Questions arising from the use of peer assisted learning as a technique to increase diverse participation in engineering education

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***Abstract**: A program of peer assisted study sessions (PASS) was piloted in the second half of 2010 in two first year engineering courses catering to both on-campus and distance students. The student cohort concerned is a diverse cohort of students, a large percentage of whom are non-traditional higher education students accessing the course through distance education. The PASS program was implemented in both traditional face to face on campus sessions as well as in an online mode, which was intended to partially address issues of inclusivity and access to peer support for this diverse cohort.*

The program was evaluated using a program logic approach. The evaluation confirmed that participants experienced all of the benefits generally associated with peer assisted learning programs: improvements in learning attitudes and skills, increased focus and motivation, mastery of course content, increased confidence and a positive attitude towards faculty.

Despite the positive results of the evaluation it was noted that the participation rates by students were low, particularly for the online version of the program. Several questions were raised by the evaluation through the dichotomy of positive perceptions and outcomes and the relatively low uptake of the program. This discussion paper reports on the initial stages of a qualitative research project investigating the effectiveness of online peer assisted study sessions for engineering students.

Introduction

There is significant literature to suggest that PASS programs have a positive impact on student engagement, retention and progression. However distance students have not previously had access to these programs. We are attempting to address this by making the benefits of a PASS program available to students in an online environment. If effective, such a program would partially address issues of isolation and the lack of peer support commonly experienced by distance students.

Background Literature

PASS sessions provide a supportive learning environment where students are encouraged to work together. Collaboration and peer learning are facilitated by session leaders who provide learning strategies that foster transferable academic skills, and specific exercises/activities that consolidate course content (Skalicky et al 2009). PASS sessions are not remedial in nature and benefit all students regardless of academic ability. In this way, they are inclusive of a range of student backgrounds and needs. The success rates of PASS are well-established both internationally and in Australia, with evidence showing that PASS improves academic achievement, reduces drop-out rates and assists students in becoming a part of the university community (Van der Meer and Scott 2009; Kieran and

O'Neill 2009; Allen and Court 2009; Cheng and Walters 2009; Couchman 2009). PASS is therefore an important program that complements the existing curriculum and improves students' overall experience at university.

Program Implementation

The two courses where PASS was piloted at USQ were key first year engineering courses: Introduction to Engineering and Surveying and Engineering Statics. These courses cater for students from multiple disciplines undertaking two, three and four year engineering programs. More than 75% of students enrolled in these courses are distance education students, most of whom are already in the workforce, mature age and studying part time.

PASS sessions were run in traditional face to face mode twice weekly for each course. One session was run on campus during the day and another in the evenings at one of the adjacent residential colleges. Both of these sessions were open to all students; on-campus, college residents and distance.

Attendances at the face to face sessions grew steadily during semester to a peak of approximately 10 consistent participants at each session, representing just over 20% of the on-campus cohort. Two of the evening participants were enrolled externally, figures are not available regarding the total number of external students resident in the local region.

The main means of interaction with course staff and peers for distance students is via the Learning Management System (LMS) on the website set up for each course. So an online version of PASS was implemented using the LMS to cater for this portion of the class. A-synchronous discussion forums were used by PASS leaders to post study tips and activities and to start discussions on topics of interest that had arisen from the face to face sessions. They also offered weekly real-time discussions using 'Wimba' technology which provided online conference call, video and 'whiteboard' facilities.

During this pilot program no students participated in the real-time sessions and during the subsequent summer semester only one student participated in real time sessions. The a-synchronous discussion forums attracted over 1500 hits during the semester, with many students returning on a regular basis to read leaders' posts. However there were only 3 posts made by students to these forums. This participation pattern was significantly different to the formal course forums, monitored by course staff, which attracted a constant flow of posts from students.

Program Evaluation Methodology

A program logic approach was used to formally evaluate this pilot program. Evaluation and monitoring matrices were developed in collaboration with project staff. Firstly, staff were canvassed for their understandings of what PASS could and should achieve and program objectives were identified.

