Program-based Peer Assisted Learning

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CONTEXT

Peer assisted learning (PAL) is recognised as a successful way to improve academic outcomes amongst groups of students, whilst also encouraging personal growth and development. Many institutions currently support *unit-based* peer-assisted learning activities, usually targeting *1st year* units, primarily to assist students' transition to university.

Shifting focus to *program-level* curriculum design and learning outcomes raises an opportunity to rethink peer-assisted learning, and to develop a complementary PAL framework that focuses on program learning outcomes and discipline-specific competencies that are expected to develop over a complete learning program.

PURPOSE

The aim of this research was to identify and develop a PAL framework and activities with the following features:

i) A focus on competencies developed throughout *degree programs*, rather than selected units,
ii) involve and serve students across *all* years of their learning program,
iii) enable and encourage *students* to take responsibility for developing, managing and sustaining PAL groups and activities.

The research is being conducted in the context of an engineering degree program, but we are seeking to develop a framework that, with appropriate changes, will be relevant in any discipline.

APPROACH

The research was conducted in two stages;

- Stage1: cross-disciplinary investigation of characteristics of a program-based PAL framework, and
- Stage 2: implementation of a pilot PAL program in engineering over a semester.

Stage 1 informed the design of the Stage 2 pilot. In Stage 1 students from a range of disciplines were surveyed to identify what features would attract them to participate in program-based PAL activities, i.e. beyond the PASS model of PAL (currently available to some 1st year students). In Stage 2 several groups of volunteer students were engaged in projects to construct a variety of kits (e.g. hexapod robot, 3D printer, Arduino microcontrollers, etc.) and to modify and/or utilise them in a novel way. Each group comprised a senior-year mentor and at least one student from each year of the engineering program representing a cross-section of engineering majors. A tutor was engaged to supervise the students and help find resources, however the primary responsibility for problem solving was placed with the students. At the end of Stage 2 all participants were surveyed, and focus groups conducted.

RESULTS

Whilst some groups of students dropped out relatively early due to lack of time, several groups rose to the challenges they encountered, both expected and unexpected. The students who remained in the program benefitted from their cross-year and cross-disciplinary projects and demonstrated an interest in continuing. However, it appears that ongoing support and specific preparation of students to work in diverse and multidisciplinary groups will be necessary if the program is to become self-sustaining.

CONCLUSIONS

Our investigations lead us to believe a there is a place for program-based PAL in universities, however further studies are required to determine how best to prepare students, structure the projects, and manage the groups to ensure their continuation.

KEYWORDS

Peer assisted learning, project based learning, supplementary learning.

Introduction

Peer assisted learning (PAL) is recognised as a successful way to improve academic outcomes amongst groups of students [1,2], whilst also encouraging personal growth and development [3].

Many universities support *unit-based* peer-assisted learning (PAL) activities [4,5]. To date, such PAL activities have usually targeted *1st year* units. In addition to supporting the achievement of formal learning goals they also assist students' transition to university, and encourage the development of independent and social learning skills.

Recent changes in Learning and Teaching policy at Macquarie University prompted a shift in focus to program-level curriculum design (as outlined in the University's L&T Strategic Framework). This presented an opportunity to rethink peer-assisted learning, and to develop a complementary PAL framework that focuses on *program* learning outcomes and *discipline-specific* competencies that are expected to develop over a complete learning program.

Aims

The broad goal of the project reported herein was to investigate the development and effectiveness of PAL activities with the following features:

1) a focus on competencies developed throughout *programs* (rather than selected units),
2) involvement of students across *all* years of their learning program (including the transition to post-university),
3) enable and encourage *students* to take responsibility for developing, managing and sustaining PAL groups and learning activities.

It should be noted that the aim was not to replace existing PAL programs [4-6], but to complement them.

Furthermore, the new PAL framework was to be designed to be applicable to any discipline, with a pilot program to be developed and trialled in Engineering, i.e. where the development of specific program-level competencies such as practical design and construction skills could benefit from a program-based approach to PAL.

