PROMOTING PROBLEM-BASED LEARNING THROUGH COLLABORATIVE WRITING

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ABSTRACT

PBL (promoting problem-based learning) is a curriculum model that emphasizes the effective use of problems through an approach of active and multidisciplinary learning. The approach is primarily student-centred (Wilkerson, 1996) and the student assumes the major responsibility for his or her learning. Rather than the tutor dispensing the syllabic content, the students decide and discover for themselves what they will learn. In PBL, students experience a problem as the trigger and motivator for learning. PBL is a powerful tool that can be used to encourage university students to negotiate task-based projects in English. In this article, I will investigate the response of a class of engineering students in Singapore in learning Technical Writing through the PBL approach.

Introduction: What is PBL?

PBL as an approach is diametrically different from the conventional didactic and teacher-centred methods. The approach is primarily student-centred (Wilkerson, 1996) where the student assumes the major responsibility for his or her learning. Rather than the tutor dispensing the syllabic content, the students decide and discover for themselves what they will learn. Problems are first given as the starting point of their inquiry, leading to discovery of the relevant knowledge and skills required to solve or understand the problem. The students work in groups to allow for collaborative and cooperative learning in order to harness the collective synergy of teamwork.

The following are some theoretical underpinnings of PBL:

- The problem is the trigger for learning
- The problem is usually a real-world problem
- Cross-disciplinary knowledge from various topics and subjects is used to solve the problem
- Learner centredness is the focus
- Learning takes place through self-directed discovery and questioning (Tan, 2003)

According to Butler (2003), the process of PBL involves generating solutions to the problem and selecting the most viable solution to the problem. The following shows the potential benefits of PBL versus a didactic educational approach:

Table 1: Differences in education approaches (Wee, 2004)

	Didactic	**Problem-based Learning**
Focus	Curriculum coverage Learning for classroom Academic rigour	Holistic Development Learning for life Lifelong learning
Curriculum	Calendar-defined Content segmentation and accumulation	Outcome-defined Content integration

As seen in Table 1, the PBL approach focuses on the total development of the learner and seeks to develop long term goals in acquiring life skills (problem-solving skills, interpersonal skills, oral communication skills etc). On the other hand, the didactic approach is geared towards short term academic goals and is mainly confined to classroom learning. According to Barell (2007), PBL is a way of challenging students to become involved in a quest for knowledge and not just finding answers to questions posed by a teacher or a textbook. The PBL approach also adopts a multi-disciplinary approach to learning. The education approach of PBL draws from multiple disciplines that include philosophy, psychology, educational research, teaching and learning and curriculum design (Barrow, 1982). Glaser (1991) argues that through PBL, students evoke their problem-solving methods and conceptual knowledge as they work in small groups. They express their ideas and share responsibility in managing problem situations. Different views on a problem are observed, leading students to ask new questions. The group nature provides the platform for interpersonal and group dynamics to be developed.

Collaborative Learning

Collaborative learning is increasingly gaining support and is adopted in the field of education. Cues (2002) views collaborative learning as a social reciprocal relationship where two or three or more individuals work to support each other. This means that collaborative learning is a win-win situation for group members as they work together for a common goal. Cooper (1997) believes that collaborative learning has a strong positive effect on educational outcomes such as academic

achievement, student retention, and attitude towards the subject matter. Hill (1990) also outlines other benefits of collaborative learning such as deeper understanding of subject, enjoyable learning, leadership skills and promoting positive self-esteem.

Collaborative Learning in PBL

As mentioned earlier, PBL plays a great role in collaborative learning. Students work on problems in small groups of five to fifteen. Their analysis and resolution result in the acquisition of knowledge and problem-solving skills (Wilkerson, 1996). In PBL, new information is acquired through cooperative learning. Students are expected to learn from the world's knowledge and accumulate expertise by their own study and research, just as real practitioners do. During this self-directed learning, students work together, discussing, comparing, reviewing and debating what they have learnt (Wilkerson,1996). In Singapore, PBL is a relatively new and different form of educational approach. Therefore, this study aims to investigate students' response to PBL through collaborative writing in a Technical Writing course.

The Study

The PBL approach was introduced to about 200 second-year engineering students from the School of Materials Engineering in Nanyang Technological University in Singapore. The study was designed to answer the research question, "To what extent does PBL motivate engineering students in Technical Writing?"