There was good agreement across the involved staff about the purpose of the program, which in their understanding went beyond the usual PASS goals of increasing performance and retention to wider issues of building learning communities. This analysis then informed the evaluation framework agreed on with staff, which can be summarised as in Table 1.

Table 1: Objectives of the program and measures used in evaluation.

Objectives	Measured By
1. Appropriate/Targeted attendance and resources of 'PASS'	Demographics/attribute data, right people (students/leaders), support needed/provided, setting, topics covered.
2. Students demonstrate a mastery of the content	More problems attempted, active contribution of students, integration of content.
3. Students demonstrate improved learning attitudes and skills	Efficient use of time, increased collaboration & confidence, time spent in study, adjusted ambitions.
4. Students demonstrate a positive attitude towards the Faculty	Attendance, class contribution
5. Students appreciate their issues in context	Support networks, problem-solving strategies, comprehension of discourse,
6. 'PASS' Leaders develop leadership skills	Developmental process.

Data collection was undertaken primarily through three on-campus focus groups conducted towards the end of semester. The Mixed group consisted of 5 PASS leaders and students; the Leader group consisted of 5 PASS leaders; and the Student group consisted of 6 students who attended PASS sessions during the course of the semester. Given the facilitative nature of focus groups, sessions were not tightly structured and were based on key topic areas used to measure objectives.

Qualitative data gathered from all three focus groups was analysed using the content analysis method. Each focus group (mixed, leader and student) was coded into categories based on key measures. Categories were then put in table format in order to provide a cross-comparative analysis of all three focus groups. The results are subsequently discussed in relation to whether or not the project has met the stated objectives.

Data regarding the online PASS sessions was gathered from leaders during the focus groups but due to the lack of active student program participants, data regarding the online program from a student perspective was not available.

Program Evaluation Results

Due to space constraints only the qualitative results pertaining to the first three program objectives are discussed briefly as being most relevant to the dichotomy that emerges.

Objective 1: Appropriate/Targeted attendance and resources of 'PASS'

Demographics: Focus group participants from the leader group identified that the proportion of mature-aged and school leaver students attending sessions varied, from approximately 50% mature-aged to 1 mature-aged student. Some participants discussed the gap between high school and university, and how first year students feel unsure of what to expect at university. One leader identified that 'PASS' helps facilitate this transition, and that they wished that 'PASS' had been established when they were in first year.

Student Attributes: There was variation between participants as to the type of student who attends 'PASS'. Some participants identified that the typical 'PASS' student was committed and doing well in their studies, whilst others stated that 'PASS' was attended by both struggling students and high achievers. One participant discussed how some struggling students did attend 'PASS' once they had reached a crisis point in their studies and realised that they needed help. These findings suggest that different types of students attend 'PASS', and their reasons for attendance vary according to their perceived needs. This finding is further supported by the final student grades which varied across all available passing grades.

Setting: All participants identified that the physical settings for face to face sessions were adequate, although some improvements were suggested. However, most participants felt that the online 'PASS' settings were not suited to the collaborative style of 'PASS'. The following reasons were discussed:

- Online chat forums can become confusing. A student can post a question and receive numerous response posts that go off on tangents. In the process, the original question or discussion starter becomes lost.
- Leaders identified that it is easier to guide students face to face, because they can better gauge students' progress through monitoring their facial expressions. Leaders can then assist students who are struggling.
- The personal interaction component of face to face sessions, and the physical working through of problems on paper was identified as more beneficial than online discussions. In particular, students preferred to talk freely in face to face sessions than type in online sessions.
- The Wimba technology was identified as problematic, in that it sometimes failed to work or students did not have the required set-up software to use it.

This suggests that there are ways in which online 'PASS' sessions may be improved in order to work better for students, however it also raises the point that some characteristics that facilitate collaboration become lost in an online setting. One leader admitted that it is difficult to accommodate every student in online sessions, but that younger students may be more open to trying different communication mediums and formats.

Objective 2: Students demonstrate a mastery of the content

Participants discussed how 'PASS' questions and exercises helped students understand course expectations and exam questions, that leaders explained content in a way students could easily understand and that as a result of 'PASS', participants were able to keep up with the lecture content. Participants from both the Leader and Student groups also identified that students were attempting more problems overall in comparison to when they first began attending 'PASS'.

