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Peer Learning and Performance: Results from a First Year PASS Implementation

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BACKGROUND
The Peer Assisted Study Scheme (PASS) is an optional program for students based upon the principles of peer and independent learning. It is often anecdotally well regarded amongst participants and implementers, and was introduced to the Melbourne School of Engineering at the University of Melbourne in semester 2, 2011. To determine the effectiveness of this introductory implementation a study was undertaken to investigate trends in student results according to participation as well as to identify the demographic that the program appeals to. Of the approximately 600 students enrolled in the subject around half of them agreed to participate in the study.

PURPOSE
This study aims to determine if there are detectable improvements in the results of students who participate in PASS and whether it appeals to the student groups typically requiring extra support within engineering, those groups being international students and female students.

DESIGN/METHOD
This study investigates the results attained by students enrolled in a first year engineering subject, comparing students who participated in a reasonable number of PASS sessions against all other consenting students in the subject. Students are grouped by their average performance in all of their previous subjects to reduce the impact of self-selection bias. Attendance was also tracked and matched up with nationality, gender and previous performance. Surveys were conducted to gauge student satisfaction.

RESULTS
PASS appears to be favoured by international students as well as female students. High performing students also are attracted to the program. Performance is not guaranteed by participation, but trends suggest that a reasonable level of attendance could have immediate benefits. Student feedback is very positive and generally agrees with the guiding principles of PASS.

CONCLUSIONS
The Peer Assisted Study Scheme appears to be well suited to Engineering, naturally attracting international students and female students, two groups that typically are targeted for support in engineering schools. The results of this study suggest that reasonable levels of attendance may result in modest immediate academic benefits. Future areas of research could include a longitudinal study of PASS as well as how best to motivate attendance.

KEYWORDS
Peer Learning, First Year Students, Engineering

Background

The Peer Assisted Study Scheme (PASS), also referred to as Peer Assisted Study Sessions (UoW, 2008), Supplemental Instruction in the United States of America (UMKC, 2012) and Peer Assisted Learning in the UK (BU, 2012), is a program where students study together in small casual groups led by a senior student. Students are given guidance but not direct answers with the emphasis being on the students to make the most of resources already available to them.

PASS was developed at the University of Missouri – Kansas City in 1973 under the name of Supplemental Instruction(ICSI, 2003). The goals of PASS, as defined by the University of Missouri-Kansas City, are:

1. To increase retention within targeted historically difficult courses
2. To improve student grades in targeted historically difficult courses
3. To increase the graduation rates of students

Goal 2 is of most interest to the authors, particularly with respect to the impact on both international students and female students, these groups typically being targeted for extra support. To this end, with the introduction of PASS into the first year subject Engineering Systems Design 2 at the University of Melbourne, a study was conducted to answer the following questions:

1. Is there a connection between PASS attendance and results?
2. Does PASS attract international students?
3. Does PASS attract female students?

Other studies have investigated these questions showing that PASS can have a beneficial effect on results (Congos & Schoeps, 1993; Hoi Kwan & Downing, 2010; ICSI, 2003, 2007; Oja, 2012) although McCarthy et al. (1997) suggest that the common methods of assessing PASS student performance are not rigorous enough and recommend considering past performance as one refinement among others.

While many studies have looked at the performance of students participating in PASS, there are significantly less that have investigated the student demographic that PASS appeals to. This is perhaps not surprising considering the importance of environment and context to demographic appeal. Oja (2012) reports finding no strong relationship between PASS attendance and gender or ethnicity, although this is in the context of the United States of America with students primarily studying science and maths.

Subject Overview

In 2011 semester 2, PASS was introduced to the subject Engineering Systems Design 2. While PASS had been available at the University of Melbourne for a number of years, this was the first time that it had been implemented within Melbourne School of Engineering. Engineering Systems Design 2 is a general engineering subject taken by the majority of first year engineering students covering digital systems, programming and mechanics. The three discipline modules are approximately 3 weeks each, with weekly group assignments, multiple choice tests at the end of each module and an exam worth 60% at the end of the semester. Contact sessions comprise of three 1-hour lectures a week as well as a weekly 3-hour workshop which begins in week 3.

