



## Does Peer-Assisted Learning Improve Student Marks in Accounting?

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### Abstract

For the past several years students in accounting at Macquarie University in Sydney have been offered the chance to participate in a peer-assisted learning program. This paper conducts a statistical analysis of the relationship between participation in peer-assisted learning and student performance, as measured by the final mark achieved in the unit offering peer-assisted learning. The paper presents a methodology for conducting the analysis that represents an advance on that found in the extant literature on this topic. Using this superior methodology, the paper finds that participation in peer-assisted learning has a statistically and numerically significant effect on student marks.

**Keywords:** Peer-assisted learning, First year accounting, Student marks

*JEL classification:* M41; A22

### 1. Introduction

The past decade has seen a substantial number of universities and higher education institutes adopting the Peer-Assisted Learning (PAL) method as a means of facilitating student learning. This has occurred in a variety of areas including accounting, bioscience, economics, law, medical education and vocational learning (Morrison, 2007; Tariq, 2005; O' Donnell, 2004; Howman, Bertfield & Needleman, 2002; Sullivan, 2002; Evans, Flower and Holton, 2001; Coe, McDougall, & McKeown, 1999; Playford, Miller & Kelly, 1999). The adoption of PAL programs in Australian universities has been viewed as a strategy to deal with the educational challenges associated with higher enrolments, increased numbers of international students and reduced government funding (Morrison, 2007; Miller, Oldfield & Bulmer, 2004; O' Donnell, 2004; Playford et al., 1999).

At Macquarie University in Sydney, PAL has operated in several accounting units since 2003. In 2007 we conducted a qualitative assessment of this program (Dobbie & Joyce, 2008). The data were collected via a series of focus groups with student participants and student leaders involved in the PAL program. Our results revealed that PAL at Macquarie generates significant academic and non-academic benefits for all those involved. In light of these findings the aim of the current study was to determine whether participation in PAL leads to improved marks, something that we did not examine in the qualitative assessment. As explained below, the paper also employs a superior methodology than is found in the extant literature on this topic. The paper is structured as follows. The next section describes PAL. Section 3 examines the literature on the benefits of PAL. Section 4 examines more closely the literature on the relationship between PAL and student marks/grades. Section 5 outlines the methodology employed in the paper. Section 6 discusses the results of the statistical analysis. Section 7 offers some concluding comments.

## 2. What is PAL?

PAL has been defined as “the acquisition of knowledge and skill through active helping and supporting among status equals or matched companions” (Topping, 2005 p.361). In a university environment this involves students, often from within the same cohort and at a similar stage of progression, learning with and from one another (Tariq, 2005; Falchikov, 2001; Playford et al., 1999). At Macquarie University for instance, the individuals who lead the PAL sessions are students who have successfully completed the subject in the recent past (Dobbie & Joyce, 2008).

The emphasis in PAL sessions is on *how* to learn and study a specific subject (Congos & Schoeps, 1993). The purpose of PAL is not to re-teach the information presented in lectures and tutorials, and for this reason, there is often no prescribed content for a PAL session. Students will bring along problems and topics that they wish to understand. It is the role of the PAL leader to encourage students to ask and answer questions regarding the material they find difficult or confusing (Dobbie & Joyce, 2008; Morrison, 2007; Tariq, 2005; Playford et al., 1999). To do so, the PAL leaders encourage student interaction, facilitate group work and develop active learning and problem-solving skills among their students (O’ Donnell, 2004; Congos & Schopes, 1993). In this way PAL programs encourage students to become more active and independent in their learning. These techniques have been defined as ‘deep learning’ approaches (Biggs, 1993; Marton & Säljö, 1976), and as such may generate benefits beyond the unit in question.

PAL programs aim to provide a friendly collaborative working environment in which students can ask questions and discuss problems. The provision of such an environment is particularly important nowadays where students often confront large lectures and large tutorials which involve highly structured content (Dobbie & Joyce, 2008; Morrison, 2007; Miller, et al., 2004; Playford et al., 1999). This type of environment is not conducive to asking questions and exploring ideas. PAL attempts to redress this.

## 3. What are the benefits of PAL?

There have been several studies examining the academic and non-academic benefits for both the students who attend PAL sessions, *and* the student-leaders who conduct the sessions. Some studies have found that the PAL sessions can provide an opportunity for the leaders to refine their knowledge of the subjects and topics they are tutoring. They also provide the opportunity to develop important skills such as leading a group, organising materials and sessions, time management, team work, communicating and public speaking (Dobbie & Joyce, 2008; Playford et al., 1999).

