International Journal of Social Science And Human Research

ISSN(print): 2644-0679, ISSN(online): 2644-0695

Volume 04 Issue 04 April 2021

DOI: 10.47191/ijsshr/v4-i4-40, Impact factor-5.586

Page No : 835-846

Assessment of Higher Order Thinking Skills Through Stem Integration Project-Based Learning for Elementary Level

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ABSTRACT:

Purpose of the Study- The purpose of this study was to assess the level of HOTS among students through STEM integration in Project-Based Learning (PBP) by using the conceptual framework and development modules of HOTS.

Design/methodology/approach-A total of 4 teachers and 12Year 6 students from SK Methodist, Kapit were selected to participate in this study. Research data were collected through Action Research method using structured interview instrument, questionnaire form, also via pre and post test.

Findings- The findings of needs analysis for the module have shown that the teachers thought that the HOTS development module should be developed by taking into account various learning strategies and using learning methods through STEM in Project Based Learning. Descriptive findings indicated that the need for students to use modules to improve HOTS is high. The t-test done to compare students' achievement from pre- and post-test has shown significant differences in pre-test scores. The post-test scores have proven that STEM integration learning methods through Project-Based Learning can improve students' HOTS.

Authenticity/value-The results of this study are expected to help Science teachers to improve teaching practices to improve students' HOTS by using STEM integration learning methods in project-based learning. In addition, through the HOTS module developed, it is hoped to help students to improve HOTS in Science subjects and also to increase the knowledge of Science teachers in integrating STEM in project -based learning to improve students' HOTS in Science subjects. The results of this study can also be used as a guide by the MOE in designing a curriculum that can improve students' HOTS through the integration of STEM in Project-Based Learning.

INTRODUCTION

Education plays a very important role in developing the economy and also the development of the country. The determinant of a country's success in facing global economic competition today depends on the skills, knowledge and competencies possessed by the community (Ministry of Education Malaysia, 2012). Among the major challenges faced by educators in the 21st century is to guide students to think creatively and critically, collaboration skills, communication and comparative thinking while focusing on concepts and knowledge.

Thus, a transformation towards existing education has been introduced by introducing the 21st century education system so that students are able to compete globally by having the ability to think critically, creatively and innovatively (Ismail, Sidek&Mahbib, 2015).

MohdRadzi (2010) stated that thinking skill is a very important aspect. Through the application of thinking skills, students are able to apply their experiences and knowledge critically in their real lives. To provide a solid foundation, early exposure to creative and critical thinking skills during the teaching and learning process can produce a steady-minded generation (Ambotang, 2014).

According to Abd Hamid (2006), teachers were found to only give exposure on the facts of the topic to students without giving students the opportunity to think about the issues learned during the teaching and learning process. Teachers need to identify the problems faced by students when they are unable to develop a strategic plan to solve problems related to Higher Order Thinking Skills (HOTS) (Abdullah, Abidin and Alin 2015). Students in Malaysia are less exposed to HOTS with project -based learning. In addition, there is a lack of resources for assessment materials related to HOTS. STEM education is able to enhance students' high level thinking skills and interest in STEM related subjects (Wahono, Lin and Chang 2020).

To evaluate the level of HOTS among students, researchershave chosen the title of Waste Material. In this topic, students are needed to produce water rockets in groups. While they were producing the water rocket, the researchers found that each group was able to draw a picture of the water rocket that was created. In addition, students can also build water rockets based on sketches made. This proves that the students can master the elements of HOTS at the Applying level. Apart from that, students were also

able to categorize the waste materials used to build water rockets and to test the water rockets created. This shows that students can master the level of Analyzing in HOTS.

The problem arises when students are found not to be able to master the level of HOTS starting from Assessing. As a result of the interviews conducted by the researchers with 30 students while they were producing water rockets, it was found that they were not confident and could not give reasons for the following questions: Give your opinion on whether a water rocket can fly if it is not filled with water. Students were also found to be unable to submit suggestions for improvements that need to be made to water rockets that were created to be able to fly high by linking them to STEM elements. This shows that the level of students HOTS have not reached the level of Assessing (Modul AmaliSains, 2020)

In other situations, it was found that students had difficulty answering Paper 2 questions in Science subjects related to HOTS items. In the Topical Test 1 of Science subject, only 12 out of 30 students which is equivalent to 40% of students were able to answer four items of HOTS questions accurately. Among the items that students could not answer were items that tested the level of assessing related to predictive and making conclusions. Apart from that, students also failed to answer questions related to designing and sketching where the students were not able to design and sketch a given object by combining STEM elements (Buku Latihan Sains, 2020).

