EFFICACY OF SELF ASSESSMENT AND REFLECTIVE JOURNALS IN PROBLEM-BASED LEARNING

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ABSTRACT

Problem Based Learning (PBL) has attracted wide attention ever since its inception. Literature identifies PBL as one of the best alternative pedagogy to Instructive Learning (IL), whilst challenges in assessing the success of PBL have also been widely reported. Unlike Instructive Learning wherein examination is the major assessment component, PBL has number of components at its disposal: portfolio, oral presentations, interviews, role play, position paper, peer assessment, self assessment, reflective journal and so on. In the School of Engineering and Science at Victoria University, Australia, often combinations of these assessment techniques are used to facilitate effective learning. A final summative grade is provided as a measure of student learning with appropriate formative feedback. It is to be noted that the assessments can be conducted at various times of the semester. This provides a sampling of the learning process across the semester but does not provide a continuum. Current trends of monitoring the learning process is centered around e-learning such as Wikipedia or custom designed tools. In this paper, the authors have analysed the process of learning using the (student) self assessment survey distributed at the start of the semester and the reflective journal submitted towards the end of the semester.

The questionnaire focussed on PBL assessments, group work, resources, skill sets required to undertake PBL and the role of facilitators. Students were asked to provide both quantitative (rating scale 1 to 5) and qualitative feedback in the form of comments. Students were given total freedom as far as the reflective journals were concerned. Questionnaires were analysed quantitatively, whilst the qualitative comments were extracted from the reflective journal. There was a clear correlation between good reflective journals and the corresponding portfolio grades. Thus the self assessment questionnaire and the reflective journals were useful in capturing the learning process.

KEYWORDS

Problem-based learning, self-assessment, reflective journals, learning process.

INTRODUCTION

Problem Based Learning (PBL) is a well recognised pedagogy in engineering education. Recently many universities in Australia such as Victoria University have embraced PBL into the engineering curriculum. Literature identifies PBL as an effective means of student
centered learning (MacDonald, R. 2005) and capable of imbibing self-learning, life-long-
learning and so on. Despite advantages, measuring the success of learning is usually difficult in PBL. (Molyneaux et al. 2006). It is to be noted that Biggs (1999) suggested the “Constructive Alignment” principle, which requires the learning activities and assessment strategies be aligned with the learning outcomes. However, in practice specifying the learning outcomes for a unit and aligning teaching activities are somewhat easier than the assessment of the learning outcomes itself. This might be due to the fact that PBL has number of assessment components at its disposal: group presentations, individual presentations, tripartite assessments, portfolio, reports self assessment and peer assessment to name a few. (Macdonald and Savin-Baden, 2004). It is important to note that these authentic assessment components are more appropriate to assess learning outcomes in PBL than the traditional norm-referenced or exams that recall factual knowledge. (Torrence, 1995, Ward & Lee, 2002).

Authentic assessment strategies are usually classified into Performance assessment, Portfolio assessment, Reflection and Self-assessment. (Palmer et al, 2008). Out of these, the combination and choice of assessment components are usually left to the teaching staff in most cases. Most academics consider the “learning process” in equal importance to the final product, although there are no clear pathways to include them into summative assessment. Formative assessment of the ‘learning process’ is feasible thru online submission of student activities. Recently, online tools such as wiki’s have been designed to map the progress thru the stages of the project and have found clear correlation with student performance. In the absence of these online tools, reflective journals, self-assessment, portfolios provide best chance of understanding the ‘learning process’. Literature provides instances of assessing the “learning process” from personal interviews, surveys and online tests besides others. (Le and Tam, 2007), (Chan and Lai, 2008) (Tai and Yuen, 2007). However, most of these provide samples of the learning process rather than a continuum. In some cases, only a single assessment strategy has been used. For example, there is little back analysis of student self-assessment surveys or clear evidence of achievement of stated goals. In this paper, the authors endeavour to find evidence of student self-assessment thru another assessment technique namely the reflective journal. These two assessment techniques have been chosen for the reason that reflection and self assessment require students to reflect, evaluate own participation and learning progress which leads to autonomous and self learning. This in effect identifies whether the reflective journal and the self-assessment are well aligned. In the next section, a brief background of the unit of study to be investigated is provided.

BACKGROUND

The unit chosen for analysis is known as “Solid Mechanics 2” in the 2nd year Engineering course at Victoria University. This unit is delivered in PBL mode and has the following learning outcomes:

1. An understanding of and an ability to calculate the deflection of beams.
2. Familiarity with failure modes of compression members.
3. An understanding of the concepts of principle stresses and Mohr’s circle.
4. An understanding of twist and torsion in structures, and an ability to determine shear stress and angle of twist in simple structures.
Four problems were designed from practical cases that could trigger the learning. Students were asked to form groups of not more than 5, not less than 3 (average 4 per group). They were distributed the self-assessment questionnaire shown in Table 1 during the start of the semester around week 3/4. By this time the groups had been finalised and had started working as teams. The questionnaire was divided into five main headings as: 1. About PBL, 2. About PBL assessments, 3. About Group Learning, 4. Study / Research skills and 5. Thinking (critical) skills. Students needed to rate each query on a scale of 1 to 5 (1 – strongly disagree to 5 strongly agree). The section “About PBL” has been included since these students had very little experience of PBL, except for one unit of study in their first year. The main idea behind this self-assessment questionnaire was to help students identify their own learning needs and no formal assessment was included. The main assessment was based on a portfolio that documented the learning outcomes. Most of these were engineering calculations that justify the choice of the members or the methods. Thus identifying the learning process was difficult and for this purpose a reflective journal was suggested. This journal was specified for each student and the entries had to be on a weekly basis. Formal marks (about 10%) of the portfolio were awarded to reflective journal.