During this period PASS was run in parallel to an on-line version of PASS, but due to negligible attendance to the on-line version, only face-to-face PASS will be considered in this paper. PASS began with 6 1-hour sessions per week, with two online sessions converting to face-to-face sessions approximately halfway through the semester. Sessions were capped at

around 13 students, although this was rarely implemented as numbers were typically below this. The primary 6 sessions were led by two third year engineering students who had been carefully selected and had received two days of training in leading PASS sessions. The subject cohort consisted of 613 students of which 279 agreed to participate in the study.

Method

Cohort Demographic

To validate the appeal of PASS to particular cohorts, the number of students involved in the study and their representation within the whole cohort was considered. The particular student groups of interest were international students (students without Australian citizenship) and female students. International students were of interest as this is a student group that the Melbourne School of Engineering, and typically other Engineering Faculties, is interested in growing. It is also a group that often needs extra support due to cultural differences and language difficulties. Female students were also included in the investigation as this is a group that is often underrepresented in engineering and also typically is targeted for extra support.

As can be seen in Table 1, self-selection should not have a significant impact on demographic appeal statistics, with approximately equal representation within the study as that within the cohort as a whole.

Table 1: Cohort Demographic Characteristics

	Cohort		*Participating in Study*	
Characteristic	# of students	% of total	# of Students	% of total
Total	613		279	
Gender				
Male	508	83%	229	82%
Female	105	17%	50	18%
Nationality				
Australian	426	69%	185	66%
Other	187	31%	94	34%

From this point forward, only students participating in the study will be discussed.

A typical risk of voluntary academic programs is that high performing students may be more inclined to participate and therefore produce biased performance figures (McCarthy et al., 1997). To reduce this problem, students will be categorised according to the average result they had achieved in all previous subjects (typically 4 subjects), and only be compared within these groups. Table 2 outlines the groups and the lower and upper bounds that define the groups. Students were allocated to a group if they had an average equal to or greater than a group's lower bound, but below the group's upper bound. These bounds have been chosen based upon grade categories at the University of Melbourne.

Table 2: Student Achievement Groups

Group	*Description*	*Lower Bound*	*Upper Bound*
A	First Class Honours Students	80%	100%
B	Honour Students	65%	80%
C	Passing Students	50%	65%
D	Failing Students	0%	50%

The number of sessions that a student must attend to be considered as having participated in PASS varies. The International Centre for Supplemental Instruction (ICSI) national surveys (2003, 2007) requires attendance at only 1 session, and while this is understandable considering the breadth of their data and their lack of control over the data collection, it also

seems to be a little unrealistic. Congos and others (Congos & Schoeps, 1993; McCarthy et al., 1997; Oja, 2012) recommend 5 sessions as being required to gain benefit from the program and this is the number that will be used in this study. Of the 279 students who had agreed to participate in the study 42 had attended at least one PASS session, and only 27 students had attended 5 or more sessions.

Student Surveys

In addition to investigating students' academic and demographic information, surveys were also created to gauge whether the PASS implementation was meeting the students' expectations and also whether there were any obvious issues that might be impacting on the results of the study. The survey was designed to generate feedback both for PASS and the online version of PASS, but as previously mentioned the online version will be excluded. Key questions of interest from the survey were:

1. How many sessions have you attended this semester?
2. What was the most valuable part of attending PASS?
3. What was the least valuable part of attending PASS?
4. How likely are you to attend PASS in the future?

Questions 2 and 3 were subjected to basic topic analysis where the topics identified were counted for each response. Question 4 was a 5-point Likert scale type question spanning from "Very Likely" to "Very Unlikely".

Results

PASS Appeal

Figure 1 shows that around 10% of students participated in PASS. Half of the students attending PASS were international students and around a third were female. These figures were approximately twice the representation of these groups in the larger cohort. As there was no variation in the way PASS was promoted to these student groups, it is clear that in this implementation, PASS appealed more to both international students and female students in contrast to Oja's (2012) findings. Although the approximately equal balance of male and female students in Oja's study and her focus on ethnicity rather than nationality may be key factors to these differences.