Therefore, this study was conducted to identify the needs of users to develop HOTS development modules based on STEM integration in Project Based Learning. Based on the needs of the users, the HOTS development module will be developed and verified by two module development experts and a Science expert. The modules that have been developed will be used to assess the level of students' HOTS through the integration of STEM in Project Based Learning.

HIGHER ORDER THINKING SKILLS

Higher Order Thinking Skills (HOTS) is defined as the ability of students to apply knowledge, skills and values in reasoning and reflection to solve problems, make decisions, innovate and be able to create something. One of the key elements in HOTS is creative and critical thinking skills. To strengthen and empower thinking skills, especially for high level thinking skills, it has been emphasized so that students can understand what they learn without relying on memorization techniques, able to think in detail, able to draw conclusions and reflect, and able to apply that knowledge in real situations. HOTS are important in assessing students' problem solving ability (Yusuf, Widyaningsih and Sebayang 2018). An inclusive and planned approach has been integrated in the implementation of HOTS at the school level where it contains three main elements namely curriculum, pedagogy and assessment; and four support elements namely co-curricular, community and private institutions support, resources and effort-building (Bahagian Pembangunan Kurikulum, 2014).

The national curriculum aims to produce students who are balanced, resilient, curious, principled, informed, and patriotic as well as having the skills to think, communicate and work in a team. To ensure that the goal is achieved, the element of HOTS is applied through writing explicitly in curriculum standard documents that focus on students' ability to apply skills, analyze information, evaluate and create products (Bahagian Pembangunan Kurikulum, 2014). Apart from pedagogy and assessment, curriculum is one of the key elements in HOTS. Teachers' understanding of the KBAT statement in the curriculum as well as the use of verbs in the level of thinking found in the curriculum document should be clear to ensure that all forms of teaching and learning are planned and implemented effectively in the classroom or outside the classroom including co -curricular activities.

The combination of STEM learning with HOTS assessment that enhances the ability to analyze, evaluate and create is an alternative strategy to improve students' thinking skills (Rosidin, Suyanta and Abdurrahman 2019).

SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) LEARNING

STEM refers to the acronyms for 'Science', 'Technology', 'Engineering' and 'Mathematics'. The subjects covered in the STEM field consist of Science, Physics, Mathematics, Chemistry, Biology, Fundamentals of Computer Science and Design Technology. In the context of Teaching and Facilitation, STEM covers three main aspects namely learning areas (in school and at tertiary level), subject packages (based on a combination of STEM specialization subjects) and Teaching and Facilitation approaches (application, knowledge, skills and values to solve problems).

STEM education was introduced in Malaysia starting in 2014 in line with the needs of this era which allows the knowledge to spike very quickly. According to Becker and Park (2011), STEM education is an exploration that takes place in the teaching and learning process involving any two or more STEM components. The Ministry of Education Malaysia focuses on the integration of STEM education in Teaching and Facilitation through training and courses for teachers and collaboration with universities. Amimah Mohamad Ayub (2018) stated that National Education Development Plan 2013-2025 emphasizes on the closure of the gap between the subjects taught in schools. Multidisciplinary education is also recommended in this plan so that the quality of education can be improved, while overcoming the challenges that exist in the Malaysian education system as a whole. Thus, as one of the plans to encourage the involvement of teachers and special students in two or more fields through Teaching and Facilitation, project-based learning, collaborative learning and STEM education have been established.

STEM education in Malaysia is currently in the second wave phase (2016-2020). Ongoing campaigns and collaborations with relevant agencies need to be implemented to meet the demands of this wave of fostering public awareness of STEM. STEM in Malaysia has a far-reaching goal which is to prepare students to face challenges and be able to compete globally (Ministry of Education Malaysia, 2016). From the aspect of the curriculum used today, namely the Primary School Standard Curriculum (KSSR), Integrated Secondary School Curriculum (KBSM) and Secondary School Standard Curriculum (KSSM), STEM elements are applied in knowledge, skills and values.

