarded for the CCAP assignment. More specifically, the authors predict that the scores derived for the CCAP assignment, as a proxy for the extent to which CCAP application was used by students, will have a positive effect on the final examination score. In addition to this, keeping in line with prior research, we use the following variables: age (AGE); gender (GENDER); prior accounting knowledge – measured in terms of marks obtained for a prerequisite course titled Accounting Concepts and Systems – (PRIORKNOWLEDGE); entry path – whether they are local or international students (ENTRYPATH); and status – whether they are full-time or part-time students (STATUS). We therefore propose the following functional relationship: (Equation 1)

Table I illustrates the dependant and independent variables used in the study.

**Research method**
This study is centred on the performance of students enrolled in a second year undergraduate course titled “Corporate Accounting”. The course is taught at a mid-sized Australian University where “consolidation accounting” is an important element of the course comprising 25 per cent of the course content by encompassing three of the 12-weekly topics that makes up the course. The three topics comprise pre-acquisition entries; eliminating intra-company transactions; and calculation and accounting for non-controlling interests. Enrolment in this course is conditional upon students meeting a hurdle requirement by successfully completing the prerequisite course on accounting concepts and systems. A typical student cohort is comprised of a combination of international and local students with the majority of students studying in full-time mode. Summative assessment in this unit is comprised of two mid-term assessment tasks, one of which is related to consolidation accounting, the CCAP assignment (weighted value of 15 per cent), and a final examination (70 per cent).

Consolidation accounting concepts are taught using a blended learning approach that combines three weekly lecture presentations with tutorial support and the CCAP. The lectures introduce consolidation concepts to students which are then reinforced by the CCAP which teaches the principles as well as the application of “consolidation accounting”. Consistent with the notions of self-centred and experiential learning discussed above, the CCAP developed by Lourens (2005), allows students to develop their knowledge of consolidated accounting by promoting positive self-paced learning strategies that allow for diverse learning styles. Students can work on procedural problems at their own pace at varying levels of difficulty and at their own choice of time. The CCAP generates an unlimited number of practical and tailor made problems for students to solve (single issue, tutorial, examination practice, examination submit case studies) and provides instantaneous feedback. Students also have to option to save a case study and return to it at a later time. The CCAP facilitates repeated attempts at each problem enabling the students to continuously work with the system until they fully grasp the concepts. The CCAP allows students to control the pace of the learning by providing them with the means to make choices in skipping unnecessary items or doing remedial work on difficult concepts.

The CCAP assignment contains instructional material with worked examples addressing the three main concepts of consolidation that are the focus of the weekly topic objectives: pre-acquisition entries; eliminating intra-company transactions; and calculation and accounting for non-controlling interests. Students obtain access to the program via the university’s WebCT and download the program directly to a storage disk or a personal computer. When the program is downloaded, students generate a randomly developed case and undertake tasks designed to develop knowledge and skills in the relevant topic area. The CCAP provides students with the facility of practising individualised transactions and/or concepts with unrestricted repetitive practice at the student's discretion. The program provides students with feedback by generating a report indicating the errors and areas of improvement. Students have the discretion to continue repetitive practice in an effort to reduce the errors appearing in the report. The CCAP assignment is assessed by submitting a copy of the report to the instructors by a predetermined date. The assignment is scored based on a negative marking scheme, in part determined by the number of errors contained in the report. The opportunity for students to maximise their score comes from repetitive practice in an effort to reduce the error rate. Consequently, the marks obtained for the CCAP assignment, reflects, in part, the time and effort students committed to the CCAP; and the error rate is indicative of students’ understanding of consolidation concepts. A high score in their assignment is ostensibly a
measure of the extent to which CCAP was utilised by students as well as their understanding of the concepts.