Table 1
Self-Assessment Questionnaire Template

<table>
<thead>
<tr>
<th>Questions</th>
<th>Rating Scale</th>
<th>Qualitative comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.0 ABOUT PBL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 I find PBL as a good/effective method of learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 I would prefer my future studies to be in PBL</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2.0 PBL ASSESSMENTS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Reports are a good way of assessing student learning than exams</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 I prefer clarity in the assessment tasks based on skill levels.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3.0 ABOUT GROUP LEARNING</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 I prefer group learning as opposed to individual learning.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2 Team mates are helpful and we worked closely</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4.0 STUDY / RESEARCH SKILLS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 I can integrate information from a number of sources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2 I can plan my own learning to address the problem.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>5.0 THINKING SKILLS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1 I can differentiate fact from opinion.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2 I can establish a set of problem-solving criteria.</td>
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</tbody>
</table>
METHODOLOGY AND ANALYSIS

Data Collection

The data collection was performed in two levels. The first level of data collection was based on Table 1. Out of a class of about 90 students 62 of them responded to the questionnaire. The second level of data collection was based on the reflective journals of these students. Thus the second level of data is qualitative evidence to the questionnaire. Tools such as Microsoft Excel were used to table the data and obtain the appropriate graphical representation for the data collected.

Questionnaire Analysis

The data analysed from the questionnaire is presented below in the form of charts. (Figure 1). For an astute researcher, the distribution is very clear.
It is important to note these students had minimal experience of PBL and the above results are in favour of PBL, i.e. about 87% of them find PBL as an effective method of learning. This is based on the presumption that scales 3 and above is favourable and 1&2 are least favourable on the scale. Again the significance of this question is that if the response to PBL was negative, then no further analysis would be required. Note that students are strongly in favour of undertaking further courses thru PBL.

Question 2.1 directly seeks answer to the popular belief that exams are a better way of assessing student learning. About 90% of students convey that it is not so and indeed reports are a better way of assessing student learning.

In regards to the questions on group work, about 20% of the students are not in favour of group work, although majority of them feel that the team mates worked closely. In regards to the questions on resourcing, planning and thinking skills majority seem to be well aligned with the principles of PBL pedagogy. Given this response, it would be fair to expect similar trends in reflective journals.

**Reflective Journal Analysis**

The second level of analysis on reflective journals had to be qualitative since the entries are noted on a weekly basis and collated towards the end of the semester. The reflective journals were carefully read thru (again) to find evidence relating to the questions in Table 1. Some of the (best extracted comments) are provided in Table 2.
## Table 2
Qualitative comments extracted from student reflective journals

<table>
<thead>
<tr>
<th>About PBL</th>
<th>PBL Assessments</th>
<th>About Learning</th>
<th>Group</th>
<th>Study/Research skills</th>
<th>Critical Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflective journals provides evidence of the learning process and improvement in student learning.</td>
<td>I believe that the subject was easier this time with exams NOT forming a major assessment component; but by saying this it was full on, very busy with reports being the main part of the subject. [Report are a good way of assessing student learning than exams]</td>
<td>We walked through various types of bridges near the University campus to find the most suitable bridge to analyse. &quot;I had a chat with my group members about what I researched.&quot; [Team mates are helpful and worked closely].</td>
<td>Before I went any further, I went through the text book and also did some google search. [I can integrate information from a number of sources, I can plan my own learning needs].</td>
<td>We selected three bridges, concrete, steel and timber. We then chose the concrete bridge for further analysis because of its huge mass and the longer length which would result in higher deflection. [Establishing problem solving criteria]</td>
<td></td>
</tr>
<tr>
<td>PBL is very powerful and effective means to promote self learning. [I find PBL as a good/effective method of learning].</td>
<td>I am relieved to know that exams don't weigh high proportions this time. I am better off in group work and writing reports.</td>
<td>We had a short meeting to discuss how we are going to approach the next problem - Order of speakers, Daniel, Rodolfa and Chan. Venue: Chan’s house.</td>
<td>I realised the importance of clear communication so as to avoid any future disputes.</td>
<td>This discussion was a milestone in my personal achievement because this was the first time that I had to use logic and reasoning in an impersonal way. [I can differentiate fact from opinion].</td>
<td></td>
</tr>
</tbody>
</table>

The above table clearly correlates with the results of Figure 1. In particular, the authors identified the scales suggested by the students and correlated that with the reflective journals. For example, if the rating scale on “Team mates worked closely” was 4 or 5 then clear evidence of this in the form of meetings/minutes of meeting and the order of speakers for each of the meetings were available in the report. Similarly if the scale for the same question was a 1 or a 2, there were complaints about specific members and very critical comments about the non-contributing member. Furthermore, there was clear evidence of good grades obtained by students with good reflective journals. Thus a clear connection between the
process of learning and the final product (thru summative assessments) could be noted. The authors also wish to note that the above table is short due to the space limitations in this paper. Full table for all the student comments and analysis is available upon request.

CONCLUDING REMARKS

This paper analysed the learning process thru a two step procedure: First by a questionnaire designed for self-assessment and second thru the reflective journals. In particular back analysis of rating scales in the questionnaire was related with the qualitative comments in reflective journals. Going thru the self-assessment survey and the reflective journal provided a better understanding of the group work and self-learning skills achieved. Thus these two assessment strategies proved to be useful in capturing / understanding the learning process. It is to be noted that some students wrote the reflective journals like diaries and not much could be interpreted out of them. Therefore the authors have planned to provide a structure of a reflective journal that could help the students follow a consistent procedure. An alternative methodology to analyse the trends would be to rate the reflective journals thru a scale of 1 to 5 as in the questionnaire and identify trends for each of the questions. This work would be undertaken in future.

REFERENCES