PROJECT BASED LEARNING

Project-Based Learning (PBL) is a method of learning with the concept of students studying in depth about an issue or topic to produce a product (Md Said & SISC +, 2019; Nation, 2008; Beddoes, 2010). Zimmerman (2010) and Kaldi et al (2011) stated that PBL is an instructional method that allows students to build skills and gain knowledge through projects, cooperative learning and hands-on techniques. The learning process in PBL begins with guided questions, an understanding of the core concepts and principles of learning. When completing a project, students will use inquiry, research, planning skills, critical thinking and problem-solving skills (Trudy Ann Freer-Alvarez, 2016).

During the workshop related to PBL, Rosenfeld et al (2001) have listed several steps to implement PBL namely; (1) construct the questions used to carry out the project, (2) select the main question or determine the project to be carried out, (3) read and find material related to the issue to be solved, (4) design the problem, (5) design the method appropriate for problem solving, (6) writing a project proposal paper, (7) executing and documenting pre -drafted assignments, (8) analyzing data and making inferences, (9) making a final report, (10) presenting a final project.

Previous studies have proven the advantages of PBL compared to traditional learning methods. Among them, it can help students to achieve learning outcomes and can help students to master the topic (AzliYeop, 2013). In addition, it can also expose students to organizational skills and time management. Blank & Harwell, 1997; Dickinson et.al, 1998), forming teamwork (Mioduser&Betzer, 2008), students are also able to use high -level thinking skills (MohdNoramdzan, 2015), and increase academic achievement (Nichola Harmer and Alison Stokes , 2014; Cengizhan, 2007; Kanter and Konstantopoulos, 2010; Selcuk, 2010; Shih, Chuang and Hwang, 2010), Individual learning of students (Chang & Tseng, 2011) and academic personality of students (Korkmaz and Kaptan, 2002; Nor Hamidah&Zanaton, 2014).

METHODOLOGY

Research design

The research design used in this study is an action research method. Semi structured interview protocol, questionnaires, pre- and post -tests were used as the instruments for data collection. The Kemmis& Mc Taggart 1998 model is the action research model that underpinned this study. Based on this model, action research moves through a continuous cycle involving four stages, namely stage 1: reflecting, stage 2: planning, stage 3: act and stage 4: observe. In this study, it is carried out based on measures such as plan, act, watch, observe and reflect (Reid & Brief, 2009). Interventions is carried out to ensure that this study is in line with the objectives and skills to be emphasized.

After the design for the intervention completed, the next step is the action to test its effectiveness on students. Observational measures were made to identify the data obtained throughout the approach as a result of the findings. The last step in a research cycle is reflection. Reflection is used to look at perceived effectiveness and shortcomings that need to be rectified to execute the next cycle using the same approach (Maxwell 2003). Figure 1 shows the action research model of Kemmis& Mc Taggart, 1988.

The reason to used Kemmis and Mctaggart action research models in this study as it can improve or enhance learning methods by making changes in learning methods through the integration of STEM elements in project -based learning. In addition, Science learning emphasizes the elements of HOTS in line with the aspirations of the Primary School Standard Curriculum (KSSR) which seeks to inculcate the culture of HOTS among primary school students.

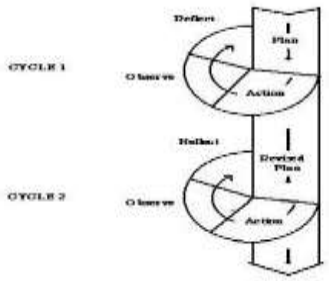

Figure 1: Kemmis & Mc Taggart Action Research Model
Source: Kemmis & Mc Taggart 1988

This action research was conducted over a period of 6 weeks. The first week was used to build modules and instruments, 3 weeks were used to run the intervention and an interval of 2 weeks to learn as usual between weeks intervention. This is to enable students to understand the topic of waste and to avoid of the intervention is influenced by the factor of repeating the content of student learning and memorization alone. Table 1 shows the action research implementation schedule.

