

# THE EFFECT OF HOTS-PBL MODULE ON HIGH ORDER THINKING SKILLS AND MOTIVATION AMONG FORM TWO STUDENTS.

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**ABSTRACT:** This study aims to evaluate the impact of HOTS-PBL module which employed problem-based learning (PBL) approach to Higher Order Thinking Skills (HOTS) and motivation to form two students. A quantitative approach to the true experimental design was used in the study. The subjects were randomly assigned to 30 students for the treatment and control groups equally. Two instruments used were HOTS-PBL test and motivation questionnaire. Data were analyzed using descriptive and inferential analysis. The result indicated that there was an increment in HOTS and motivation level for the treatment group compared to the control group. As a conclusion PBL-SC2 module has the ability to improve the student's level of HOTS and motivation in learning and teaching science.

**Keywords:** PBL Module, HOTS, motivation

## 1. INTRODUCTION

Higher order thinking skills (HOTS) has become the areas of concern in the assessment and public examinations [1]. 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 [2]. 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 attempts 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 [3].

A study was done by Tan Yin Peen & Yusof Arshad [4] also shows that the teaching and learning in the secondary classrooms in Malaysia today is still dominated by teacher-centred and focused on the transfer of information. Teachers act as an information provider and practising teacher-centred learning. Students tend to rely on the information presented by the teacher. As a result, students in Malaysia not actively involved in their learning [5], passive and lack of higher-order thinking skills [4]. 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 to Sungur, Tekkaya, and Geban [6], PBL is an open inquiry learning method that could improve student achievement, improve problem-solving skills [5], developed self-learning and interpersonal skills of students [7]. PBL is a strategy that has been widely adopted by developed countries such as Singapore, Finland and the United States [8]. 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 great potential to meet the pedagogical needs of teachers in schools.

Research questions

1. Is HOT-PBL module effective in improving students' higher order thinking skills (HOTS)?

- i. Is there a difference in HOTS pre-test scores for the control group and the treatment group?
  - ii. Is there a difference in the HOTS post-test scores for the control group and the treatment group?
  - iii. Is there a difference in HOTS pretest scores and post-test score for the treatment group?
2. Is HOT-PBL module effective in improving students' motivation?
- i. Is there a difference in mean scores motivation for the control group and the treatment group before treatment?
  - ii. Is there a difference in mean scores motivation for the control group and the treatment group after treatment?
  - iii. Is there a difference in mean scores motivation before and after treatment for the treatment group?

## 2. RESEARCH METHODOLOGY

This is a quantitative study which employed true experimental study. This true experimental study aimed to compare the achievement and motivation 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 characteristics [9]. 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 the treatment group. Samples were selected based on their achievements in the 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 test assessment (pre-test and post-test) and motivation questionnaire.

## 3. RESULT AND DISCUSSION

1. The effectiveness of HOTS-PBL Module on High Order Thinking Skills

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

Analysis of independent samples t-test showed no significant difference ( $t = -.626, p > .05$ ) 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).

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

Group	N	Mean	SD	t-Value	Significant
Control	35	20.11	11.25	-0.626	0.534
Treatment	35	21.66	9.286		

Significant value:  $p < .05$

This concludes that both groups have the same level of higher-order thinking skills before the intervention. Wong and Day [10] in their study also ensure that both groups used in their study (control and the treatment) have the same level of achievement. The equality of student's level in term of their achievement and thinking between these two groups was an important aspect to determine. This is to make sure both groups are equal and comparable.

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

Analysis of independent samples t-test showed a significant difference ( $t = -4.690$ ,  $p < .05$ ) between the treatment group and the control group in the post-test HOTS score (Table 2).

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

Group	N	Mean	SD	t-Value	Significant
Control	35	32.11	10.80	-4.690	.000
Treatment	35	46.46	14.512		

Significant value:  $p < .05$

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 the PBL approach as well as the traditional approach to learning. However, the score for students who experienced the Problem Based Learning approach is better than the score for students who experienced traditional approach learning. The increment of score indicates that students understand more when they learn about the topic through PBL session. This is because the PBL session encourages the student to actively involved in their learning. According to Tan Yin Peen & Yusof Arshad [4], PBL stimulates students thinking through the active learning sessions, analyzes the information [11] and find a solution to the scenario [5].

iii. 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 ( $t = -11.406$ ,  $p < .05$ ) between pre-test and post-test scores of the treatment group. This indicates that there is a significant difference in the HOTS level before and after PBL intervention (Table 3).