**Descriptive results**

The sample in this study comprises of 1,103 students who were enrolled in this unit over three semesters. The course content and assessment regime remained unchanged in the relevant period with the same teaching faculty involved in delivering the course. In the sample, 52.9 per cent (584) were male students, 21.6 per cent (239) were local students (defined by Australian citizenship and permanent residency) and only ten were enrolled in part-time mode (see Table II). The average age of the student sample was 22.37 years with the majority of the students being comparatively young (as illustrated by the median age of 21.55 in an age range of 18-45.5), which is not uncommon for a cohort of students predominantly with full-time enrolment status. Finally, the average score for the prerequisite accounting unit that permits entry in the course was 68.88 per cent.

**Findings**

The data in Table II illustrates that students scored an average of 78.39 per cent for the CCAP assignment, a reasonably high score, but scored only 40.56 per cent for the examination question on consolidation accounting in the final examination. A score of <50 per cent for the examination question suggests that the students were unable to fully grasp the competencies or knowledge required of consolidation accounting. This finding casts some doubt on the effectiveness of the CCAP to enhance learning outcomes. However, the purpose of this study is not to compare or evaluate the raw scores obtained in the relevant assessment tasks but to determine whether students’ performance (in the final examination) is enhanced by examining the relationship between the CCAP assignment and final examination scores. A significant and positive relationship implies that the final examination score would have been lower if not the intervention of the CCAP.

The data in Table III presents the results of the regression analysis for the data examined, which comprised of 1,103 observations. The regression equation was designed primarily to determine whether a positive association can be established between CCAP usage and exam performance relating to the subject matter dealing with consolidation accounting. The finding from the regression model demonstrates that application of the CCAP (CCAPUSAGE), gender (GENDER) and prior accounting knowledge (PRIORKNOWLEDGE) are significant and positive determinants of final exam performance. The explanatory capability of the model is relatively strong with 22.9 per cent of the variation of the dependant variable (FINALEXAM – marks scored for the consolidation question in the final exam) being explained by the independent variables (adjusted $R^2=0.229$). Therefore, the findings in this study support $H1$ in the CCAP score is positively associated with the final examination score on consolidated accounting. In order to enhance the robustness of the main findings in this paper, additional tests were performed to assess the influence of CCAP and the extent of usage on the final examination consolidation question. Given that the CCAP was downloaded and used by students on personal computers, the researchers were unable to determine the time that students devoted to using the CCAP. However, in an attempt to identify and light and heavy users of the CCAP, students were assigned to two groups based on the mean and median scores of computerised consolidation assignment. The regression analysis based on this dichotomy found that despite using two separate models the results remain unchanged and are consistent results of the original model. In conclusion, the results in this study support
and it is find that the CCAP had a positive and significant influence on final examination in the same subject matter.

Student gender (GENDER) is the next most significant independent variable and the results suggest that female students demonstrate a superior performance compared with their male counterparts, a trend also observed by Gammie et al. (2003), Gracia and Jenkins (2003), Tho (1994) and Tyson (1989). The finding in this study rejects H2 and it is concluded that female students using the CCAP perform better in the final examination question on consolidation accounting. A similar result was found in students’ performance (PRIORKNOWLEDGE) in a prerequisite course. Consistent with prior evidence, the findings in this study suggests that students who demonstrated superior performance in their prerequisite course and used the CCAP performed better in the final examination question on consolidation accounting. The third (H3) is therefore rejected and it is concluded that prior knowledge has a significant and positive influence student performance.

Further interrogation of the data using correlation analysis indicates that the application of the CCAP (CCAPUSAGE, 0.3315), gender (GENDER, 0.1165) and prior accounting knowledge (PRIORKNOWLEDGE, 0.3960) are the only variables that have a significant correlation with the independent variable, final exam performance (see Table IV). Overall, it appears that students learn and consolidate their knowledge of consolidation accounting concepts using the CCAP, which is then tested through the CCAP assignment (as captured by the variable CCAPUSAGE) and assessed in the final examination. The authors contend that the correlation between the CCAP usage and the marks for the examination question on consolidation accounting reflects the positive influence of using a computerised learning program on the achievement of student learning outcomes.