The broad outcome hoped for was ongoing student learning of discipline-specific and generic skills and competencies, and that this would occur amongst diverse groups of students participating in enquiry-driven projects, ideally in a dedicated space and in an atmosphere of mutual and cooperative learning.

Expected additional benefits of a program-based approach to PAL (PB-PAL) include:

i) Improved student learning; junior students will be guided in their learning of program-related concepts and skills by more senior students, whilst senior students will develop a deeper understanding of what they have been learning, and the connections between the various aspects of their learning, through the process of guiding others along the same path.

ii) Improved student cohesion and satisfaction within the discipline through the development of supportive student networks within and across years of the relevant program. It is also hoped to engage better, through their peers, with those students who are often left on the "outer" in traditional learning environments because of their cultural background, gender, personal disposition, or other factors.

iii) Personal development of students, including opportunities to develop and exhibit leadership and mentoring skills, and other valuable qualities that will expand their opportunities and assist their advancement post-university.

Project Organisation

In developing the PB-PAL framework and pilot project we were guided by established methodologies [7] and existing planning and implementation frameworks [8]. We also aimed to build on experience gained in a related area, i.e. peer convening [9], and principles common to all PAL implementations, e.g. that PAL activities should be student-led [10].

The project was conducted in two stages, organised as follows;

Stage 1: Semester 2 2015 - Research and design of the program-based PAL framework.

i) Existing hierachical PAL schemes (i.e. in which senior students mentor junior students) were reviewed to identify features which may be adapted to program-based PAL. For example, hierarchical peer support is an aspect of the PASS program at Manchester University [11].

ii) A series of consultations were conducted by two undergraduate merit scholars (one from Law and the other from Engineering) with a wide cross-section of students from professionally-oriented disciplines (Engineering, Business, and Law) to determine their perspectives on;

    a) what program-specific skills they thought they most needed to develop, i.e. which were not developed adequately in their regular coursework,

    b) the type of projects and activities most likely to engage the students and develop the latter program-specific skills, and

    c) the group structures, mentoring roles, and rewards most likely to attract students and be effective in facilitating mutual learning.

    The consultations were conducted by surveys and focus groups with a set list of questions addressing the latter issues. Questions such as 'would female-only PAL groups make the PAL activities more attractive to female students?', were also included to investigate how best to engage the widest possible cohort of students.

iii) One of the investigators (Tse) undertook formal PASS supervisor training, so the team could adopt best practice from standard PAL, whilst also clearly differentiating PB-PAL.

iv) A range of PB-PAL activities were developed, ranging from programming of simple microcontrollers (i.e. Arduinos) to do specified tasks, to construction and programming of relatively complex kits (e.g. a six-legged robot, a 3D printer). Most projects combined electronic and mechanical aspects and could be classed as mechatronic projects, with the intention of engaging students across a range of engineering specialisations.

    Each project was designed to be conducted in two phases; i) a construction and testing phase, and ii) a “challenge” phase in which the students were tasked to implement a specific nontrivial functionality that would challenge even the senior students. For example, one challenge was to develop a system to make a remote-controlled drone follow a pair of white lines on the floor of the laboratory.

Stage 2: Semester 1 2016 - Implementation of a pilot PB-PAL program.

i) The PB-PAL project was advertised to all engineering students early in semester, both online and in classes, and responses logged.

ii) A "town-hall" meeting of all respondents was held, in which the nature and organisation of the research project was explained, together with the group allocation process (i.e. to maximise diversity by age, gender, background, etc.), and the projects to be completed by the students were discussed. Any questions were answered.

iii) Student mentors were identified and trained to ensure they understood their role (i.e. to mentor the less senior students, and manage the group, etc.), and that they were willing and able to fulfil that role. (Note: to help attract mentors they were offered some credit towards the professional engagement requirements of their degree).