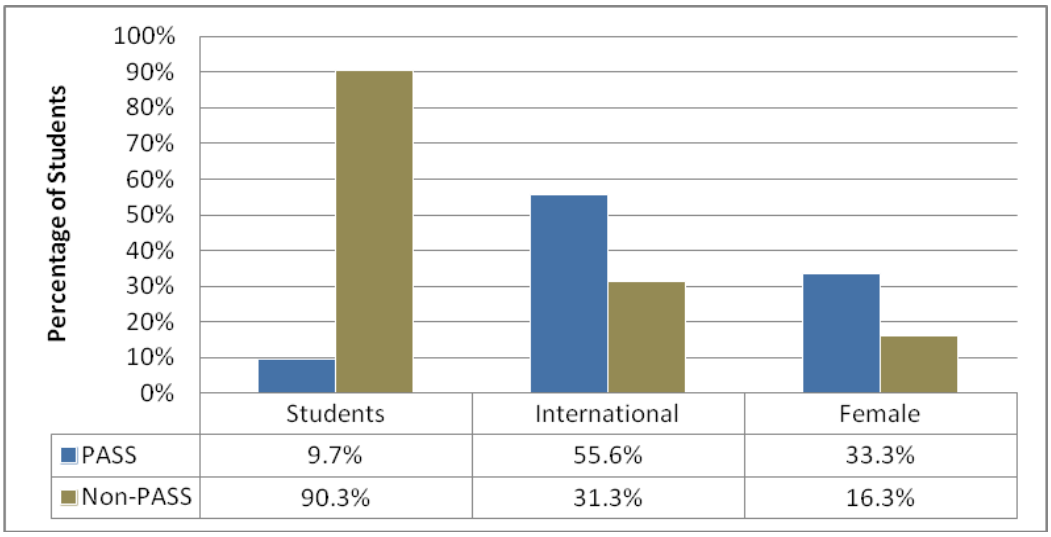
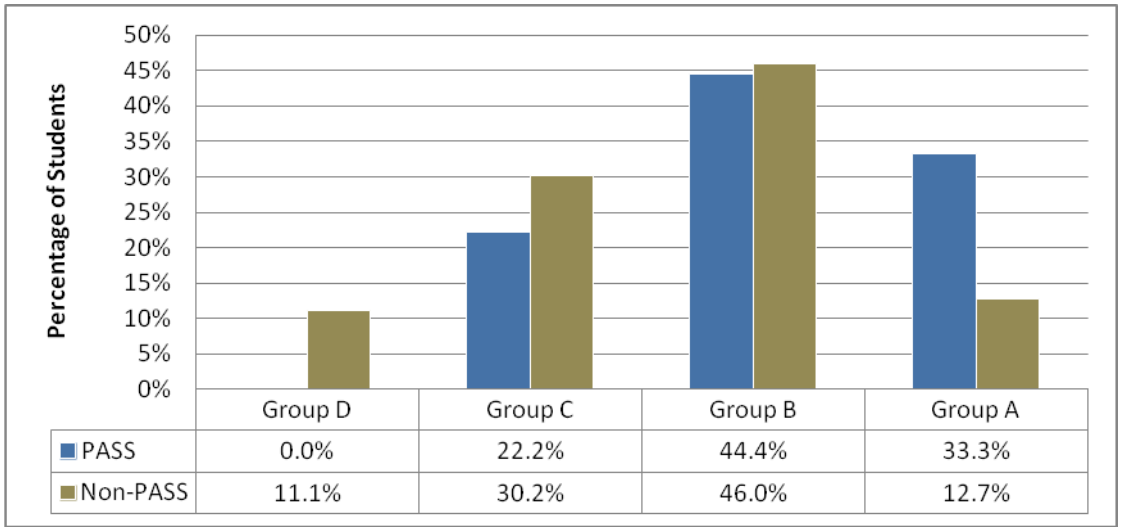


Figure 1: Demographic Representation

Self-Selection

The representation of achievement groups is depicted in Figure 2 as a percentage of all PASS students and all non-PASS students. A clear bias is apparent for high performing students to participate in PASS with a third of all PASS participants being in Group A, and only an eighth of non-PASS students being similarly categorised.



