Promoting Class Peer Assessment in Engineering Education

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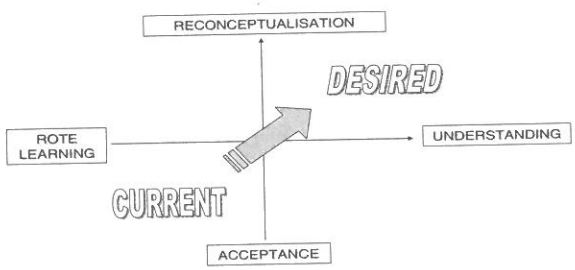
Abstract: The supportive statement to reduce rote learning in current education system from the Deputy Prime Minister of Malaysia in April pointed out a new direction in the current education development in this country. In light of this, the author's faculty initiated pilot study of the Transformative Learning in three engineering classes during the May 2007 semester. The idea of this study is to implement the relatively new philosophy of learning into the current education system that switches the learning environment from Rote learning to understanding and from an Acceptance mindset to reconceptualisation. Having been involved in the research of the study, the author has introduced the idea of Class Peer Assessment into the class activities in helping students to reconceptualise knowledge. This paper reports on the students' perception on this idea and their performance with the implementation of the idea.

Introduction and Background

The idea of transformative learning has been introduced with the aim to empower students so that they become active learners who are classified as independent, resourceful, adaptive, flexible, innovative and initiated. This idea was introduced back in the 1980's by Mezirow (1991), who, based on the eighty-three women returning to college in twelve different reentry programs, described ten stages of the process of personal perspective transformation starting from the experience of a disordering dilemma to reintegrating into society with the new perspectives.

The existing education system is in a form that behaves more toward the summative assessment in comparison to the formative assessment. As a result, more emphasis is on the final examination rather than the continuous assessments. This phenomenon has increased the tendency to rote learning among the learners and teachers in the community. In addition, students are more in the position to accept what has been taught than to reconceptualise the idea. This is shown in Figure 1 where the current education system with its emphasis on rote and acceptance learning is located at the lower left quadrant in the figure. In contrast the transformative learning, with its emphasis on understanding and reconceptualisation is on the upper right quadrant.



Assessments, from a student's perception, affect them in their learning life, yet most of the students agree that they are in the dark on what goes in the minds of their examiners or assessors. Students' involvement in the assessment helps to improve their understanding of the subject in terms of their learning and evaluation, and hence helps them to realise what is really required from them in order to achieve a well-rounded understanding of the concept.

Peer assessments is seen to be an increasingly popular form of assessment nowadays, especially in the western countries, and this type of assessment also improves the "conventional" assessment forms – which are characterised by both essay and the multiple-choice examinations (Sambell *et al.*, 1997; Struyven *et al.*, 2005). There are good reasons to use this method, which are outlined by Race (Race, 2001). This includes better understanding about the assessment cultures, the ability to learn from each other's success and the ability to learn more deeply when they have a sense of ownership of the agenda. In other words, students in order to peer assess others, need to know what the subject is all about, and hence organise the structure content into a coherent whole (Ramsden, 1996) and then emphasis is on the internal (within the students). With this, students have total knowledge on the subject, and are able to access their peers.

Peer assessment may be implemented in various activities of formative and summative assessments, which include clinical skills, oral presentations, essay writing, interpersonal skills and small group activities, (Kane and Crawford, 1989). Although peer assessment is bound to the factors such as gender, affiliation, age and participation (Langan et al., 2005; Falchikov, 1986), in the case of Engineering Education, this may have a small amount of influence to the results of assessments, which may be an interesting area to look into.

To date, in the Faculty of Engineering and Technology in a university college in Malaysia, peer assessment is adopted formally only in the subject of Interdisplinary Engineering Design Project. In this subject, three or four students from the disciplines of Civil Engineering, Electrical and Electronic Engineering, Manufacturing Engineering and Mechanical Engineering work together on a design project title, and at the end of the course, they are required to perform the evaluation of their teammate based on their performance. Therefore, the aim of this paper is to introduce and promote class peer assessment into engineering education.