iv) Construction of allocated projects commenced in Week 4 of semester. Participating students were required to attend a teaching laboratory where they worked in allocated groups on allocated projects for two hours per week for eight weeks under the supervision of a postgraduate student, who was instructed to facilitate project progress, but not direct the students. (Note: we plan to implement a less-controlled and more open approach to group formation and project choice as PB-PAL develops and grows – ideally students would identify and develop projects themselves which they are motivated to complete, and would form groups based not only on social connections but also with the aim of bringing together the specific skill-sets needed to complete their projects).

v) Three optional workshops were also offered throughout the semester, as follows: i) a learn-to-solder workshop, ii) a seminar by a successful entrepreneur on their experiences, and iii) a MatLab workshop. The workshops were intended to fill some specific skills gaps, provide motivation and/or ideas, and assist in the development of useful software tools by illustrating the role of modelling in engineering projects.

vi) A wind-up Pizza-night was held to celebrate the end of the project, obtain direct feedback from students on their experiences, advice on what worked well and what could be done better, and plan the next stage towards self-sustaining PB-PAL activities.

Project Outcomes

The project was supported and enabled by Strategic Priority Learning and Teaching research funding provided by the University, which was used to purchase equipment (project kits and components), provide PASS training, employ a merit scholar (an undergraduate law student) during Stage 1, and employ a Research Assistant (an undergraduate engineering student) during Stages 1 and 2. The undergraduate students were employed to undertake student surveys, plan and coordinate activities with students, and record and report on project outcomes. It is worth noting that the two student employees made a significant positive difference to obtaining the participation of students in the surveys and subsequent PB-PAL activities during the research project.

Stage 1: Semester 2 2015 - Research and design of the program-based PAL framework.

The feedback obtained from students through surveys and focus groups regarding what they would most value in program-based peer-assisted (PB-PAL) learning, was strongly influenced by their recent experiences of PASS-type PAL, if any.

For example, the Law and Business students valued the following highly; "small groups", "mentors who had excelled in the unit previously", "regular self-assessment tasks", and other such attributes of PASS-type PAL. These responses were of limited assistance for designing a PB-PAL framework. Nevertheless, it was interesting to gain insights into a very active Law Society which provides many PB-PAL-type learning experiences for these students. It was

also noted that the motivation of many of the students participating in these activities was to improve their “curriculum vitae”.

The response from Engineering students, most of whom had not previously participated in any PAL, was more diverse and helpful. For example, it was stated that they expected participation in a PB-PAL project would help them “achieve a better understanding of Engineering, and work effectively in a group”. Furthermore, there was a strong preference for a choice of PB-PAL projects addressing real-world problems, each with a clear deliverable after 4 to 6 months. The latter was well aligned with what we intended to provide, except that we had expected the participants would identify and specify their own projects.

With the latter information we embarked upon designing a PB-PAL framework to be implemented within the time and resources available for Stage 2 of the project.

Stage 2: Semester 1 2016 - Implementation of a pilot PB-PAL program.

The response to the call-out for project participants was almost overwhelming, with approximately 200 students across all four years of their engineering programs indicating an interest in participating in the PB-PAL activities on offer. Most attended the initial “town-hall” meeting to find out more about the project.

It was originally intended to limit participation in Stage 2 of the project to 24 students (i.e. 4 groups of 6) however, given the unexpectedly large student response we changed our plans to accommodate as many students as possible by running projects of decidedly different types on two separate evenings, involving approximately 100 students at the commencement of Stage 2. We believed this strategy would improve the chances of the students continuing with PB-PAL after the conclusion of the research project, whilst also providing additional insights into how different types of projects engaged students.

In the first session 44 students were divided into 6 groups of 7 or 8 students and provided with one of the following kits to construct and test and use: hexapod robot, quadcopter, drone with camera, mini-drone (x 2), 3d printer. In the second session 45 students were divided into 9 groups of 5, and provided with an Arduino kit with which to work. Composition of the project groups was deliberately made diverse in terms of both year of study and specialisation, and each group had at least one senior student as mentor.

