Promoting engagement and critical judgement skills through peer-assessed reflective journals

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INTRODUCTION

Journals are a means of developing meta-cognitive awareness [1] by chronicling and evaluating one's own attempts at making meaning of particular topics. In an educational context, journals or diaries "capture the process of learning and the stages in a learner's development over the time of the programme or course" [2]. Their role is not only to increase what students learn but also how they learn and how they apply their knowledge [3].

Not only can journals be valuable as evidence to show learning and development at the end of a course but they also act as a spur to regular reflection. The use of *reflective* journals in science and engineering contexts has been shown to produce more sophisticated conceptions of learning, greater awareness of cognitive strategies [4] and improved critical thinking skills [5] [6]. Allowing personal reflection gives students "the opportunity to pull from previous experiences, link these experiences to the literature, and to construct their own meaning of the science content in the literature" [7]. Introducing journal writing seems especially beneficial to enhancing collaborative learning in engineering courses [6] and appears to lead to enhanced learning outcomes [8].

While the positive effects of reflective journal writing have been well-documented in the aforementioned references, there is little discussion of their implementation in large, compulsory multi-disciplinary engineering subjects. As part of the first year subject assessment, students submitted a weekly journal entry reflecting on the lecture themes of the week and how they relate to a real-world engineering project of their choice. Additionally, they critically reviewed three other students' entries anonymously using a standard marking form and provided comments for feedback. Setting the reflection process in the context of peer review in this manner is designed to strengthen both reflective and critical judgement skills and promote engagement within the subject material.

To measure the impact and effectiveness of implementing the journals, data was collected including submission rates, peer ratings, feedback given and student perceptions of the journals. This data was then analysed for trends indicating effects on student learning and engagement and any improvement in the quality of submitted journals through the peer review process.

In this paper, it is discussed that in a collaborative learning environment, reflective journals serve as valuable, regular, individual feedback for both staff and students, assist in both personal and professional development, enhance learning outcomes and promote student engagement. Our experiences in the implementation of a reflective journal, its intended goals and effect on promoting engagement and improving feedback in a large first year engineering subject are presented.

1 BACKGROUND

The student body today is recognised as being a diverse group [9]. As such, appealing to different students' learning styles, approaches to learning, and intellectual development levels is a difficult but vital task for promoting and maintaining student engagement in order to enhance their learning. The first-year engineering subjects at the University of Melbourne were designed from scratch to facilitate collaborative learning and to encourage students to take a more active role in their education. The creation of these large, compulsory multi-disciplinary subjects for first year engineering students allow them to be exposed to a wide-range of engineering fields; however this multi-disciplinary approach will naturally not appeal to all students in the subject. Invariably, students will be engaged less by subject topics that are unfamiliar, perceived as being difficult, or not in their area of interest. The reflective journals provide a mechanism for students to continue to explore topics that interest them and relate them back to the actual subject topics; offering this level of freedom in exploration encourages students to put what they are learning in the subject syllabus into a more familiar context for analysis and discussion. This in turn promotes engagement in the subject material. The reflective journals were designed to support several of the learning objectives of the subject of the subject including the ability of students to

- Explain the importance of engineers and engineering in society

- Discuss the differences between the key engineering disciplines

- Explain the importance and principles of sustainable development and safety

On top of this, classifying the reflective journal as a piece of assessment is a strategic tool for creating student engagement and makes it clear to students that the journal is a valued record [10] [11]. Reflective journals were chosen to make up 10% of the assessment for the subject Engineering Systems Design 1 (ESD 1), which is in addition to the 60% final exam and 30% workshop tasks components of assessment.