From the students’ viewpoint, several studies suggest that PAL programs can promote significant academic progress with regards to a greater and more in-depth understanding of the particular material covered during the sessions (Atkins, May & Marks-Marden, 2005; Finlay & Faulkner, 2005; Tariq, 2005; Playford et al., 1999). In addition, research suggests that students who attend PAL regularly develop valuable skills such as deep learning strategies, critical thinking, problem solving, team-work, time-management and communication skills (Dobbie & Joyce, 2008; Atkins et al., 2005; Finlay & Faulkner, 2005; Tariq, 2005; Miller et al., 2004; Playford et al., 1999).

The development of these types of skills is particularly important. Recent research suggests that technological advances and competition within the industry have led to increased expectations with regards to the capabilities and skills that accounting graduates should possess (Kavanagh and Drenan, 2008; Birrell, 2006; Lee & Blaszczyński, 1999). It has been proposed that, from an employer’s point of view, an accountant’s value is increasingly reflected in higher-order skills and abilities such as problem solving, critical thinking and oral communication (Hunton, 2002; Leveson, 2000). The PAL program is one in which such skills are automatically fostered and developed among students and leaders alike, and may thus positively influence their employability on graduation.

Research has also found that PAL programs can produce significant social and emotional benefits for PAL leaders and students. These benefits include social development, positive self-concept, improved self-esteem, opportunities to develop friendships and connections at university and increased motivation to learn and study (Dobbie & Joyce, 2008; Morrison, 2007; Ginsburg-Block, Fanuzzo & Rohrbeck, 2006; Tariq, 2005; Howman et al., 2002; Fantuzzo & Ginsburg-Block, 1998 and Saunders & Gibbon, 1998). This is an important finding when we consider that developmental and educational research has already established that positive associations exist between academic achievement, and factors such as self-esteem, self-concept, friendship and social skills (Ginsburg-Block, et al., 2006; Eccles, Roeser, Ginsburg-Block Wigfield & Freedman-Doan, 1999; Parker, Rubin, Price & DeRosier, 1995). But does PAL actually improve student grades? The next section turns to the literature on this.

## 4. Does PAL improve grades?

Many of the studies examining this question have focused entirely on the students’ *perception* of how PAL has influenced their performance, often doing so with evidence that is essentially anecdotal and based on small samples of students (Ginsburg-Block, et al., 2006; Finlay & Faulkner, 2005; Tariq, 2005). Tariq (2005) for example surveyed 114 undergraduate bioscience students at the University of Central Lancashire in the United Kingdom. In this study, 85% of students reported that PAL was an extremely valuable experience. Similar positive feedback was also reported in a study by Atkins and colleagues (2005) that examined the success of a PAL-based mathematics aid program at Kingston

University in the UK (Atkins et al., 2005). The study involved interviews with 9 students who attended PAL. All students reported that PAL helped them to perform better and achieve higher grades in their assignments.

Interestingly, a qualitative study at Macquarie University (Dobbie & Joyce, 2008) revealed mixed opinions when students were questioned about whether PAL had helped improve their grades. While most students were confident that the program assisted them in developing study skills and a greater understanding of the material, some students also reported that they were uncertain as to whether or not their attendance at PAL directly impacted on their overall mark in the unit. Indeed several students commented that simply attending PAL did not necessarily guarantee a good grade. Nevertheless, a number of students were adamant that the PAL program had a significant and positive effect on their grades, aiding them in obtaining higher grades than what they believed they would be capable of achieving. All of these studies are limited however, in that they do not go beyond reporting the subjective opinions of students regarding how PAL impacted on their marks.

Two papers that try to establish whether PAL actually does improve student grades are O'Donnell (2004) and Playford et al (1999). O'Donnell (2004) undertook an assessment of the effects of PAL on student grades at Macquarie University, while Playford et al (1999) undertook a similar study of the University of Queensland's Peer-Assisted Study (PASS) program. In essence, these studies compared the distribution of grades between students who had, and who had not, participated in peer-assisted learning programs. O'Donnell (2004) also compared, for a first year accounting unit, the grade distribution for a year in which PAL had been offered, with the grade distributions from two previous years in which PAL had not been offered. Both studies found that the distribution of grades was better for those students who participated in PAL type programs. O'Donnell also found that the grade distribution was better in the year in which students had the opportunity to avail themselves of PAL. In both studies the improved grade distributions were attributed to the effect of PAL.

O'Donnell (2004, p.7) noted that this methodology is far from perfect, since it does not rigorously control for the effect of variation in innate student ability between the PAL and non-PAL student cohorts. As a result of this, these studies cannot conclusively establish whether the observed differences in the grade distributions were due to the effect of PAL, or the effect of differences in innate ability between the PAL and non-PAL student cohorts. The research reported in this paper follows a methodology developed by McLennan (2006) which is able to directly address this methodological concern. As such the results reported in this paper are more rigorous than those in the extant literature on the topic. The methodology is outlined in the next section.