The Subjects

The subjects involved in this study were two hundred second-year EFL engineering students from the School of Materials Engineering in Nanyang Technological University. As part of their course requisites, second-year students in the School of Materials Engineering are required to take up a few course modules in Communication Skills. SM112 is one of the course modules in Communication Skills. It is a course specially designed to improve students' skills in Technical Writing. The main objective of the course is to teach students to apply skills and knowledge to write academic reports such as Lab Reports, Industrial Attachment Reports and the Final Year Project Report. Students are also taught the organizational and functional roles of major elements in a typical technical report. Each class has an average of twenty five students. The course is conducted for a period of thirteen weeks.

The PBL versus the Conventional Approach to Teaching Technical Writing

In the conventional teaching approach adopted by the school, students attend a one hour lecture weekly, and have two hours of tutorial fortnightly. Information on Technical Writing is taught by a class teacher. The course follows a prescribed syllabus and the topics for the Technical Writing course include writing the various sections of a report (introduction, methodology, results and conclusion). However, in the PBL approach to Technical Writing, the teacher acts as a facilitator and does not conduct formal lessons on Technical Writing. Instead, information pertaining to Technical Writing is posted online.

In the PBL approach, students work on group projects, which form the platform for the students' learning (Moesby, 2002). For the PBL Technical writing course, students were assigned a report writing project where they work in groups of four or five. According to Speck (2002), the quality of group interaction and the quality of the document the group produces are inextricably bound together. Thus the evaluation of the document becomes in part an evaluation of the group's effectiveness. However, Speck observes problems in collaborative writing groups such as identifying the leader of the group, conflict between group members and ensuring that members put in their fair share of work.

Why PBL was Adopted

The conventional Technical writing course at the university is usually taught by the teacher. However, students usually get bored merely listening to information imparted by the teacher during the Technical Writing class. In addition, the teacher-centred Technical Writing course does not allow students to develop critical thinking as students merely become passive receptors of knowledge. PBL was adopted to enable Materials Engineering students to develop collaborative decision-making and to develop their critical thinking as they negotiate among themselves to find solutions to solve a problem. In addition, the PBL approach would encourage students to improve their communication skills as they work with other students. The PBL approach mirrors the real working world as engineers often have to collaborate with other engineers to complete an engineering project.

Description of the Learning Process using PBL

In groups of four of five, students brainstorm among themselves over a problem in the real world which is technical in nature, and is related to their area of studies in Materials Engineering. They have to define the problem and tailor it to a specific

audience. Students, with the help of the teacher, examine the problem and clarify what it is they know and don't know. They also formulate possible hypotheses and identify learning issues they intend to investigate. They then submit a Memo Report on their proposed project, to seek approval from their teacher to proceed with their project. The groups then employ research strategies to collect relevant information. Students discuss their findings and peer-teach what they have learnt. The group then develops an outcome for the problem and presents their findings to other groups in their Group Project Presentation, where their peers and the tutor evaluate their project. Students reflect on the way they have learnt in their groups through an online survey.

An example of students' definition of the real problem they intend to solve is illustrated below (only minor editing was done to retain the authenticity of the materials):

Extract 1: An example of students' definition of a real problem

> *Our group would like to look into the problems that women face when using sanitary napkins. The problem is: Even though some women had already utilized maximum absorbency napkins available in the market, they still have to change their napkins very frequently due to their inefficiency in absorption. Through our research, we hope to find out if there is any better materials that has higher absorbency limits which might be used as materials for sanitary napkins in the market.*

Students were asked to write minutes for every meeting and submit them as appendices in their project report.

Data Collection

In order to answer the research question, "To what extent does PBL motivate engineering students in Technical Writing?" data from the following sources were obtained :

- Students' responses to using the PBL approach in Technical Writing in an online survey
- Minutes recorded by students during group meetings.
- Students' comments on the PBL approach via a semi-structured interview
- Observations of students' learning behaviours by the teacher

To eliminate bias of students towards PBL, students were not told specifically that the course was run using the PBL approach. Neither was there any specific mention of PBL in the online survey. Instead students were asked to respond to the survey to help the teacher to evaluate the course. This was deliberately done so as to examine whether the PBL approach had made any significant impact on students' learning.