In-subject polling has indicated that the majority of students tend to arrive at university with a pre-conceived idea of which discipline of engineering they wish to pursue. This may be influenced by a wide range of factors – e.g. subjects taken at high school, academic performance in these subjects, high school careers advisors, perceived job prospects and parental pressure [12]. The engineering programme at the University of Melbourne has been designed such that students may delay their decision on which discipline to specialise in until their second year of study; to allow this the syllabus of the first year of the programme covers topics from the various disciplines of engineering offered at the university. The reflective journal specifically requires students to read a range of external sources in an effort to broaden their

reading on engineering related topics. Students are encouraged to use the journal as a tool to use their own initiative and explore disciplines they might not have considered specialising in - forming the initial steps in their professional development. For example, one of the reflective journal topics in ESD 1 requires contacting a lecturer or researcher in engineering and describing what type of research they do and methods they use in their research. Interaction with teaching and/or research staff is something a typical first year student would not do on their own initiative; using the journal as a vehicle to encourage this may shatter common misconceptions about careers and develop engineers with a broader knowledge across the spectrum of engineering careers.

2   INITIAL IMPLEMENTATION OF THE JOURNAL

2.1 Details of the journal process

As an initial implementation of journaling in ESD 1, students were typically given a specific weekly reflective journal topic to write about. The journals commenced after the second lecture in week 1, with the full schedule given in *Table 1.*

Table 1. Reflective Journal Topics

Week	Journal	Description
1	RJ01	Definition of engineering and engineering disciplines
2	RJ02	Identify major engineering project
3	RJ03	Safety and sustainability issues
4	RJ04	Project design and decision making
5	RJ05	Research in engineering
6	RJ06	Computer modelling and simulation
7	RJ07	Engineering job description
9	RJ08	Problems with engineering projects

Each topic was drawn from material covered in the previous week's worth of lectures and workshops and may also involve assigned readings and reference to external sources. Every Monday a topic was automatically released and was due the following Monday, when the next topic was released. Submission of journals was done electronically, through the university's Learning Management System (LMS). The LMS facilitates the automatic scheduling of releasing assessments and handling student submissions and thus reduced the administrative load on staff. It also acted as a repository for students so that they could review their previous submissions.

Each week, tutors would mark the submissions made by their students and record the marks on the LMS for students to receive rapid feedback on their work. With the large volume of students enrolled in ESD 1 it was decided, for ease of marking, that the journals would be marked on a scale of 0/1/2/3 according to no submission, poor quality, good quality and exceptional quality, respectively.

Students could receive feedback about an entry individually from their tutors if they wished. The coarseness of the marking scheme was designed to encourage participation in the journals, rather than having students worry unnecessarily about achieving perfection.

2.2 Outcomes of the journal

Figure 1 shows the percentage of students that submitted each reflective journal; note the consistently high level of participation even though each journal was only worth approximately 1% of the final subject mark. There is a slight roll off of the submission rate during the semester, with the last journal entry having a significantly lower submission rate. This could have been due to it being set after a two week gap from the previous one, thus breaking the weekly routine, or that students had end of semester assignments from other subjects due and valued the journal entry as a low priority item. The average reflective journal submission rate of over 90% shows that the journal appears to have promoted a comparatively high level of student engagement simply through participation
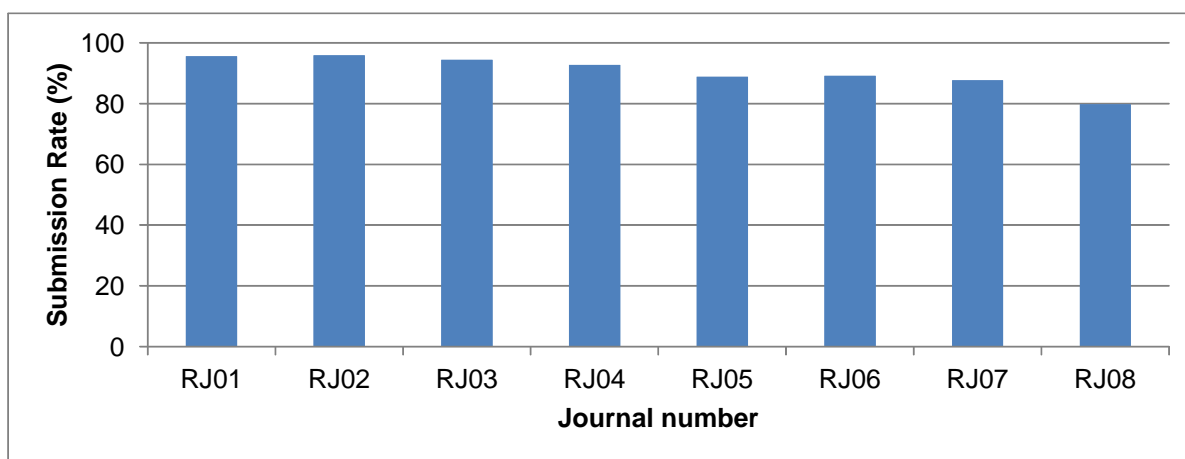