## 5. Objectives of this study and methodology

The purpose of this paper is to examine the relationship between student performance, as measured by their Standard Numerical Grade (SNG), and their participation in PAL, while controlling for a range of other factors likely to influence SNG. This is done by estimating the following linear regression model with homoscedastic disturbances:

$$\begin{aligned} SNG_i &= \beta_0 + \beta_1 PAL_i + \beta_2 GPA_i + \beta_3 CHINA_i + \beta_4 OTHER_i + u_i \\ u_i &\sim N(0, \sigma^2) \\ i &= 1, \dots, n \end{aligned} \tag{1}$$

Where:

SNG = standard numerical grade. This is the final mark out of one hundred awarded to each student in the unit.

PAL = a dummy variable taking the value of one if a student participated in PAL. The variable takes the value of zero if the student did not participate in PAL.

GPA = grade point average. This is a calculation which reflects the overall grades of each student. It is based upon units completed only at Macquarie University. Given the way the formula for calculating a GPA at Macquarie works, the GPA is a number between zero and four. A GPA of zero implies that the student has failed every unit they have enrolled in. A GPA of four implies that a student has received a High Distinction, the highest grade, for every unit they have ever been enrolled in. The rationale for including this variable is as follows. A student's SNG may be influenced by participation in PAL, but it will also be a function of the student's ability. In this study GPA is used to measure this 'ability'. Indeed, in order to separate the influence of ability and PAL on SNG, what is required in this study is some measure of ability prior to participation in PAL. Therefore the GPA that is included in the data is the GPA of each student prior to undertaking the unit for which the student participated in PAL.

The variables CHINA and OTHER are dummy variables capturing nationality. Specifically, CHINA is a dummy variable, equal to one if a student was from Mainland China and zero otherwise.

OTHER is a dummy variable, equal to one if a student was from any nation other than Australia or Mainland China and

zero if the student was from either of those nations. Note that students of Australian nationality are the omitted reference category. The reason for including these controls for nationality is that they may act as a proxy for a range of nationality related factors that influence SNG. Included in these factors would be language proficiency and cultural differences in approaches to learning.

A potential problem arises with the estimation of (1) due to the possibility of a relationship between GPA and PAL. It may be that the more capable students are more likely to enrol in PAL in order to improve their grades. On the other hand poorer students may be disproportionately represented in the PAL cohort as a means to improve their grades. In either event there is the possibility that these two 'independent variables', PAL and GPA, are not really independent, thereby raising the estimation problems associated with collinearity. To address this, a two-step method is applied as follows.

The first step involves modelling PAL as a Probit, with GPA as a regressor. The Inverse Mills Ratio (IMR) is computed for all observations, and saved as a variable. In the next step (1) is estimated using Ordinary Least Squares (OLS), but the variable PAL is replaced with the IMR as obtained in the first step. The IMR has the characteristic of being a continuous measure of the probability of a student participating in PAL, but with the influence of GPA on PAL participation factored.

The model is estimated for the accounting units; ACCG200, Fundamentals of Management Accounting and ACCG251, Accounting and Information Systems. These are both second year units. While PAL is also offered in a first year accounting unit, there are insurmountable problems with estimating the type of model in (1) for this unit. Most students undertaking the first year accounting unit have just commenced their university studies. As a result they do not have a GPA that can then be used to proxy their ability. An alternative approach would be to use each students University Admissions Index (UAI) as a measure of ability. The problem with this approach is that overseas students, who make up around 30 per cent of the intake, would then have to be excluded from the study as they do not have an Australian UAI. The result would be an unrepresentative sample based essentially on domestic students only. Another option would be to give all students without a UAI, the sample mean UAI. As just noted however this would involve replacing a crucial variable for 30 per cent of the sample, something we found to be unacceptable. We have therefore chosen to limit the study to the two units for which these problems do not arise. In the next section the results are presented and discussed.

## 6. Results

The results of the statistical analysis are reported in Tables 1 and 2. We discuss the results for each unit in turn.

### 6.1 ACCG200

As can be seen from Table 1, the main determinant of variation in SNG is variation in student ability, as measured by GPA. This is a robust result that is almost identical using the OLS or two-stage estimation procedures. The results suggest that for each one unit increase in GPA, SNG increases by approximately 10.3 marks. These results are significant at the one per cent significance level.

Participation in PAL has a statistically significant effect on SNG, although the magnitude of the effect is much smaller than for GPA. In the OLS results, participation in PAL results in an increase in SNG of 6.5 marks, on average, all other factors held constant. This result is statistically significant at the one per cent significance level. In the two-stage results the size of the effect from PAL participation is halved to 3.02 marks. This result is statistically significant at the one per cent significance level. The smaller magnitude of the coefficient in the two-stage estimation is consistent with the finding from the Probit regression of GPA on PAL. This regression, reported in Table 2, suggests that more able students are more likely to enrol in PAL, although it should be noted that this results fails to achieve significance at conventional levels. If there is indeed some correlation between GPA and PAL, then we would expect the IMR to be a more independent measure of the effect of PAL on SNG, since it has the influence of ability (GPA) factored out. In other words the estimated effect, as measured from the OLS regression, overstates the influence of PAL, since part of the influence being captured is due to ability (correlated with PAL).