In line with prior literature, the effect of student age (AGE) on exam performance seems to be inconclusive with lower level of significance and the model suggesting that younger students outperforming mature-aged students. Not surprisingly, study mode (full/part-time) (STATUS) and whether they are local or international (ENTRYPATH) are not significant variables, which is also consistent with prior literature. It should be noted that in relation to study mode, this finding might be the product of low power due to a small sample. Therefore, H4, H5 and H6 are not rejected and it is concluded that these variables do not have a significant effect on student performance in the final examination.

Discussion

The findings in this study is consistent with the central proposition in this study that CAL packages have an important influence on learning objectives and outcomes, thus emphasising the importance of the CCAP in students’ learning and performance. The association between the application of a computerised teaching tool and the achievement of student learning outcomes is consistent with various prior studies that also demonstrate an effect on student performance (e.g. Potter and Johnston, 2006; Davidson, 2002; Fetters et al., 1986; Friedman, 1981; Groomer, 1981). The introduction of CAL and the positive association with exam performance is encouraging and appears to have aided the learning process in a way that was not previously available to students. Improved performance on the examination question suggests that the CCAP has improved the quality of the learning experience providing valuable assistance in dealing with difficult concepts. In the absence of additional data the critical success factors are difficult to determine; however, the researchers suggest that the
perceived benefits of CAL packages are derived from the feedback function within CAL as well as the interaction of CAL combined with traditional modes of study.

A major feature of instituting CAL is that it provides instant feedback on the accuracy of problem solving. The CCAP provided individualised feedback and assessment thereby allowing self-correction by students. Instant feedback provided students with the opportunity for additional and repetitive practice that in turn provides students with the opportunity to develop a deeper understanding of the material. Students will know immediately if their answers are correct allowing students to rework the questions until they reach a level of comfort or competence with the subject matter providing the potential to alter learning outcomes. Potter and Johnston (2006) suggest that immediate and informed feedback on individual performance should lead to an improvement in performance through increased motivation. An increased motivation affects the level of effort applied to the task, thus increasing interactive participation with the materials and heightening the learning experience. To this end, the CCAP was beneficial in that it allowed students to take control of the learning technology, make self-paced choices, and engage them with the materials. To the extent that motivation reflects commitment and effort, the findings in this study counters the findings of Perera and Richardson (2010) who found that the time students spent online in the university's WebCT (viewing and/or downloading documents links and participating in discussion boards) was not related to exam performance. This finding suggests that spending more time online is not necessarily related to improved performance, it is more important to understand how students use their time when utilising technology in the learning process.

Prior research on gender and performance is generally mixed (see e.g. Koh and Koh, 1999; Gammie et al., 2003; Gracia and Jenkins, 2003; Auyeung and Sands, 1994; McDowall and Jackling, 2006). Empirical evidence suggest that male students demonstrate greater self-efficacy in the use of computers (McDowall and Jackling, 2006); however, this study is concerned with the benefits derived from using a learning program rather than computer skills or confidence. While the existing evidence on this issue is inconclusive, the findings in this study suggest that the performance of female students after using the CCAP on the exam question was superior to that of male students. The precise reasons for this result are unknown, until further research is undertaken to examine this specific issue.

The present study has also confirmed a positive association between student performance in a prerequisite accounting course and their performance in the final examination question on consolidation accounting. The significance of the control variable measuring the prior accounting knowledge is also consistent with existing evidence (see e.g. Tho, 1994; Auyeung and Sands, 1994; Gul and Fong, 1993; Eskew and Faley, 1988). This finding suggests that relevant and adequate levels of prior knowledge are essential for students to grasp the more complex issues facing students on consolidation accounting, and post-requisite courses generally. Therefore, a carefully designed prerequisite course could have a direct impact on students’ performance on consolidation accounting and other accounting concepts.