Fig. 1. Reflective Journal Submission Rates

The impact of participating in the reflective journal on academic results is an important consideration in determining their effectiveness. To investigate how the reflective journal relates to the other assessment tasks in ESD 1, performance in the three categories of assessment – workshops, reflective journals and final exam were compared for each student. Students who did not sit the exam were removed from the results, leaving 756 sets of results. The measure used for the reflective journal was chosen as the total amount of journals submitted by a student over the semester. This reflects a student's level of participation in the journal process and is not based on the mark received for the quality of the entries; thus being less dependent of the quality of the student.

Figure 2 shows the average marks for the group work components (workshop) and individual assessment (final exam) components of ESD 1 versus the number of reflective journals submitted for each student. The masking effects of assessment derived from working in groups can be clearly seen, with a fairly consistent level of workshop mark being attained by students who submitted between one and eight journals. On the other hand, the exam average appears to scale in a monotonically increasing fashion with three or more journals submitted. The exam average for students who submitted only one journal appears as an outlier which could be due a small sample size of only 1% of students falling into this category.

The ESD 1 subject pass rates versus the amount of reflective journals submitted per student are also shown in *Figure 2*. Tellingly, all of the students who did not submit a single reflective journal failed the subject; typically due to performing poorly on the final exam. There is a similar pattern in pass rates to the exam average, with a general trend of pass rate increasing as more journals are submitted.
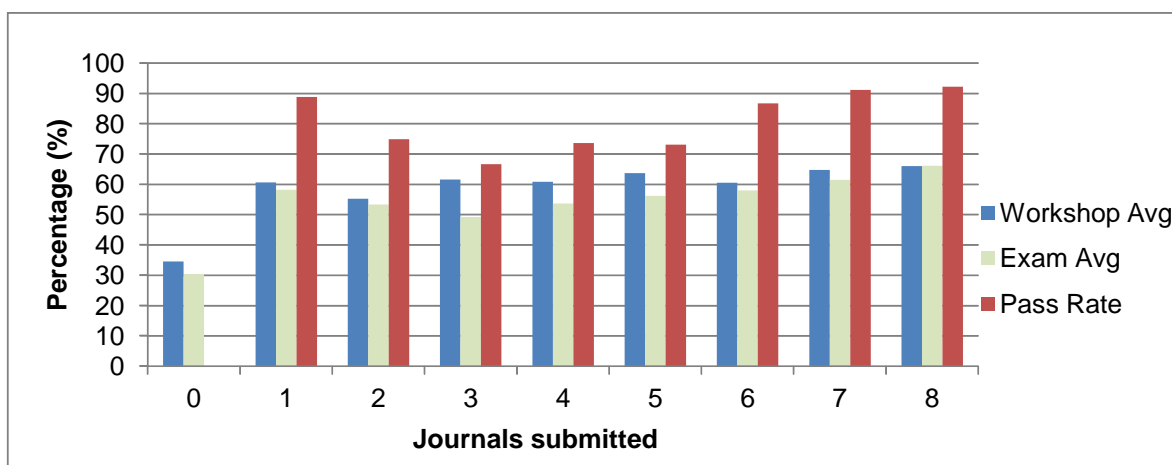
Fig. 2. Average marks and pass rates per reflective journal submitted

An Analysis of Variance (ANOVA) test was performed with the final exam mark as the observation variable and both workshop mark and number of reflective journals submitted as the predictors; these results are presented in *Table 2*.

