

Development of HOTS-PBL Module and It's Effect on High Order Thinking Skills among form Two Students

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Abstract: This study aims to develop and evaluate the impact of HOTS-PBL module which employed Problem Based Learning (PBL) approach on Higher Order Thinking Skills (HOTS) among form two students. Quantitative approach with true experimental design was used in the study, the subjects were divided into 30 students for the treatment and control groups equally. Two types of instrument used were HOTS-PBL module and HOTS test for maintenance and continuity of life theme. Data were analyzed using descriptive and inferential analysis. The result indicated that there was an increment in HOTS level for treatment group compare to control group. As a conclusion PBM-SC2 module has the ability to improve the student's level of HOTS in learning and teaching science.

Key words: Descriptive, HOTS, PBM-SC2, data, thinking, maintenance

INTRODUCTION

Higher Order Thinking Skills (HOTS) has become the areas of concern in the assessment and public examinations (MEM., 2013a). In Malaysia, Ministry of Education Malaysia's (KPM) plan assessment transformation when Malaysia's achievements in Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA) shows the position of mathematics and science at an alarming level. Malaysia showed a decrease in performance began in 2003 and continued to decline until 2011 (MEM., 2013b). Ironically, the question of science in TIMSS and PISA contains 60% of the questions that require application and reasoning involving HOTS and questions of current socio-scientific issues. One of the attempt made by KPM in overcoming this problem is to encourage learning and teaching of mathematics and science which focuses on higher order thinking skills and adopts these elements as learning strategies in the classroom (MEM., 2013c).

A study done also shows that the teaching and learning in the secondary classrooms in Malaysia today is still dominated by teacher-centered and focused on the transfer of information. Teachers act as information provider and practicing teacher-centered learning. Students tend to rely on the information presented by the teacher. As a result, students in Malaysia not actively involved in their learning (Syafii and Yasin, 2013), passive and lack of higher-order thinking skills (Peen and Arshad, 2014). Therefore, to hone Higher

Order Thinking Skills (HOTS) among students, authentic teaching and learning approaches should be implemented in the classroom. Problem-Based Learning (PBL) in the learning and teaching of science have a clear potential to increase HOTS and motivation of the students. According Sungur *et al.* (2006), PBL is an open inquiry learning method that could improve student achievement, improve problem-solving skills (Syafii and Yasin, 2013), developed self-learning and interpersonal skills of students (Neo *et al.*, 2002). PBL is a strategy that has been widely adopted by developed countries such as Singapore, Finland and the United States (Tan, 2003). In line with these developments, many studies have been conducted on PBL in Malaysia. However, studies related to PBL for lower secondary students is still new and has a great potential to meet the pedagogical needs of teachers in schools.

Research questions:

- Is HOT-PBL module for the topic of the world through our senses and nutrition have good validity and reliability?
- Are HOT-PBL module effective in improving student's Higher Order Thinking Skills (HOTS)?
- Is there a difference in HOTS pre-test scores for the control group and the treatment group?
- Is there a difference in the HOTS post-test scores for the control group and the treatment group?
- Is there a difference in HOTS pre test scores and post test score for the treatment group?

MATERIALS AND METHODS

The construction of HOTS-PBL module involved two stage. The first stage was preparing a draft module. The draft was constructed based on nine steps as proposed. Nine steps include the construction of goals, setting the theory and basic framework, research needs, setting objectives, content knowledge, selection of strategies, logistics selection, media selection and consolidation of the draft modules. The second stage is the stage of evaluation which involved the process of validation by an expert and determination the realibility of the module through pilot study. After that an experiment was conducted to test the effect of HOTS-PBL module on student's HOTS. This true experimental study aimed to compare the achievement of students involved in problem-based learning with traditional learning. Random sampling was done, so that, all sample in groups are balanced and has similar charateristics (Paw, 2011). The study was conducted at one of the schools located in Kuantan, Pahang. The samples used in this study were 60 form two students. The students were divided into two groups, 30 students in the control group and 30 students in treatment group. Samples were selected based on their achievements in 2015 year end examination and they were all moderate achievers. This study used HOTS-PBL module as a means of intervention and an evaluation instrument used were HOTS item assessment (pre-test and post-test).

RESULTS AND DISCUSSION

Validity and realibity of HOTS-PBL module: PBL module incorporate elements such as inquiry learning, problem solving, application of socio-scientific issues, reflective learning, collaborative learning and learning self-regulation that consistent with the requirements of pedagogical transformation suggested by the MOE. The module is built with a variety of colour, diagrams and text. The text in the module were presented in I-Think maps and smart art to attract the attention of user.