Conclusion

Gaining a better understanding of the factors influencing student performance is an important issue and is likely to be a high priority for academics and administrators of educational institutions. The present study found that a CCAP and the extent of its usage has the potential to positively impact student performance in an examination question on consolidation accounting. The motivation to incorporate a CCAP in the teaching program was to enhance
the technical skills of undergraduate accounting students in the subject area of consolidation accounting. The evidence in this study suggests that the CCAP achieves this objective. One implication for the accounting academic community is to consider ways in which CAL may be incorporated and used in their course design. The findings in this study suggest that the application of the CCAP is directly related to student performance. Therefore, instructors wishing to integrate CAL into their teaching program should consider whether to incorporate the CCAP as a standalone and self-assessing program, or to purposely design its application in a blended form that integrates its application with traditional modes of delivery. Adopting new technologies could prove ineffective unless they are adopted with appropriate pedagogical strategies. It should be noted that the CCAP in this study was used by students in conjunction with staff support and conventional methods of teaching that included lectures and tutorials. Instruction from multiple sources is beneficial to the extent that it caters to the variety of student learning approaches as well as reinforce the concepts taught. Using CAL in this way rests on the notion that the computer cannot completely supplant the need for traditional face-to-face teaching methods (Boyce, 1999).

The results of this study provide the motivation for further study into computerised accounting packages on consolidation accounting and their usefulness as a learning tool in the discipline of accounting. However, the results should be interpreted with caution. The data were collected from a single institution which may not represent the population of accounting students. Furthermore, due to ethical reasons (relating to equity and equal treatment in developing an assessment regime), the study lacked a control group that would have allowed meaningful comparison and assessment of student performance in the final exam. Without a control group it is difficult to determine whether the findings are due to CAL or other factors, however, given that the data collected in this study was collected over three semesters, the impact of factors in a given student cohort or semester is likely to be minimised. Additionally, whilst the findings in this study were able to demonstrate a positive association between the CCAP and exam performance, it is unable to determine the quality and depth of the learning experience from using the CCAP. In order to address the limitations of this study, further research could investigate the potential reasons for this relationship by seeking student perceptions on the effectiveness on the CCAP (and its elements) to enhance their learning. Further analysis could also examine the qualitative elements of the CAL assignment and the final examination. The research undertaken in the present study could also be extended to other accounting courses which use computerised packages in their pedagogy. Such research will permit comparative analysis across institutional as well as functional disciplines in accounting.
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</table>

**Table I Description of variables**

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Sample size</th>
<th>(%)</th>
<th>Mean</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>FINALEXAM (%)</td>
<td>1,103</td>
<td>40.56</td>
<td>25.24</td>
<td>0.00</td>
<td>100.00</td>
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<tr>
<td>CCAPUSAGE (%)</td>
<td>1,103</td>
<td>78.39</td>
<td>23.52</td>
<td>0.00</td>
<td>100.00</td>
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<tr>
<td>PRIORKNOWLEDGE (%)</td>
<td>1,103</td>
<td>68.88</td>
<td>12.58</td>
<td>50.00</td>
<td>100.00</td>
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<tr>
<td>AGE (years)</td>
<td>1,103</td>
<td>22.45</td>
<td>3.01</td>
<td>18.01</td>
<td>45.53</td>
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<tr>
<td>GENDER</td>
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<td>Male</td>
<td>584</td>
<td>53.0</td>
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<td>Female</td>
<td>519</td>
<td>47.0</td>
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<tr>
<td>ENTRYPATH</td>
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<tr>
<td>Local</td>
<td>329</td>
<td>30.0</td>
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<tr>
<td>International</td>
<td>774</td>
<td>70.0</td>
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<td>Part-time</td>
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<tr>
<td>Full-time</td>
<td>1,093</td>
<td>99.1</td>
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**Table II Descriptive statistics**
Table III Regression analysis