Table 2. Analysis of Variance of final exam mark

Analysis of variance (Final exam mark)					
Source	Sum Sq.	d.f.	Mean Sq.	F	Prob>F
Journal Posts	3441.3781	8	430.1723	3.0073	0.0038714
Workshop Mark	95382.5273	611	156.1089	1.0913	0.26867
Error	19453.8766	136	143.0432		
Total	127936.4381	755			

Table 2 shows that the number of reflective journal posts that a student made was a strong predictor of final exam result and clearly separable from the workshop mark. If exam results are used as a measure of the extent to which the learning outcomes of the subject are being met, then it can be surmised that simply contributing more journal entries enhances the learning outcomes of the subject for a student.

3 INCORPORATING PEER FEEDBACK INTO THE JOURNAL

3.1 Reflection and peer assessment

Reflection is recognised not only as a purely individual process of internal exploration but also that of a social process involving learner-learner interaction [13]. The ability to compare one's own thinking with that of other learners and learning how to critically appraise it can lead learners to be more articulate themselves. It is reported that collaborative reflective activity and the ability to compare one's own thinking with that of other learners yields positive results and better facilitated learning than individual reflection [14]. In particular, the positive contribution to learning outcomes of an online reflective journal with peer feedback has been noted previously [15]. It has been noted that "a synergy can develop between writing and collaborative learning when students are asked to peer review their writing" [6]. It is with this in mind that the reflective journals in ESD 1 were subsequently modified to comprise of a two stage process for each entry – submission and evaluation :

- During the *submission* stage, journals are submitted according to the regular weekly timetable. Once the submission date has passed, the evaluation stage begins.

- During the *evaluation* stage, each student must anonymously evaluate 3 other students' journal entries and mark them according to a set form with detailed marking criteria and a model response. This gives an example solution of a very high standard to assist them in their marking.

The marking scheme was also altered to score each journal not on quality, but on participation in the submission and review process. The peer assessment was only used for formative feedback. A mark of 0.5% was awarded if students successfully submitted an entry and performed the required 3 anonymous evaluations. This was performed 9 times during the semester with only the best 8 counting for 4% of the final mark. At the end of the semester students were required to submit a complete reflective journal, featuring a culmination of all of their previous entries after reflection and improvement based on peer feedback. This final journal entry was marked by staff and contributed 4% to the final assessment. It is clear with this scheme that participation is encouraged two-fold – by receiving the weekly mark and reducing the amount of work required to put together the final journal entry.