**Table 3 Pre-test and Post-test scores for the treatment group**

Group	N	Mean	SD	t-Value	Significant
Pra	35	21.6	9.286	-11.406	.000
Pasca	35	46.46	14.512		

Significant value:  $p < .05$

This shows that PBL has a positive impact on students' 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 a significant impact on critical thinking skills [12], analytical skills [13] and reflective thinking [14]. All of these studies constitute the effects of

PBL on the cognitive domain. Therefore, it can be concluded that PBL is significant in improving HOTS among students.

2. The effectiveness of HOTS-PBL Module on students' motivation

i. Is there a difference in mean scores motivation for the control group and the treatment group before treatment?

Analysis of independent samples t-test showed no significant difference ( $t = -.056$ ,  $p > .05$ ) between mean scores motivation for the control group and the treatment group before treatment. The findings indicate that the control and treatment groups were similar in terms of motivation before the intervention (Table 4).

**Table 4 Mean scores motivation for control group and treatment group before treatment**

Group	N	Mean	SD	t-Value	Significant
Control	35	2.97	.213	-0.056	.965
Treatment	35	2.97	.260		

Significant value:  $p < .05$

This concludes that both groups have the same motivation level before the intervention. The equality of motivation level before intervention also stated in a study done by Suzilawati [15]. According to Pallant [16], this equality is a prerequisite requirement before students experience intervention session. The equality of student's level in term of their motivation was an important aspect to determine. This is because we want to make sure both groups are equal and comparable.

ii. Is there a difference in mean scores motivation for the control group and the treatment group after treatment?

Analysis of independent samples t-test showed there is no significant difference between mean scores motivation ( $t = -.848$ ,  $p > .05$ ) for the control group and the treatment group after treatment (Table 5).

**Table 5 Mean scores motivation for control group and treatment group after treatment**

Group	N	Mean	SD	t-Value	Significant
Control	35	3.26	.245	-.848	.400
Treatment	35	3.32	.314		

Significant value:  $p < .05$

The finding indicated that the control and treatment groups have no differences in motivation level after the intervention. This result showed there was an increment in motivation level for the control group even though they undergo traditional method of teaching as well as the treatment group. Traditional teaching in this study involved teaching approach as recommended by the Teacher Education Division such as inquiry approach, questioning technique and active learning. According to Webb [17], inquiry learning was able to increasing students' motivation. A study was done by Khamis, Dukmak, and Elhoweris [18] also found that students' confidence level with certain teaching approach will influence their motivation. Besides that, students already familiar with traditional teaching and they may be comfortable with that approach. In addition, medium achievement students seem to lack confidence in their classroom learning and always need teacher assistant. This may be the reason for the same level of motivation between these two groups.

iii. Is there a difference in mean scores motivation before and after treatment for the treatment group?

Analysis of paired t-test found that there was a significant difference ( $t = -5.682$ ,  $p < .05$ ) between mean scores motivation before and after treatment for the treatment group. This indicated that there was a significant difference in student's motivation before and after treatment for the treatment group.

**Table 6 Mean scores motivation before and after treatment for the treatment group?**

Group	N	Mean	SD	t-Value	Significant
Control	35	2.97	.260	-5.682	.000
Treatment	35	3.32	.314		

Significant value:  $p < .05$

The analysis conducted found that there was a significant difference ( $t = -5.682$ ,  $p < .05$ ) between pre and post motivation for the treatment group. The findings indicate that there is a difference of motivation before and after PBL sessions conducted. This shows that PBL has a positive impact on students' motivation level. This PBL approach has a significant impact on students' motivation as a study done by Sungur and Tekkaya [6] and Suzilawati Shamsudin [15]. Both of this study is a quasi-experimental study that compares the level of motivation before and after the intervention. This finding can be interpreted that the self-regulation cycle in the PBL instruction has a positive impact on student motivation. Intrinsic motivation is an inner encouragement that is influenced by internal factors such as competition, autonomy, needs, challenges, and effort [19]. The desire and effort triggered by the ill-structured stimulus, namely learning scenario [20]. All higher-order cognitive processes such as analyze, apply, evaluate and synthesize occur in the process. This increases the challenge for students and so on increase the intrinsic motivation. Therefore, PBL can significantly increase student motivation.

#### 4. CONCLUSION

This research confirmed that HOTS-PBL is capable of increasing higher order thinking skills and motivation among students. Indeed, PBL not only increases students' HOTS and motivation, but its also increase students interpersonal skills, communication skills, and improved self-confidence among students. The step by step process in PBL stimulates students' thinking and then motivates students to solve the problem assigned. 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 and motivation.

#### ACKNOWLEDGMENT

The research reported in this article was supported by a grant from the Universiti Pendidikan Sultan Idris (Research Code: 2016-0054-106-01).

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