Students from mainland China also seem to perform better than all other students. This result is significant at the one per cent significance level and results in approximately an additional 5 marks on average, all other factors held constant. The adjusted R-squared for this regression is 0.34, which is quite reasonable given that the data being used is cross-sectional.

### 6.2 ACCG251

As was the case for ACCG200, the major determinant of variation in SNG in ACCG251 is variation in ability, as measured by GPA. Each one unit increase in GPA is associated with a 6.3 mark increase in SNG, on average, with all other factors held constant. The estimated coefficients on GPA are significant at the one per cent level in both the OLS and two-stage estimations. Participation in PAL has a small positive effect on SNG. The result is significant at the ten

per cent level. The magnitude of the effect on SNG is 3.32 and 2.03 in the OLS and two-stage estimations respectively. The fact that the two estimation processes produce numerically close estimates is consistent with the evidence from the Probit reported in Table 2. The estimated coefficient on GPA is numerically small at 0.02, and the t ratio is also very low. The conclusion is that for this group of students there is no relationship between ability and participation in PAL. Hence the two estimation procedures produce very similar results.

The estimated coefficients on the nationality dummy variables suggests that compared with Australian students, both students from mainland China and those from other countries perform worse, all other factors held constant. The magnitudes of these effects are 13.34 and 11.83 respectively. The adjusted R-square is 0.23, which is again quite good, given the cross-sectional nature of the data employed.

### 6.3 Discussion of results

In both units the single most important explanation of variation in performance is variation in ability. Nevertheless, it is also the case that in both units participation in PAL has a positive effect on performance as measured by SNG. Students who participate in PAL perform better than those who do not, even after controlling for a range of other factors which could influence performance, most notably, ability. The magnitude of the effect is reasonable in ACCG200, with students improving their results by 6.5 marks on average. The magnitude of the improvement achieved by PAL in ACCG251 is more modest at around 2 to 3 marks. Students from mainland China seem to perform better than other students in ACCG200. In ACCG251 it is domestic students who perform better than non-domestic students. This result was put to the lecturers in these units. As one explained, ACCG200 is a more 'technical' unit. Some 70 per cent of the assessment in ACCG200 involved solving practical numerical questions that may well have suited the learning style of students from Mainland China, as well as placing less emphasis on written communication skills.

## 7. Conclusions

This paper has a very specific focus. It sets out to quantify the effect of participation in PAL on SNG. We find evidence of numerically and statistically significant effects, especially in ACCG200. The results of the current study support past research findings that attending peer-learning programs can improve overall grades (O'Donnell, 2004; Playford et al., 1999). These quantitative results complement the findings reported in an earlier paper focusing on the qualitative benefits of PAL (Dobbie & Joyce, 2008). Together, these papers present a significant endorsement of the PAL approach. A fruitful direction for future research would be to attempt to establish whether the higher order skills that are developed in the PAL program are associated with greater success in the workforce post-graduation.

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Table 1. Regressions of SNG on student characteristics

	ACCG200	ACCG200	ACCG251	ACCG215
	(1)	(2)	(3)	(4)
	OLS	Two Stage	OLS	Two stage
CONSTANT	39.88** (27.60)	40.05** (27.74)	53.34** (20.02)	54.39** (20.57)
GPA	10.27** (18.17)	10.34** (18.32)	6.25** (5.52)	6.28** (5.55)
PAL (OLS)	6.561** (2.75)		3.32# (1.66)	-
PAL (IMR) (2 step)	-	3.02** (2.75)		2.03# (1.67)
CHINA	5.62** (4.58)	5.63** (4.58)	-13.34** (-5.51)	-13.34** (-5.51)
OTHER Nation	1.41 (0.92)	1.41 (0.92)	-11.83** (-4.10)	-11.83** (-4.10)
Number of Observations	686	686	210	210
Adjusted R <sup>2</sup>	0.34		0.23	

**Notes:** \*\* implies significant at the 1 per cent level. # implies significance at the 10 per cent significance level. The *t-ratios* are in brackets. *F-tests* for joint significance (not reported) rejected null hypothesis in all models.

Table 2. Probit Regressions of PAL as a function of GPA

	ACCG200	ACCG251
Constant	-1.86*** (-9.20)	-0.48** (-2.66)
GPA	0.10 (1.21)	0.02 (0.23)

**Notes:** \*\* denotes significance at the 1 per cent significance level. The *t-ratios* are in brackets.