3.2 Outcomes of the journal

The participation rates for both phases are given in *Figure 3*. It is interesting to note that the submission rate drops more sharply than previously, possibly due to students knowing that that staff will not be marking them directly, the reduced marks value of each entry, or a combination of both as other work commitments take over their time.
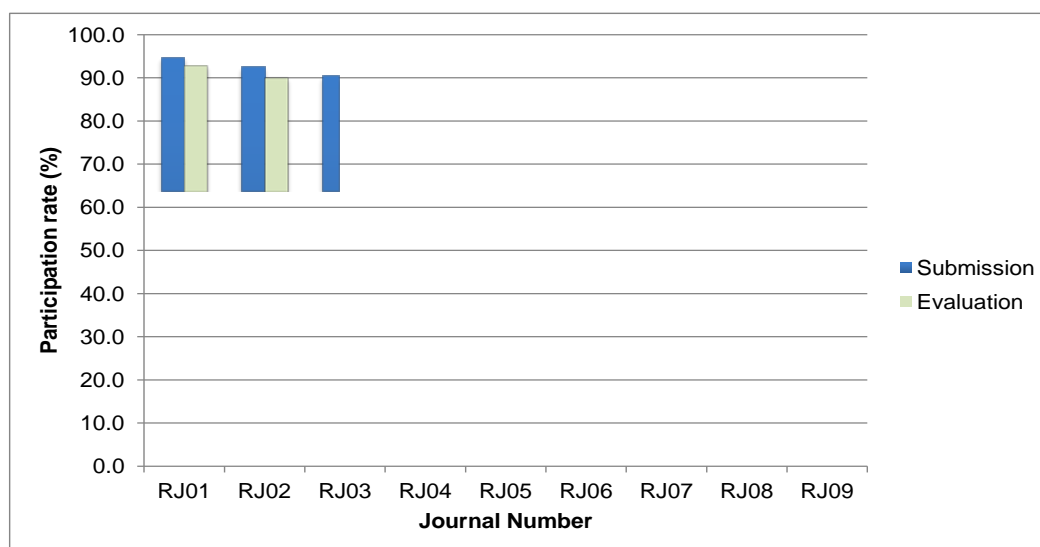

Fig. 3. Reflective Journal Participation Rates

Figure 4 shows the average marks for the group work components (workshop), individual assessment (final exam) and final reflective journal components of ESD 1 versus the number of reflective journals submitted for each student. Similar traits can be identified as before the introduction of peer feedback such as the increase in exam performance based on the number of journals successfully completed. It is also observed that students who have participated in the weekly journals perform better on the final journal submission.
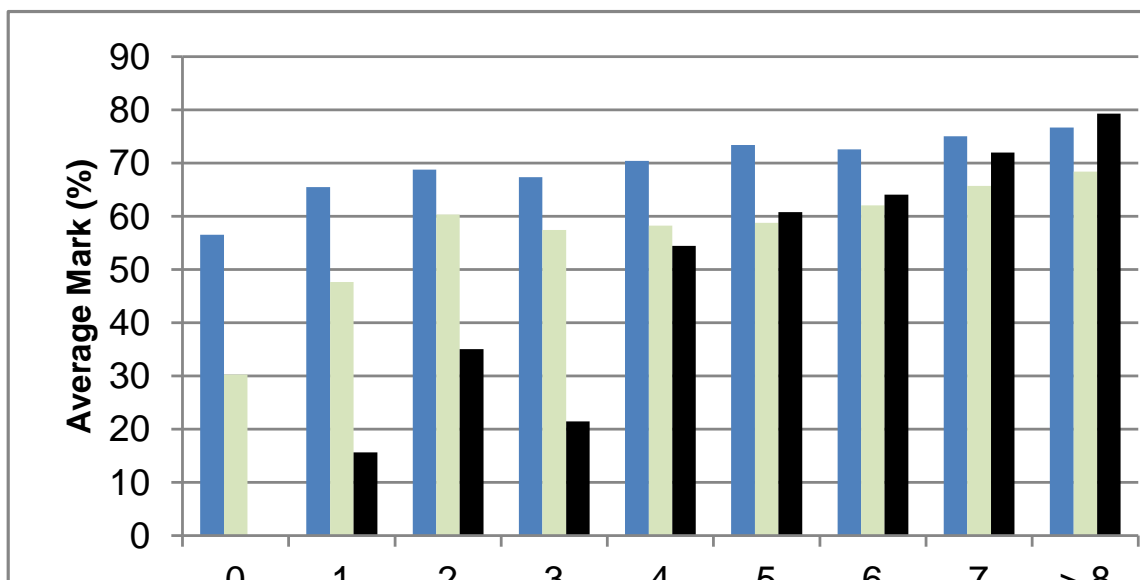
Fig. 4. Average marks per reflective journal submitted

4 DISCUSSION

While the results presented in this paper are encouraging for the continued use of the reflective journal, more research needs to done – in particular surveying students' perceptions of the goals of the journal being met. An anonymous in-class survey, similar to the university-wide *Quality of Teaching* surveys completed at the end of semester would be useful to gauge student responses to questions to measure their improvement in judgement skills, broadening of their engineering knowledge and general engagement with the subject. could be posed early, during and at the end of semester to gauge these quantities.