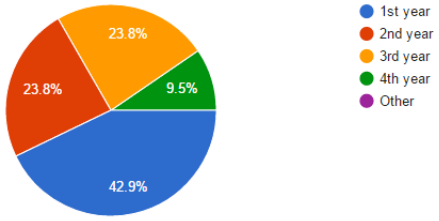
Most groups did not progress beyond the construction and testing phase of their projects due to unexpected challenges encountered (e.g. broken components), however most groups made good efforts to overcome these challenges. Group dynamics were observed to vary substantially from very collaborative efforts to situations in which a dominant individual drove the project, almost in a “watch and learn” approach.

There was no expectation on participants to continue in the group projects if they did not wish to, and the attrition rate was initially very high - the number of participants dropped to less than half of the commencing cohort within a few weeks. The reasons for this rapid reduction in participation are not clear, however we suspect the large initial group size is a factor, combined with an increase in regular coursework as semester progressed.

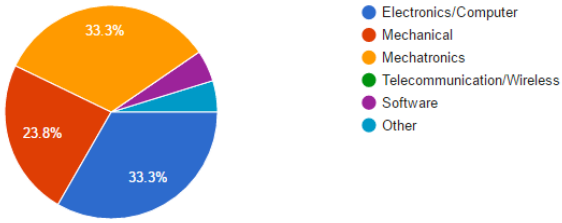
At the end of the project a “wind-up” event and focus group was held which attracted fifteen participants, and this provided valuable insights into these students’ experiences and learning. An online survey was also distributed to all participants to obtain their perspectives on the successes and failures of the PB-PAL activities as implemented. Some of the results of that survey are presented schematically on the following page. The results validated our approach to providing program based peer assisted learning, and the benefits of such an approach to PAL.

For example, a significant majority of participants found the interactions with students from other years and other majors a positive experience, and there was also a good amount of two-way learning occurring. A significant number of participants also indicated they wished to continue with the PB-PAL projects, however this has not yet eventuated.

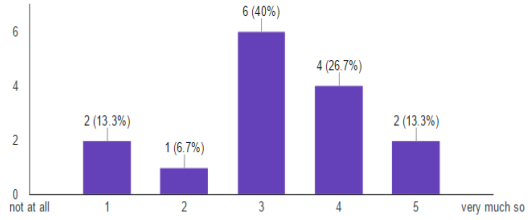
What year are you currently in? (21 responses)



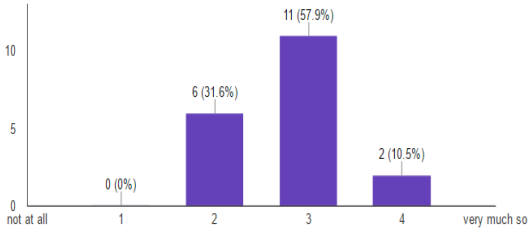
What is your Engineering Major? (21 responses)



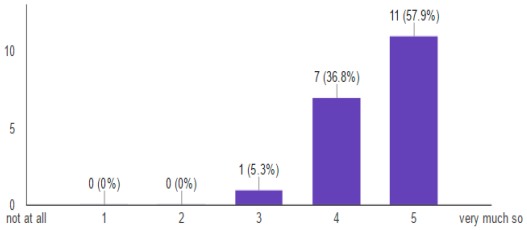
Were the workshops (e.g. on soldering) worthwhile? (15 responses)



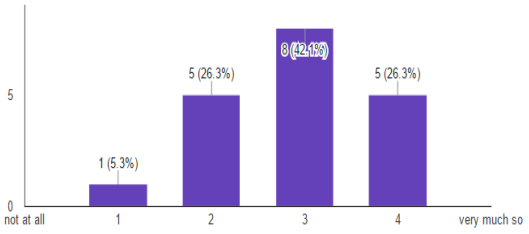
Did you find the project to which you were allocated interesting? (19 responses)