The content of HOTS-PBL module has been validated by five experts who are experienced in PBL as well as the construction of the modules and curriculum. There were five dimension of evaluation conducted which were the dimensions of content knowledge, students interaction, strength of the module, learning objectives and learning activities. The average percent approval among experts in every dimension ranged from 80-84%. This value shows that all the dimensions of the module has good validity. This is because according to

Gani *et al.* (2013), 80% expert aggreement is acceptable in verifying the contents studied. The reliability of the module derived from a pilot study conducted on 30 students. The alpha value obtained was 0.838. The reliability coefficient obtained fulfill the requirement as stated by Hair *et al.* (2010) with the strength of the relationship is very good. Thus, the PBM-SC2 module is acceptable for the use of learning and teaching in science classroom:

- The effectiveness of HOTS-PBL module on high order thinking skills
- Is there a difference in HOTS pre-test scores for the control group and treatment group?

Analysis of indepentent samples t-test showed no significant difference ($t = -0.626$, $p > 0.05$) between the treatment group and the control group in the pre test score in HOTS. The findings indicate that the control and treatment groups were similar in terms of knowledge before the intervention (Table 1).

This concludes that both groups have the same level of higher-order thinking skills before the intervention. Wong and Day (2009) in their study also ensure that both group used in their study (control and the treatment) have same level of achievement. The equality of student's level in term of their achievement and thinking between these two groups were important aspect to determine. This is because we want to make sure both group are equal and compareable:

- Is there a difference in the HOTS post-test scores for the control group and treatment group?

Analysis of independent samples t-test showed a significant difference ($t = -4690$, $p < 0.05$) between the treatment group and the control group in the post-test HOTS score (Table 2).

The finding indicated that the control and treatment groups have differences level of higher order thinking skills after the intervention. The result shows that the post test score in the topic nutrition increase after the intervention of PBL approach as well as the traditional approach of learning. However, the score for students who experienced problem based learning approach is better than the score for students who experienced traditional approach learning. The increment of score indicate that students understand more when the learnt about the topic through PBL session. This is because PBL session encourage student to actively involve in their learning. According to Peen and Arshad

Table 1: Pre-test scores for the control and treatment group

Groups	No. of students	Mean	SD	t-value	Significant
Control	35	20.11	11.251	-0.626	0.534
Treatment	35	21.66	9.286		

Significant value $p < 0.05$

Table 2: Post-test scores for the control and treatment group

Groups	No. of students	Mean	SD	t-value	Significant
Control	35	32.11	10.802	-4.690	0.000
Treatment	35	46.46	14.512		

The level of significant $p < 0.05$

Table 3: Pre- test and post-test scores for treatment group

Groups	No. of students	Mean	SD	t-value	Significant
Aras Pra	35	21.66	9.286	-11.406	0.000
Pasca	35	46.46	14.512		

Significant $p < 0.05$

(2014), PBL stimulates students thinking through the active learning sessions (Peen and Arshad, 2014), analyzes the information (Silver and Barrows, 2006) and find a solution to the scenario (Syafii and Yasin, 2013):

- Is there a difference in pre-test score and post-test scores for the treatment group?

Analysis of paired t-test found that there was a significant difference ($t = -11,406$, $p < 0.05$) between pre and post-test scores of the treatment group. This indicate that there is a significant difference in the HOTS level before and after PBL intervention (Table 3).

This shows that PBL have a positive impact on student's higher order thinking skills. The strength of PBL is that students learn how to acquire the contents of knowledge and understanding the learning content as a whole. Other studies also show PBL have significant impact on critical thinking skills (Nasoha, 2013), analytical skills (Liu *et al.*, 2010) and reflective thinking (Lim, 2011). All of these study constitute the effects of PBL on cognitive domain. Therefore, it can be concluded that PBL is significant in improving HOTS among students.

CONCLUSION

This research confirmed that HOTS-PBL is capable in increasing higher order thinking skills among student. Indeed, PBL not only increase student's HOTS, its also increase students interpersonal skills, communication skills and improved self confidence among students. The step by step process in PBL stimulate student's thinking and than motivate students to solve the problem given. All the instruction and activity in PBL demand students to think actively and reflectively. This HOTS-PBL module is able to help teachers implement teaching and learning and stimulate students HOTS.

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