	Group D	Group C	Group B	Group A
PASS	0.0%	22.2%	44.4%	33.3%
Non-PASS	11.1%	30.2%	46.0%	12.7%

Figure 2: Student Representation by Achievement Groups

These results suggest that Congos' and others (Congos & Schoeps, 1993; McCarthy et al., 1997; Oja, 2012) concerns are justified, and reinforce the importance of considering the students' past academic performance when evaluating the impact of PASS. This does contrast a little with the findings of McCarthy et al. (1997) where similar attendance was observed for students from both 'disadvantaged' educational backgrounds and 'advantaged' educational backgrounds, but in consideration of the differences in context (academic performance versus educational background, and Australia versus South Africa), this may not be entirely signficant.

While some students with an average below 50% (Group D) attended 1 or more PASS sessions, none of these students attended 5 or more sessions.

PASS Participation

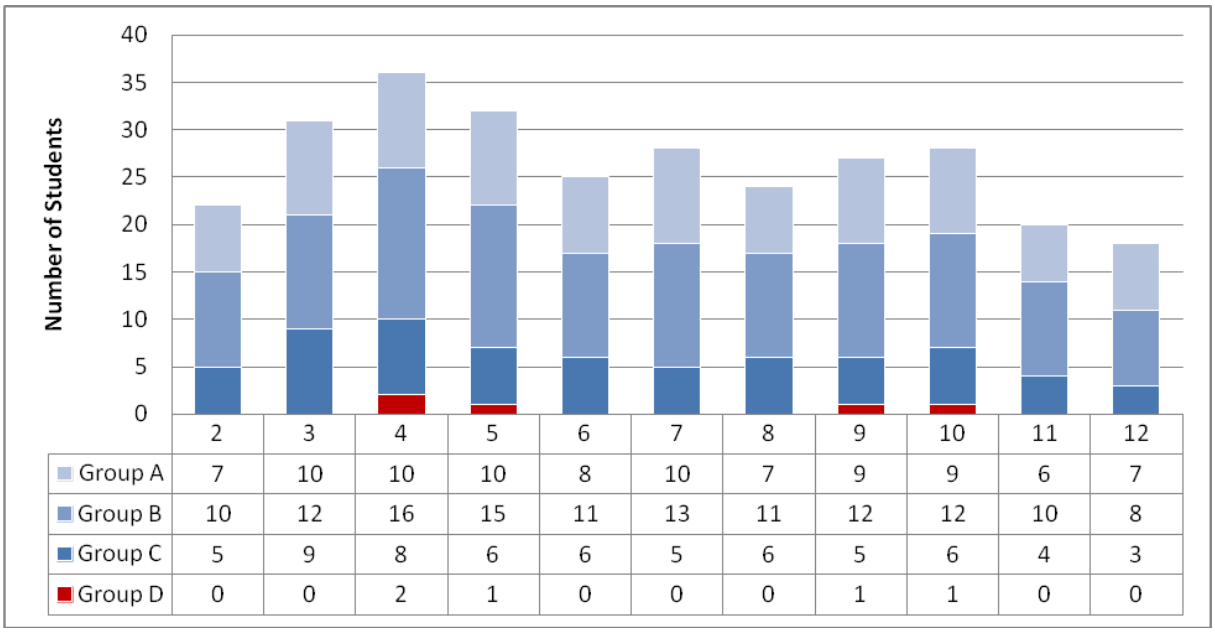
Throughout the semester there were 6-8 sessions of PASS per week. Attendance varied from 0 to 12 students per session, with the strongest attendance being early in the semester followed by a gradual decrease across the later weeks.

Participation was encouraged by student leaders promoting the program during lectures, periodic announcements through the subject's official web page, reminder emails from leaders to registered students, providing lollies during PASS sessions and occasionally awarding coffee vouchers to participants.