In a way it is not a surprise that participation in the reflective journal is a strong predictor of final exam result as shown in *Figure 4* – students who are diligent and conscientious during the semester will naturally be expected to score well in the exam. Correlating these results with prior academic performance could explain this trend further, however this is unlikely to be possible as ESD 1 is a semester one subject in the first year of the course and as such no university academic record exists for the majority of students.

5 CONCLUSION

In this paper an implementation of an assessed reflective journal was described, including its perceived benefits to student learning and engagement. Coupling peer review with reflection through reflective journal writing in this subject has brought together two aspects of learning vital to a student engineer's education to improve both engagement and critical judgement skills. Setting the reflection process in the context of peer review further strengthens these skills. The effectiveness of participating in the reflective journal writing process can be seen in the final academic results for the subject. Further surveying of students is expected to continue to investigate these effects in greater detail and modify the journals into the future.

REFERENCES

[1] Newton, E. V. (1991). Developing Metacognitive Awareness: The Response Journal in College Composition. *Journal of Reading*, Vol. 34 No. 6, pp 476-

478.

[2] McGill, I., and Beaty, L. (1992). *Action Learning.* London: Kogan Page Ltd, London.

[3] Selfe, C. L., & Arbabi, F. (1983). Writing to learn : engineering student journals. *Engineering Education*, pp 86-90

[4] McCrindle, A. R., and Christensen, C. A. (1995). The impact of learning journals on metacognitive and cognitive processes and learning performance. *Leanring and Instruction, 5*, pp 167-185.

[5] Burrows, V., McNeill, B., Hubele, N., and Bellamy, L. (2001). Statistical Evidence for Enhanced Learning of Content through Reflective Journal Writing. *Jorunal of Engineering Education,* Vol 90 No. 4, 661-667.

[6] Wheeler, E., and McDonald, R. (1998). *Using writing to enhance collaborative learning in engineering courses.* Paper presented at the ASEE/IEEE FIE Conference.

[7] Blake, R., & Blake, R. (2003). Science as a way of knowing : Using Reader Response as a means to construct a personal understanding of science literature. *Electronic Journal of Science Education,* Vol. 7, No. 4

[8] Broadway, F. S.-P. (2005). *The use of reflective journals for student learning and development.* Paper presented at the F2C, Indianapolis, IN.

[9] Felder, R. and Brent, R. (2005). Understanding Student Differences. *Journal of Engineering Education,* Vol 94, No. 1, pp 57-72

[10] James, R., McInnis, C., & Devlin, M. (2002). Assessing Learning in Australian Universities. Melbourne, Australia

[11] Pavlovich, K. (2007). The development of reflective practice through student journals. *Higher Education,* Vol. 26, No. 3, pp 281-295

[12] Krause, K.-L., Hartley, R., James, R., & McInnis, C. (2005). The First Year Experience in Australian Universities: Findings from a Decade of National Studies.

[13] Kemmis, S. (1986). Action Research and the Politics of Reflection. In D. Boud, R. Keogh & D. Walker (Eds.), *Reflection: Turning Experience into Learning* (pp. 139-163). London: Kogan Page, London

[14] Kim, D., & Lee, S. (2002). Designing Collaborative Reflection Supporting Tools in e-Project-Based Learning Environments. *Journal of Interactive Learning Research,* Vol. 13 No. 4, pp 375-392.

[15] Xie, Y., Ke, F., & Sharma, P. (2008). The effect of peer feedback for blogging on college students' reflective learning processes. *The Internet and Higher Education,* Vol. 11, No. 1, pp 18-25