Research Methodology

The target students considered here are 33 level two students taking "Combustion, Heat and Mass Transfer" in January 2007 session. In this pilot study, students are briefed on the idea of peer assessment, which is applied on the class presentation. Here the criteria of assessment are discussed among the class and few items are suggested to be the marking criteria of the presentation. The idea here is to let students own the agenda, and they know what is required in the assessment. After the presentation, students are required to mark and give comment on the performance of their friends followed by suggestions for improvements. At the same time, one other set of evaluation form is set and filled by the lecturer and marked as a control to ensure the validity and reliability of the peer assessment. In attending to the students' perception of class peer assessment, a set of questionnaire is given out to the students at the end of the course to observe students' opinion towards this relatively new assessment style

The items of questionnaire request students to state their degree of agreement, which are strongly agree, agree, disagree and strongly disagree to the statement of the questions. The analysis of the response is carried out numerically by the four-point system, which is, marking each of the responses 1, 2, 3 and 4, respectively. The total marks obtained by each student, and each question is then averaged to see the general response of the student and question. Depending on the average marks, the analyses of the results are divided into six bands as shown in Table 1.

Table 1 The Analysis of the Questionnaire is Divided into Different Bands to Observe the Degree of Agreement of Students towards the Statements

Band	Average mark range	Response	Comment
I	≤ 1.5	Mostly strongly agree	Students of this band generally agree with the question, with the possibility that at least half of them chose the strongly agree option.
II	1.51 – 1.75	Strongly agree – agree	Students of this band are on the average agree band, where they have a roughly even distribution of the agreement.
III	1.76 – 2.00	Mostly agree	Students of this band are at a position that where they are agree to most of the questions, but not to the extent of strongly agreeing with the researcher.
IV	2.01 – 2.50	Agree - disagree	Students of this band are said to have some agreement and disagreement to the statements in the questionnaire. There are probably small amounts of strong agreements in their opinion.
V	2.51 – 2.99	Mostly disagree	Students in this band are more towards the disagreement of the statements, with small portion in agreement with the idea of the researcher.
VI	≥ 3.00	Disagree – strongly disagree	Students of this band generally disagree with all statements of the researcher, with those who obtained 3.5 point and above said to be strongly in disagreement with most of the statements.

Results and Discussions

The results from the questionnaire are grouped into a number of categories for analysis, namely

i. The awareness of importance of the peer assessment
ii. The outcome of the assessment on students' learning
iii. The outcome of the assessment on improving students' study skills
iv. The effect of the peer assessment on lecturer's work
v. The contribution of the peer assessment to the total learning
vi. General worries on the peer assessment

The Awareness of Importance of the Peer Assessment

Questions in this category review the awareness among students about the importance of peer assessment. The results are shown in Figure 2, where the responses generally falling in Band III

(separated buy the cut-off lines in the figure), with one of them showing Band II results. This shows that students are well aware that peer assessments play an important role in the formative assessment where they are able to progress continuously from the feedback given to them. At the same time, they believe that this will help them to develop the ability to make independent judgements when they are involved in the assessments. In addition, by assessing their peer, students are able to observe the strengths and weaknesses from their friends, which help them to improve themselves.

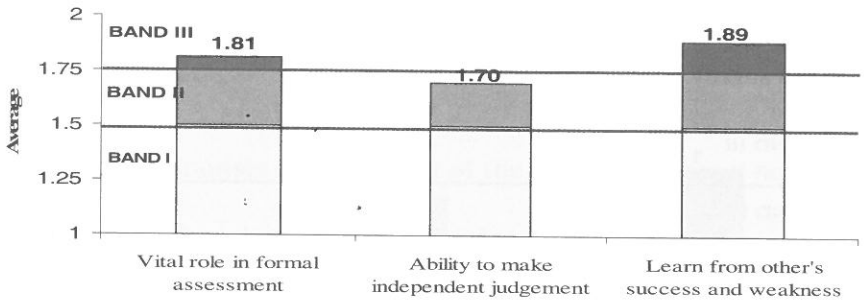


Figure 2 Students' Responses on the Awareness of Importance of the Peer Assessment

The Outcome of the Assessment on Students' Learning

When researching into the effect of the peer assessment on students' learning, it is observed that students feel that they become more responsible and involved as well as they are able to focus on the continuous improvements on their learning, as shown in Figure 3. The idea of peer assessment is to learn more when students have ownership of the assessment agenda, which will then promote the deep learning experience on the subject. Perhaps due to the first introduction to the subject, students are still yet to accept the benefit that peer assessment will eventually help them to achieve deep learning. Hence, one of the possible ways to overcome this problem could be the encouragement from the lecturer to students in making use of the available resources, such as library, and the online learning management system.