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<tr>
<th></th>
<th>Coefficient</th>
<th>SE</th>
<th>t-statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCEPT</td>
<td>-22.75934</td>
<td>6.174002</td>
<td>-3.686319</td>
<td>0.0002</td>
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<tr>
<td>CCAPUSAGE</td>
<td>0.293055</td>
<td>0.03201</td>
<td>9.703547</td>
<td>0.0000</td>
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<tr>
<td>AGE</td>
<td>-0.250184</td>
<td>0.222617</td>
<td>-1.123833</td>
<td>0.2613</td>
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<tr>
<td>ENTRYPATH</td>
<td>0.354223</td>
<td>1.590683</td>
<td>0.222686</td>
<td>0.8238</td>
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<tr>
<td>GENDER</td>
<td>-3.185137</td>
<td>1.348761</td>
<td>-2.361528</td>
<td>0.0184</td>
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<tr>
<td>PRIORKNOWLEDGE</td>
<td>0.690015</td>
<td>0.056366</td>
<td>12.24163</td>
<td>0.0000</td>
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<td>STATUS</td>
<td>-0.175836</td>
<td>7.064657</td>
<td>-0.024889</td>
<td>0.9801</td>
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<tr>
<td>$R^2$</td>
<td>0.233201</td>
<td>Mean-dependent variable</td>
<td>40.55927</td>
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</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.29003</td>
<td>SD-dependent variable</td>
<td>25.23556</td>
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</tr>
<tr>
<td>SE of regression</td>
<td>22.15845</td>
<td>Akaike information criterion</td>
<td>9.040641</td>
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<tr>
<td>Sum squared resid.</td>
<td>538,132.5</td>
<td>Schwarz criterion</td>
<td>9.072409</td>
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<tr>
<td>Log likelihood</td>
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<td>Hannan-Quinn criterion</td>
<td>9.052657</td>
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<tr>
<td>$F$-statistic</td>
<td>55.55299</td>
<td>Durbin-Watson statistic</td>
<td>1.627314</td>
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</tbody>
</table>
| Probability ($F$-statistic) | 0.000000

Notes: CCAPUSAGE, percentage marks obtained for the CCAP assignment as proxy for the usage; AGE, measured in years at the start of the semester when they undertook the corporate accounting; ENTRYPATH, dummy variable that takes a value 1 for international students and 0 for local students; GENDER, dummy variable that takes a value 1 for male students and 0 for female students; PRIORKNOWLEDGE, percentage marks in the prerequisite accounting unit; STATUS, dummy variable that takes a value 1 for part-time students and 0 for full-time students.

Table IV Spearman's rank-order correlation analysis

<table>
<thead>
<tr>
<th></th>
<th>AGE</th>
<th>CCAPUSAGE</th>
<th>ENTRYPATH</th>
<th>FINALEXAM</th>
<th>GENDER</th>
<th>PRIORKNOWLEDGE</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
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<td>AGE</td>
<td>1.0000</td>
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</tr>
<tr>
<td>CCAPUSAGE</td>
<td>0.1050***</td>
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<tr>
<td>ENTRYPATH</td>
<td>-0.1864***</td>
<td>-0.2551***</td>
<td>1.0000</td>
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<tr>
<td>FINALEXAM</td>
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<td>0.3315***</td>
<td>0.0049</td>
<td>1.0000</td>
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<tr>
<td>GENDER</td>
<td>-0.0277</td>
<td>-0.0654**</td>
<td>0.0469</td>
<td>-0.1165***</td>
<td>1.0000</td>
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<tr>
<td>PRIORKNOWLEDGE</td>
<td>0.0978***</td>
<td>0.1719***</td>
<td>0.1901***</td>
<td>0.3960***</td>
<td>-0.1068***</td>
<td>1.0000</td>
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</tr>
<tr>
<td>STATUS</td>
<td>0.0497*</td>
<td>-0.0151</td>
<td>0.0422</td>
<td>-0.0102</td>
<td>-0.0248</td>
<td>-0.0165</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

Notes: ***Correlation is significant at the 0.01 level (two tailed); **correlation is significant at the 0.05 level (two tailed); *correlation is significant at the 0.1 level (two tailed).

Equation 1

FINALEXAM = f(CCAPUSAGE, AGE, GENDER, PRIORKNOWLEDGE, ENTRYPATH, STATUS)

Note

1. The CCAP is a program developed by J. Lourens and Swinburne University of Technology designed to help users to acquire and enhance knowledge and skills on concepts in consolidated accounting.
References


Lourens, J. (2005), Consolidated Accounting Program, Swinburne University of Technology, Melbourne.


**Further reading**


**Corresponding author**

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