Table 1: Action Research Implementation Schedule

Time	Detail
Week 1	Module and research instrument development
Week 2	Action research Cycle 1
Week 3	PdPc as usual
Week 4	Action research Cycle 2
Week 5	PdPc as usual
Week 6	Action research Cycle 3
Week 7	Overall data analysis

The needs analysis phase is to determine the development requirements and module specifications where the data obtained will be used for the next development phase. The second phase of the study, namely design and development, is based on the summary of the needs analysis phase which involves designing module materials, teaching and learning strategies and evaluation of the module prototype by two appointed experts.

The last phase, the implementation and evaluation phase, focuses on the evaluation of the level of HOTS using the modules provided. Therefore, in order to obtain meaningful study results, the reporting of the module development process in this study is arranged in a more orderly manner and documented according to the phases in ADDIE. In the study of this, each phase has different study participants, as well as different data collection methods, instruments and data analysis as shown in Table 2.

Table 2: Methodology by phase

Phase	Participants	Method	Instruments	Analysis
Needs Analysis	4 teachers Science Primar School	Semi -structure interviews	Interview Protocol	Use of Atlas software Ti (Thematic)
	30 year 6 students	Questionnaire	Feedback form	Use of SPSS Software
Development	2 field experts	Expert review	Expert review form	Comparative Analysis
Implementation and Evaluation	12 students	Pre and Post Test	Paper test question set 2	Use of SPSS Software

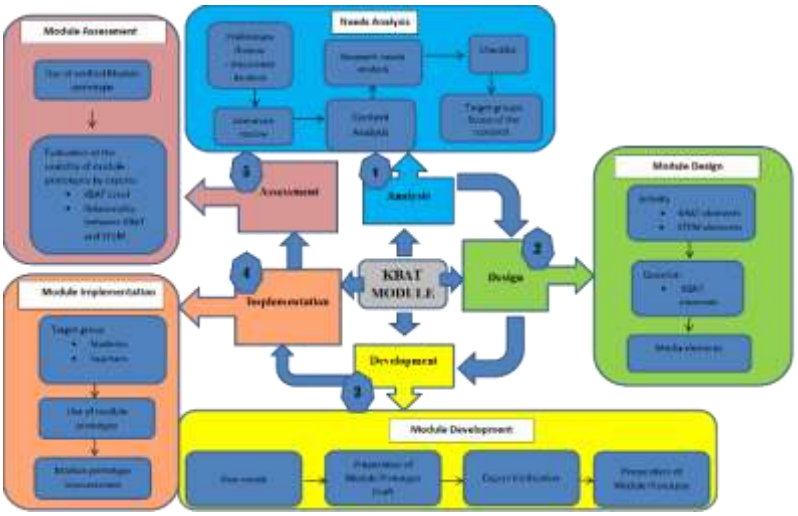

Figure 2: Conceptual Framework of the Study

Sample

In this study, *purposive sample* selection was chosen for the purpose of selecting the study sample. For the qualitative study, 4 teachers who teach Science year 6 were selected to identify the needs and specifications of the KBAT development module. Meanwhile, for the quantitative study, 30 Year 6 students in the category of failed to pass (GALUS) in Science subjects were selected to obtain information on STEM integration learning needs through Project Based Learning. The location of the study was SK Methodist, Kapit, Sarawak, Malaysia.

12 out of 30 students consisting of 7 female students and 5 male students who gained scores below 50 % during the Pretest were selected to assess their level of KBAT after they have used the KBAT development module through STEM integration in Project Based Learning. To maintain confidentiality, all personal information such as names used as study participants are pseudonyms (Norafifah Bali & Mohamad Hashim Othman, 2017).

Measurement of Variables

To identify the need for teachers to develop HOTS modules through STEM integration in project -based learning, the interview questions contained 18 items (background of respondents 3 items, teaching strategies 10 items, activities in teaching and learning Science 5 items).

In terms of student needs to develop modules, the questionnaire contained 11 items (background information 2 items, project-based learning effect in improving students' HOTS 4 items, STEM integration effect in Science learning 4 items, module requirements characteristics 1 item). For this section, the questions are in the form of closed questions where the respondent has two answer choices, namely "Yes or No".

Developed modules were reviewed and validated by two expert evaluators of the module who have expertise in the field of module development as well as Primary School Science subjects. A total of 15 items were assessed in the modules that were developed.

To ensure that the data obtained is accurate, study items were already reviewed and have high validity. The activities contained in the modules and the questions constructed in the pre and post tests should follow the syllabus description so as not to run away from the topics studied by the study sample. In addition, the terms and instructions used in the test questions and questionnaires should be clear and easily understood by the study sample.