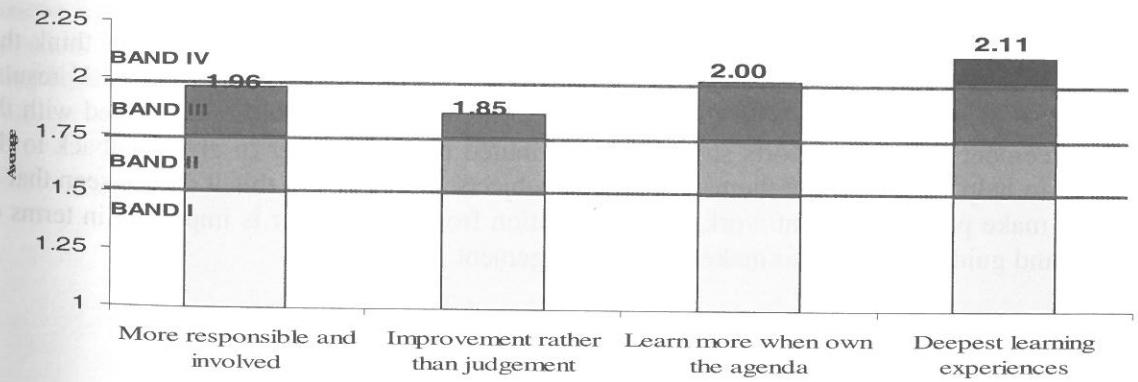


Figure 3 Students' Responses on the Outcome of the Assessment on Students' Learning

The Outcome of the Assessment on Improving Students' Study Skills

In terms of improving students' study skills, the results of the survey show that peer assessmen is not only able to develop the ability to analyse other students' works but also learn from thei friends through observation. These results are shown in Figure 4, where the average mean mark fall in Band III and where students agree with the idea of skill development and peer learning This is definitely a skill that can be developed and practiced by the faulty to promot transformative learning

In transformative learning, students are required to understand and reconceptualise knowledg leading to the critical analysis of their peer's work (Idrus and Koh, 2007). This is shown by th Band II results in the survey.

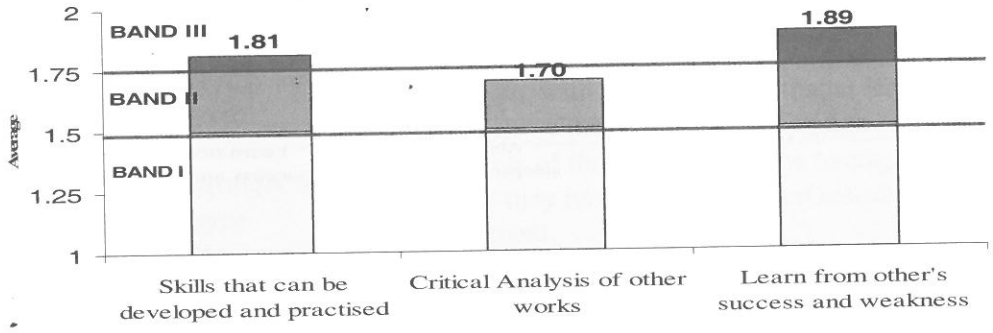


Figure 4 Students' Responses on the Outcome of the Assessment on Improving Students' Study Skills

The Effect of Peer Assessment on Lecturer's Work

There are some conceptions that, having peer assessment means the workload of a lecturer wil be reduce as part of the duties have been "shifted" to students. In reality, this is not the case, a the facilitators, lecturers will have more to lead students to reconceptualise ideas in the pee assessment method, and at the end of the assessment, to give feedback to both the studen assessors and students who attempt the questions.

As shown in Figure 5, engineering students do realise this reality that they do not think tha lecturers' work will be reduced from peer assessment. This is shown by the Band V results where 70% of them disagree with the statements. This statement is further supported with th 92% agreement that more efforts should be contributed by the lecturer to give feedback to th students to help them improve themselves in the subjects. Hence from this it can be seen that i order to make peer assessment work, the contribution from the lecturer is important in terms o leading and guiding students to make the right judgement.