Problem Solving: Leaders identified that some students struggled with problems when presented in a different way to the worked example, demonstrating that they had not mastered the method of problem-solving prior to 'PASS'. Leaders addressed this issue by identifying specific components of the problem that students did not understand, and demonstrating how each part fits together to make up the whole. Some students were identified by leaders as improving as a result of this assistance, whilst others still struggled. Both leaders and students identified that problems set during sessions became more complex as the semester progressed. These findings suggest that most students are understanding the fundamentals of content, and are moving onto attempting more difficult questions and subsequently more difficult content.

Leaders also discussed the importance of finding different ways to represent the problem as part of a problem-solving method (for example, visual representations such as diagrams). One participant discussed how for some students, problem representation was new information, suggesting that students are learning effective problem-solving strategies in 'PASS' that they have not previously encountered (or remembered) in classes or lectures. Students were also identified as attempting more problems and persevering in working through problems, due to the range of alternative strategies provided by 'PASS' session leaders.

Objective 3: Students demonstrate improved learning attitudes and skills

The following graph represents the percentage of participants from each focus group (Mixed, Leader and Student) who identified 'PASS' as providing an opportunity for them to develop or practice the following learning attitudes and skills: Mastery of Content; Efficiency of Learning; Work Ethic/Learning Orientation; Problem-Solving and Collaboration/Joint Problem-Solving. Although focus group data needs to be analysed qualitatively, the following graph provides an indication of the number of participants who identified that 'PASS' helps develop academic skills.

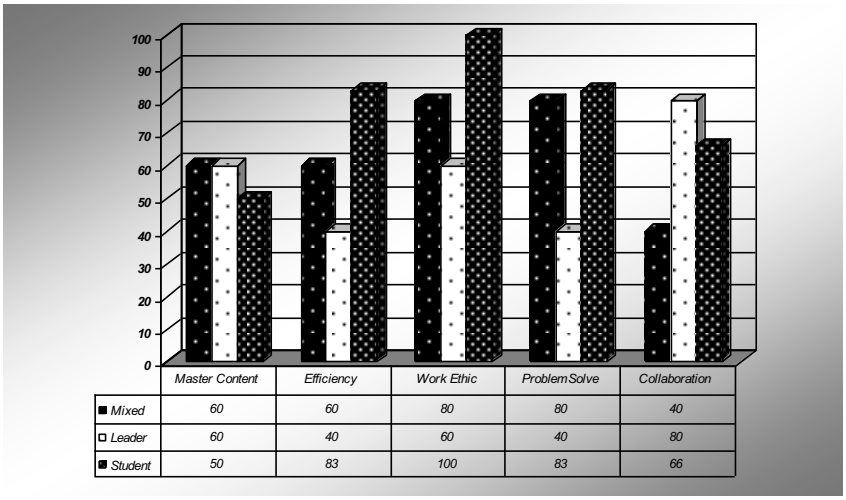

Figure 1: Participants' Discussion of Learning Attitudes and Skills

This graph demonstrates that most participants identified 'PASS' as a positive learning resource which had helped them develop or improve their academic skills. Reasons for lower percentages in the Leader Groups for efficiency and problem-solving may be explained by leaders' cautiousness in drawing a direct correlation between 'PASS' sessions and student behaviour. Nevertheless, the students themselves attributed their improved learning skills and academic achievement to 'PASS' sessions, to the extent that one participant identified that they would have probably failed the course if

they had not attended 'PASS', and two more participants identified that they perceived 'PASS' session students as performing better than students who did not attend 'PASS'.

Efficiency of Learning: Most participants from all three focus groups discussed how 'PASS' sessions teach learning strategies and time organisation skills that equip students to prepare for assessment more efficiently and effectively. Students discussed how the strategies they learned and implemented during 'PASS' have helped them understand content and solve problems in a shorter period of time, which meant that they were able to keep up with the course content overall. In particular, specific strategies leaders provided for moving through exam questions quickly and effectively were identified as helpful and not provided previously by lecturers and tutors. This suggests that 'PASS' complements the existing curriculum by better equipping students for assessment tasks.