There appears to be little correlation between attendance and assessment points, as the only variations in the assessment were module tests in weeks 5, 8, 10 and 12. This contrasts with the findings of Webster and Dee (1998) who observed increases in attendance immediately before four exams held throughout the semester. This variation may be explainable by the very low percentage allocated to the tests within Engineering Systems Design 2, although it is unclear what percentage of the subject marks were allocated to the exams in Webster and Dee's study.

Additionally students typically find the programming module the hardest, performing the worst in this section of the exam. While this module spans weeks 6 to 8 there still appears to be no particular increase in attendance. Time of attendance also doesn't appear to strongly

correlate to achievement group as can be seen from Figure 3, although Group A students do appear to attend with the greatest consistency.



	2	3	4	5	6	7	8	9	10	11	12
Group A	7	10	10	10	8	10	7	9	9	6	7
Group B	10	12	16	15	11	13	11	12	12	10	8
Group C	5	9	8	6	6	5	6	5	6	4	3
Group D	0	0	2	1	0	0	0	1	1	0	0

Figure 3: Weekly PASS Attendance by Performance Group

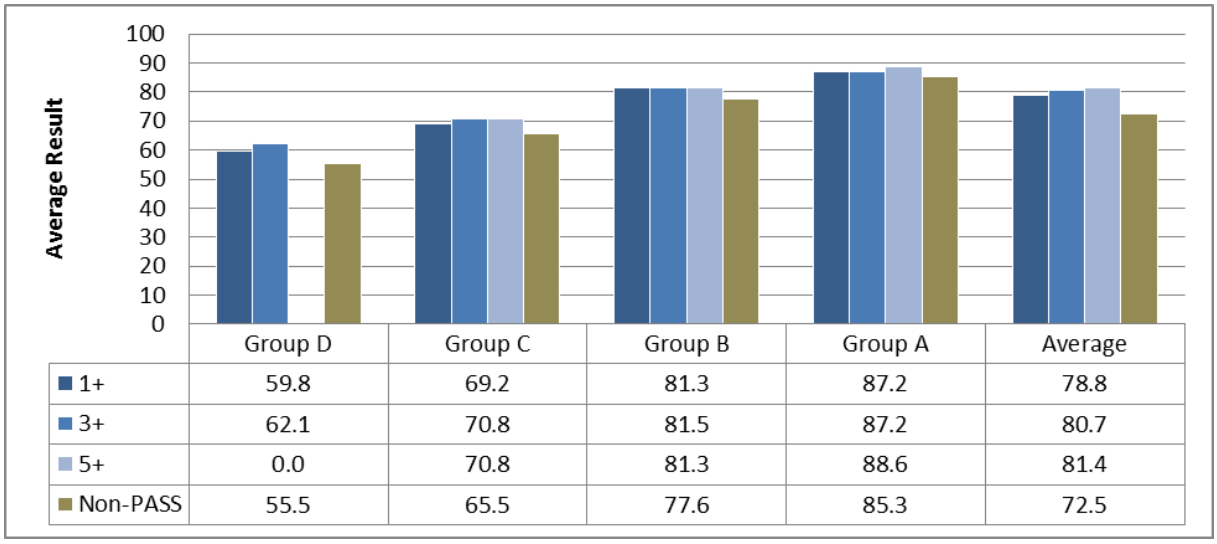
Performance

While performance is not guaranteed by attending PASS, there does appear to be a correlation between attending PASS and improved results in agreement with the findings of many others (Congos & Schoeps, 1993; Hoi Kwan & Downing, 2010; ICSI, 2003; McCarthy et al., 1997; Oja, 2012; Webster & Dee, 1998). Students attending PASS in Group C (Passing students) averaged a 5% improvement over their non-PASS counterparts, with Group B (Honours) students averaging around a 4% improvement and Group A (First class honours) students around 3%. As no Group D (Failing) students participated to the minimum amount in PASS, no trend can be observed. The variation in improvement between lower and higher achieving students could be expected as per McCarthy's et al. (1997) findings but in this case is not likely to be significant.