Results from the Online Survey

The online survey was conducted at the end of the thirteen weeks, when students had handed in their final project reports to the teacher. Out of a total of 205 students, only 169 students responded to the survey. The survey consisted of True or False, Multiple Choice and Short Answer questions to elicit their response on the extent PBL encouraged collaborative writing. The results of the survey are tabulated below:

Table 2: Results of students' responses to PBL learning

Statement	Responses
1. Working in a collaborative group has helped me learn the materials for this Technical Writing course.	
True	86%
False	12%
2. I feel that the teacher should have lectured more instead of assigning so much group work.	
True	35%
False	64%
3. I enjoyed the experience of collaborative learning	
True	86%
False	12%
4. While researching the final project, how much of the feedback given to you by your group members was useful?	
All	3%
A great deal	49%
Some	44%
Not much	2%
None	1%
5. How much of the feedback that you gave your group was implemented by them?	
All	1%

	A great deal	1%
	Some	62%
	Not much	5%
	None	1%
6.	I could have written a better formal report if I had worked alone.	
	True	17%
	False	82%
7.	It was more work working with my group than it would have been if I had worked alone.	
	True	33%
	False	66%
8.	I respected the judgment of others in my group.	
	True	96%
	False	3%
9.	I felt that the other members of my group respected my judgment.	
	True	92%
	False	7%
10.	Overall I feel that this course	
	could have been better organized	17%
	was generally fun and I enjoyed learning	38%
	was perfect-don't change it in any way	4%
	was too much work	38%
	was confusing- I'm not sure I learnt much	2%

The results of the online survey show that 86% of the students responded that working in a collaborative group had helped them learn materials pertaining to the Technical Writing course, while only 12 % felt that they did not learn much about Technical Writing. In addition, a high percentage of students (86%) stated that they enjoyed collaborative learning. Similarly, 82% disagree that they could have written a better formal report if they had done it on their own. . Only 17% agreed that they would be able to write a better report on their own (refer to Question 6). As suggested by Speck (2002) in collaborative writing, the quality of group interaction and the quality of the document the group produces are closely connected. There is no doubt that PBL enhances the quality of report writing compared to the traditional teacher directed self-written report writing course.

In addition, 33% of students also felt that it was more work working with their own group than it would have been if they had worked alone. This shows that a majority of students agreed that PBL encourages collaborative writing. In addition, about half of the respondents (49%) felt that a great deal of the feedback by group

members was useful, compared to 2 % of respondents who disagreed. As mentioned by Glaser (1991), through PBL, the learner is exposed to alternative points of view and thus students evoke their problem-solving methods and conceptual knowledge on Technical Writing through collaborative writing.

About 96% of students also agreed that they respected the judgment of their peers in their group which suggests that students do not only turn to the teacher for knowledge, but also their peers. This means that PBL provides a platform for students to "learn to learn" by themselves (Moesby, 2002:6) and provides a learning environment that mirrors the working world. Students were asked how they found the writing course in general. About 38% agreed that it was fun and they enjoyed learning and 4% felt the course was perfect. However, as this was the first time students had experienced PBL, some students found that the course could have been better organized (17%). About 38% of students found the course was too much work for them. However, this is understandable as students in Year Two have to take several course modules (usually about eight modules). Perhaps, PBL would have been more effective if it had been implemented in the Final Year, where students take fewer modules and have more time to work on their PBL writing project.

Sample Minutes by Students

A study of the minutes written by students during their group meetings also showed that students learn to identity problems and provide solutions among themselves. Below is a sample of minutes by a group which carried out a research study to evaluate the most effective material to use in sanitary napkins.

Extract 2: An example of minutes written by students

Minutes of the 1st official project meeting

Matter Discussed

A. Discussion of Project Topic
1. *Siong suggested that we should look into the problems that women face when using sanitary napkin. The problem is: Even though some women had already utilized maximum absorbency napkins available in the market, they still have to change their napkins very frequently due to their inefficiency in absorption.*
2. *Kiat suggested that we should carry out simple experiments to see which brands of sanitary napkins had the highest absorbency limit.*

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3. *Seng suggested that we should also find out if there is any better materials that has higher absorbency limits and why it is not being used in sanitary napkins in the market.*
4. *Eileen suggested that we should also include the negative aspects of these absorbent materials to the customers.*

B. Role and Responsibility
*1. We discussed and decided to go to the library and find information on our area of research together. We also shared with each other the information gained from our shallow research on our topic on absorbency materials. From the pool of information gathered, we catego*rise them.