Work Ethic/Learning Orientation: Participants from all three focus groups discussed how 'PASS' encouraged students to stay focused and motivated, which in turn resulted in students working on content in their own time. Students and leaders discussed how 'PASS' encourages students to study and work with their peers on problems, rather than procrastinate by themselves. This motivation became a work ethic which carried over to students' independent study times. Direction from leaders during sessions helped students understand if they were on the right track, which in turn helped students continue to work through problems instead of becoming discouraged and giving up. Students and leaders identified an increase in work ethic as the major benefit of the sessions and it could be postulated that this can be expected to lead to better results and better retention.

Collaboration: Students discussed how they helped one another with problems and questions, according to their various backgrounds and strengths, and that this "teaching" helped each student with their own learning. Leaders confirmed that helping other students consolidates content, and discussed how students were helping one another and sharing their experiences more in comparison to when they first began 'PASS'. This suggests that 'PASS' sessions facilitate a peer learning environment and encourage students to participate in class, which in turn contributes to a better understanding of the content.

Increased Confidence: Many leaders identified that that there has been an increase in students' confidence since the inception of 'PASS', as characterised by the following indicators:

- Students ask more questions, and admit when they are struggling with content.
- Students are willing to attempt problems
- Students have a better idea of how to approach their study, how to organise their time during exams, and what they need to know for exams.

The students themselves did not directly discuss how confident they felt, however other indicators discussed previously such as attempting more problems and increased collaboration could be taken to indicate increased confidence as well.

Discussion

The program evaluation overwhelmingly indicated that the program was meeting the objectives for participants articulated by program staff. In particular, a range of students attended the sessions and their mastery of course content, academic skills and attitudes to study appear to have been positively affected by their PASS experience. These broad findings indicate that PASS is an appropriate student support mechanism for this type of fundamental numerical course.

However the one area that was disappointing was the uptake of the program by students in the face to face but more particularly in the online mode. The seeming lack of interest in the online PASS program is particularly puzzling in light of consistent calls by distance students for more support and equity between services offered to on-campus and distance students. The program was clearly promoted to students on this basis.

Several possible barriers to the success of the online program in terms of setting were suggested during the evaluation process and have already been discussed. Further possible barriers could include;

- If a student wants to ask a specific question about course material they already have this facility through the forums monitored by course staff. Students may perceive that the same service is

being offered by both course staff and PASS leaders, and that these forums are effectively competing with one another.
- The collaborative nature of learning facilitated by PASS programs is not suited to the online environment. It should be noted that these same students had already completed project based learning courses in an online mode, where peer collaborative learning (albeit facilitated by staff rather than student leaders) is required.
- Current technology (the Moodle LMS and Wimba tool) are problematic and perceived by students as difficult to access. This may be characteristic of the demographics of the cohort. Younger students may feel more confident with online technology, whereas the significant portion of older students in the distance cohort may find it intimidating.
- Competing demands for student time (including employment, family and other study commitments) and the large number of online resources may be reflected by a preference for a-synchronous resources rather than committing to a set time for interaction.
- The personalized, intimate support provided by face to face peer collaboration is difficult to replicate online.
- The nature of engineering courses may be less suited to a-synchronous collaborative work than more discursive courses

Future strategy to investigate the barriers to online PASS

Adjustments that can be made to future implementations of the online PASS program which could assist in its uptake include the investigation of alternative technologies and clearer communication of the purpose and objectives of online PASS. If a more assessable technology can be identified as providing the required facilities then it may encourage students to try the real time sessions. Promotion of the sessions could also more clearly differentiate the program from staff support and highlight the collaborative learning intentions of the program.

Research into this area could include the collection of data collection from distance students regarding their perceptions of the program and its perceived barriers. A wider literature search regarding online collaboration could also yield clues to more effective implementation.

The aim of such future research would be to address inclusivity in access to peer support for our diverse student cohort by merging two powerful student learning tools; online technology and peer assisted learning.

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