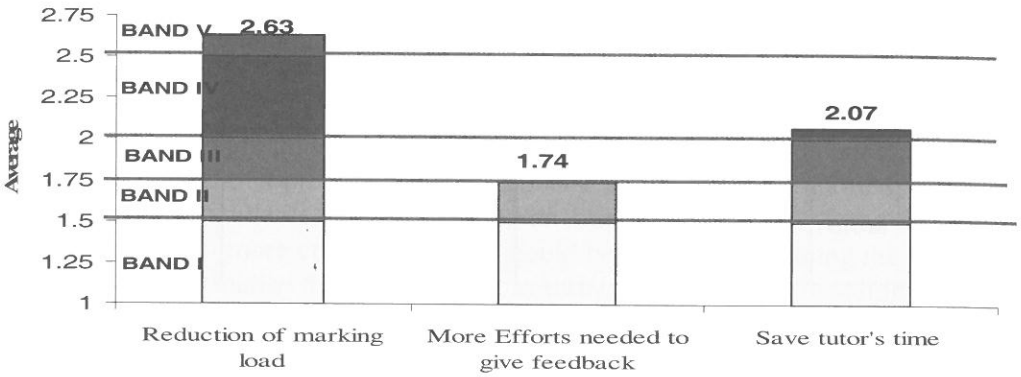


Figure 5 Students' Responses on the Effect of the Peer Assessment on Lecturer's Work

The Contribution of the Peer Assessment to the Total Learning

The concept of total learning environment comprises the people involved in the learning process, that is, students and lecturers, the academic curriculum, which are syllabus, assessment and final outcomes, and the relationship between them, (Kahn and Kyle, 2005). Peer assessment helps to develop deep learning among students from the analysis of the subject to the design of the assessment criteria, hence contributing to students' total learning environment.

Nearly all students agree that peer assessment should play a role in the formative assessment, and contribute to the overall assessment, with one-third of the students strongly feels that it is necessary to include peer assessment in the overall assessment, as illustrated in Figure 6, where Band II results is obtained. However, they think that although there is a need to include the peer assessment into the summative assessment, the proportion of the marks should be small, perhaps due to various worries that might occur, as will be discussed in the next section.

In addition, students do feel that they receive a wide range of feedback from peer assessments because here they are not only receiving feedback from the lecturer; they are also receiving various feedbacks from their peers, which can help them to improve in the subject. This is shown in Figure 6 where the degree of agreement of students in receiving feedback is ranked Band III for this statement.

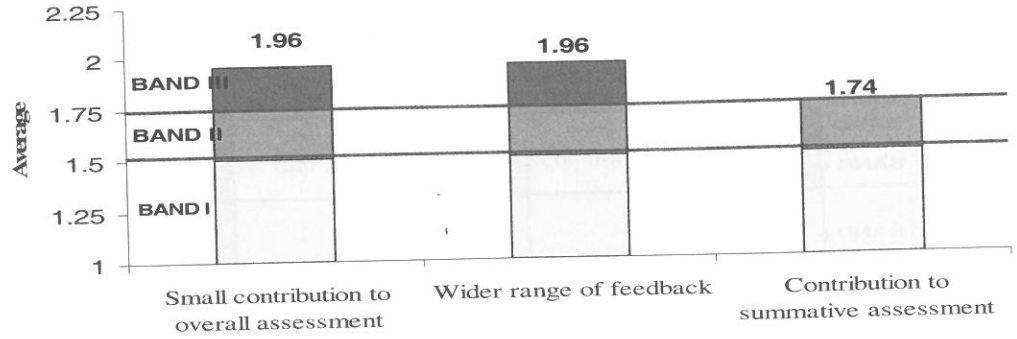


Figure 6 Students' Responses on the Effect Peer Assessment to the Total Learning

General Worries on the Peer Assessment

In general, students do have worries. Up to 85% of the students in the class feel that students may not have the ability to evaluate their friends, leading to mis-judgement on their friends. In addition, no serious participation of peer assessment is another worry of students, which is represented by the strong agreement among the students (where the Band II results in Figure 7 shows this trend). Students feel that friendship could influence students into giving high marks and this may not reflect the actual performance of the student. to their friends despite the poor actual performance of their friends. Furthermore, there is a possibility that they are afraid of being misunderstood and discriminated again which may be the cause of the low marks. At the initial stage, it is one of the worries that may affect validity and reliability of the peer assessment.