To check the impact of restricting PASS attendance to a minimum of 5, Figure 4 includes average academic performance in Engineering Systems Design 2 for students who attended:

- 1 or more PASS sessions;
- 3 or more PASS sessions;
- 5 or more PASS sessions; and
- less than 5 PASS sessions (the standard non-PASS group).

As can be seen, an improved average performance would be still observed even if the minimum requirement for PASS classification was lowered to 3 or 1. By looking at the overall average it is also clear that the improvement would be significantly exaggerated without considering past performance, with an average result in students participating in PASS being 9% higher than that of students who didn't participate.



	Group D	Group C	Group B	Group A	Average
1+	59.8	69.2	81.3	87.2	78.8
3+	62.1	70.8	81.5	87.2	80.7
5+	0.0	70.8	81.3	88.6	81.4
Non-PASS	55.5	65.5	77.6	85.3	72.5

Figure 4: Average Academic Result in Engineering Systems Design 2 by Performance Group

Feedback

Overall, the respondents felt that the PASS implementation was worthwhile. Thirty-one survey responses were received with respondents having attended between 1 and 12 sessions. As can be seen from Table 3 the majority of students felt they would be very likely to attend PASS again.

The most common topic found amongst the positive aspects of PASS was peer learning. This was expressed in ways such as “Being able to practice problems with peers who wanted to be there.” and “Being able to collaborate ideas with other students and a great mentor.”. The value of having a good leader is also suggested by the high response rate identifying the leader as being one of the most valuable parts of PASS. Other positive aspects of PASS that were only identified by a few responses have been omitted.

Regarding the negative aspects of PASS the vast majority felt that there were none, with only a few isolated concerns.

Table 3: Feedback Results

	Result
Total number of responses	31
How many PASS sessions have you attended this semester?	8.6 (Average)
How likely are you to attend PASS in the future?	
• Very Likely	24
• Very Unlikely	2
• No response	4
What was the most valuable part of attending PASS?	
• Peer Learning	11
• PASS leader	8
• Completing questions	8
• Subject revisions	7
What was the least valuable part of attending PASS?	
• Nothing was bad about PASS	22
• Some unclear explanations	1
• Low attendance	1
• Confusion over room allocations	1
• Being left with mint lollies	1

Conclusion and Limitations of the Study

The key limitation of this study is the population size of 27. With a population of this size the results of this study can only suggest what future findings may be. Even so, as an evaluation of an initial implementation, these results are of use for guiding future action. The second limitation of this study is the inclusion of only a single subject. Any conclusions that can be made from this study can only be considered in the context of Engineering and also only within the Australian tertiary education environment. As the majority of students will be first year undergraduate students, a further limitation will be placed upon how the results may be interpreted with regard to more experienced cohorts. Future studies will benefit by spanning multiple subjects and possibly multiple years, although focusing on a particular discipline may still be useful.

This study suggests that within groups of students with similar academic performance histories, there are likely to be observable improvements in the average result of students who have participated in PASS compared to those who haven't. Due to the small sample size these improvements are only indicative and not conclusive, but these results support the significant body of literature that states that PASS improves academic results and does so within the Australian Engineering context.

Within this implementation, PASS has also had a stronger appeal to both female students and international students, making it a potentially desirable program for Australian Engineering schools aiming to increase their numbers and retention of both of these groups.

The appeal of PASS to high performing students, while expected, is an area that requires more investigation and effort. It would be preferable to connect the academic benefits of PASS with a larger proportion of lower performing students, particularly as they appear to possibly benefit greater than their higher achieving counterparts.

Attendance was inconsistent and is another area that needs further investigation. The impact of promotion versus incentives may be a useful area of study as well as reasons why students attend only a couple of sessions and then drop out.

Finally PASS was identified as being well received amongst the student group who participated in it to some degree. The vast majority of participants who responded to the survey felt that they would participate in PASS again. Additionally the component of the program most commonly identified as being of value was peer learning, the key principle of PASS. There were also no significant problems identified, with most respondents feeling that there were no problems with the program in any form.

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