Through the minutes recorded by students, it can be concluded that PBL enables students to take charge of their learning experiences as they collaborate with each other in providing solutions to real-world problems. In addition, PBL also broadens the knowledge base of the students while engaging in research for their writing projects. The group report writing project helps students to focus on acquiring important skills, concepts and ideas among themselves. As stated by Barell (2007), PBL challenges students to become involved in a quest for knowledge and not just finding answers to questions posed by a teacher or a textbook. The PBL writing project also allows student to explore and verify the ramifications of their own ideas, and to mimic the kinds of problems they will encounter in the real world - problems which demand careful thinking.

Results of the Semi-structured Interview

A semi-structured interview was also conducted among students to cross validate the results of the online survey. The semi-structured interview was designed to investigate students' impressions of the writing project. The following common response from students was elicited:

1. Students increase their knowledge and understanding about Technical Writing as they collaborate in collaborative writing. A majority of students agreed that working in a collaborative group has helped them learn the material for the Technical Writing course in general. The PBL writing assignment provides students with the opportunities to interact with other students. There is evidence that learning takes place through self-directed discovery and questioning (Tan, 2003).

2. Students also learnt about the different working styles of other students. Initially, some students confessed that they had difficulties working with some other students due to differences in opinions and personalities (Speck, 2002). However, they learnt to accommodate the differences and in the process they also learnt what teamwork entails when negotiating the problem with other members within their own group. Thus the PBL approach encourages students to adopt a social reciprocal relationship as members within the group work to support each other (Cues, 2002). In contrast, the conventional writing course is often done individually and students (especially students who are weak in written English) find it rather challenging to complete the writing course on their own.

3. In terms of pedagogical gain, a number of students recognised the importance of the learning process arther than the outcome and products in writing the report. Students felt that in the process of solving the problem they acquire much knowledge about the problem they sought to solve. This is because PBL requires a multi-discipline approach to solve a problem (Barrow, 1982). For the writing project, students had to use various approaches to find a solution to the problem. This includes information search in the library, interviewing professors or experts, conducting experiments to test hypotheses and conducting surveys. However, some students complained that the PBL project was rather demanding and thus they requested for more time to complete the assignment.

Observations by Teacher

As suggested by Wilkerson (1996), the PBL approach is primarily student-centred and the student assumes the major responsibility for his or her learning. It was observed that during the course, students learnt by themselves through self discovery and not through the teacher. Through PBL, students realized that the process of writing is more important than the final outcome, the report itself. When presented with a problem in report writing, students learnt to take charge of their learning experiences.

Conclusion

From the data collected, there is no doubt that the engineering students generally had a positive experiences with PBL as they worked on the writing project in groups. Students acquired self-directed learning as they worked together in finding a solution to a problem which mirrors the real world. The problem served as a

stimulus and framework for learning which is different from conventional writing course, where technical writing skills are transmitted through the teacher. Through feedback from peers, students learnt to express their ideas and share responsibility in managing problem situations.

A major limitation of the PBL approach is that some students might resist working with others to solve a problem due to conflicting personalities, different working styles and different language abilities. A small number of students (about two or three) did not particularly enjoy working with others in the PBL assignment as they felt that some members in their groups were not competent in English. Others felt that certain members in their groups tended to be domineering. Sometimes it was not easy for students to come to a common agreement in solving the problem as different members had different opinions and it was difficult to accommodate the differences. However, this problem will be resolved as students learn to accommodate each other.

If the conditions are suitable, there is a strong possibility that PBL will benefit tertiary students well as they learn from the world's knowledge and accumulate expertise by their own study and research just as real practitioners do. The group–based learning process of PBL has strong collaborative features, and therefore allows students to reap the benefits of collaborative writing. In international universities where there are students from different nationalities, PBL could encourage students to communicate in English more frequently with other foreign students from diverse linguistic backgrounds as they work together in collaborative writing.

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