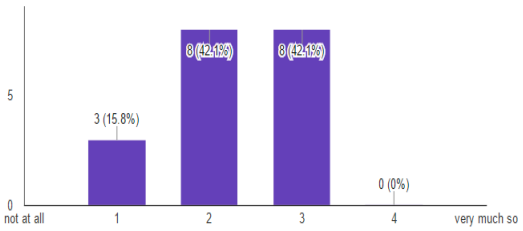
Was interacting with engineering students from other years and majors a positive experience for you?
(19 responses)



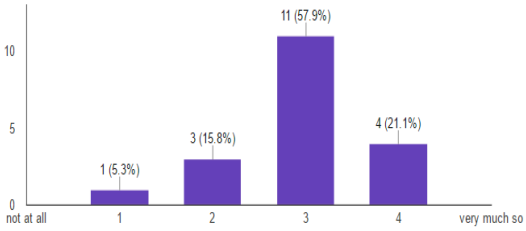
Overall, was your experience with MQEPAL worthwhile? (19 responses)



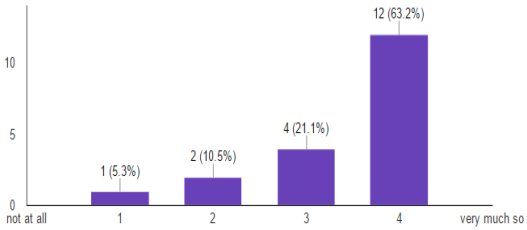
Do you feel other team members learnt something from you? (e.g. regarding teamwork, practical skills, or knowledge?)
(19 responses)



Do you feel you learnt something from other team members? (e.g. regarding teamwork, practical skills, or knowledge?)
(19 responses)



Would you like to continue doing MQEPAL projects? (19 responses)



Conclusions and Further Work

The strong initial response to PB-PAL projects and workshops indicated that engineering students are generally keen to learn and apply practical skills associated with engineering, but which are not always developed within their standard coursework. Not all interested students could be accommodated by this offering of PB-PAL workshops and projects, however a good proportion of those students who commenced stayed involved for the full eight weeks of the project, and provided insightful feedback at the end of the project.

Based on the feedback from participants our primary hypothesis that students can learn generic and program-specific skills from their peers, especially when working on projects in groups containing a diversity of experience, was generally supported. However, it was less obvious if and how the more senior and advanced students benefitted from passing on their knowledge to their less advanced peers; this is an area requiring further investigation.

We found that the type of project offered can have a significant impact on student interest and retention, and that when assessment is not involved students are motivated by a challenge. For example, relatively complicated projects based on construction of a commercial kit (e.g. the hexapod robot, and 3D printer projects) were found to provide better motivation and resulted in much better student engagement and retention than less challenging projects based on programming and interfacing a specific microcontroller platform (in this case, the Arduino). Relevance of the project to the students' engineering major or specialisation appeared to have little impact on motivation and retention. Allowing students propose their own projects may improve motivation, however based on student comments it's not quite that simple – when challenged, many students could not conceive of their own projects, and instead asked for "relevant" projects to be specified. The involvement of students in the project identification and specification process is potentially a valuable learning experience itself, and warrants further investigation.

The fact that the projects established to initiate students to PB-PAL did not seed ongoing student-driven projects was disappointing, especially after the commitment and interest displayed by the core group of fifteen students. The lack of continuing momentum was in this case largely due to the lack of an appropriate space available for students to engage independently in PB-PAL- type activities. To provide such a space with a minimal level of ongoing supervision would require resources which are in short supply, nevertheless we believe the investment would be more than repaid in learning of generic and program-specific skills, and in student satisfaction, adding substantial value to formal studies. Further strategies to build on the enthusiasm displayed by students for extra-curricular project work are being considered.

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