In the author's class, steps were taken to prevent the occurrence of these worries. A set of evaluation were prepared by the lecturer to work as control to the peer assessment activities in the class. In other words, the presentation by the students was marked by both lecturer and their peers. Encouragingly, in the January session, it was observed that the peer assessment marks agreed with the lecturer's mark with a small difference.

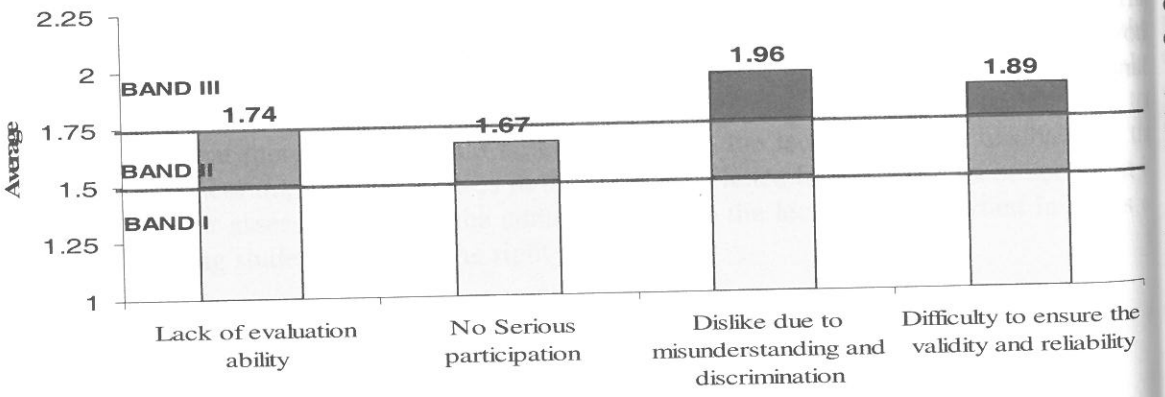
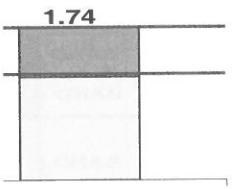


Figure 7: Students' Responses on the General Worries on the Peer Assessment



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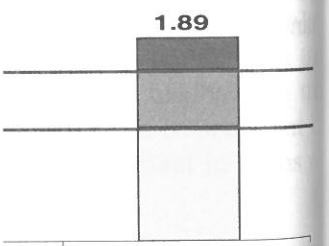

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Suggestion for Future Development

From the encouraging results obtained, more attention should be paid in reducing students' worries on the class peer assessment, which could encourage further confidence and greater participation in peer assessment among students. This includes the control marking from the lecturer on the peer assessment, and continuous constructive feedback given to students, as being practiced currently. In the context of giving feedback to the students, more specific feedback should be provided to students, as this will be an important dynamic force to help them to improve. On top of that, more critical analysis should be encouraged among the students to help them to further reconceptualise the ideas, which, in turn could improve the validity and reliability of the assessment.

Conclusion

A pilot study on 33 students on the class peer assessment was carried out in the author's class, as part of the activity of the transformative learning promoted in author's faculty. The idea of the transformative learning was to promote a student learning based on the understanding and reconceptualisation rather than the rote learning and acceptance. Therefore, with the class peer assessment, students are able to understand the subject and reconceptualise the idea of the subject to enable them to evaluate the performance of their peers.

The introduction of the peer assessment in the class received encouraging results, where students generally welcome the idea, and are able to perform the task with the result as predicted, which is shown by the similar marks awarded by both lecturer and students.

In promoting this idea, the lecturer is definitely playing an important role, not only as a facilitator but a motivator too. They starts with the explanation of the concept to the students, and then lead students to the reconceptualisation of the idea of peer assessment and creation of the criteria. Throughout the assessment process, continuous feedback and encouragement should also be given to the students to help them in building the confidence and correcting the shortcomings that they have made throughout the process.

However, educator should pay more attention to the potential drawbacks of peer assessment, as discussed before, to make sure that students take the peer assessment seriously to ensure the quality of the end results and the validity, as well as the reliability of the class peer assessment.

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