The reliability of the items in the test should also be considered to ensure that the assessment given is honest and in accordance with the guidelines given. The test has high reliability by performing the test in a conducive and fair environment. Pre- and post -tests are reviewed based on scoring guidelines the standard of the Examination Board so that teachers can interpret the answers of the study sample correctly.

To assess the level of HOTS among students, researchers have chosen a title Waste. In this topic, students have to produce water rockets in groups using waste materials. While they were producing the water rocket, the researchers found that each group was able to draw a picture of the water rocket that was created. In addition, students can also build water rockets based on sketches made. This proves that students can master the elements of KBAT at the level of applying. Apart from that, students are also able to categorize the waste materials used to build water rockets and are able to test the water rockets created. This shows that students can master the level of analyzing HOTS.

DATA ANALYSIS

The results of the module development interviews with four science teachers were analyzed thematically while the *Statical Package for Social Science* (SPSS) version 25 application software was used to analyze the students' needs to develop STEM -based HOTS development modules in Project Based Learning. Achievement scores in pre and post tests were analyzed by descriptive analysis in terms of mean and standard deviation while inferential analysis used t-test and one-way ANOVA test.

The pre and post tests are reviewed based on the standard UPSR scoring guidelines from the Examination Board. The 2 Science paper scoring guide is in the form of a rubric that assesses the elements of KBAT applying, analyzing, evaluating and creating. The full mark for the test question is 20 marks.

FINDINGS

All the teachers who were selected are Science teachers who teach year 6, have an acdemic qualification of degree in Science and have at least five years of Science teaching experience . The purpose of teacher selection is to obtain useful information on the development needs of the HOTS module.

Meanwhile, a total of 30 students involved in the study, consisted of 14 male students (46.7%) and 16 female students (53.3%) year 6.Based on test results, it was found that a total of 9 students (30%) obtained grades A, 9 students (30%) got grade B, 7 students (23.3%) got grade C and a total of 5 students (16.7%) got grade D.

In the needs analysis phase, teacher respondents were selected to be interviewed to obtain the needs in developing the KBAT module. After the interview recordings were transcribed, the data were categorized into themes based on semi -structured questions and then analyzed to produce the following themes:

A) Strategies and methods in science teaching are diversified to improve Higher Order Thinking Skills

All four respondents agreed that variety of strategies and methods in teaching sciences can help improve students HOTS understanding of the concepts of science being learned. Table 3 shows teacher comments and constructs or themes formed from the comments provided by teachers

Table 3: Comment teachers and constructsformed from the comments given by teachers related to strategies and methods teaching Science.

Teacher's comment	Constructs/Themes Formed
My students had fun when the learning session that day required students to produce a project as opposed to a learning session using the question and answer method. In addition, the students better understood the topics they studied that day and were able to answer the KBAT questions that I gave. (T1).	1. Project -based activities increase studer ’interest in learning 2. Project -based activities increase studen understanding of HOTS
My students are not tired of learning when they produce a project as opposed to a drill -down learning method. They are also quick to understand what I teach and are able to think at a higher level (T2).	1. Project -based activities increase studer ’understanding of what they are learning. 2. Project -based activities can shape HO among students

T = Teacher

B) The use of STEM integrated learning methods in Project -Based Learning can improve students' high -level thinking skills

Apart from activities and strategies in science teaching, all four respondents also agreed that the use of STEM integration learning methods in Project -Based Learning can improve students ’Higher Order Thinking Skills Table 4 shows teacher comments and constructs formed from teacher comments.

Table 4: Teacher comments and constructs formed from comments given by teachers related to the effect of STEM integration in Project -Based Learning on students' HOTS.

Teacher's comment	Constructs/Themes Formed
While teaching Science using my Project Based Learning methodhas also integrated STEM to further enhance students 'creativity and innovation as well as improve students' high -level thinking skills (T3).	1. Project Based Learning Methods through STEM integration can increase students' creativity and innovation. 2. Project -Based Learning Method through STEM integration can improve students' HOTS.
My student's high -level thinking skills increased when I integrated STEM in Project Based Learning sessions. They were also more creative and more fun to learn Science (T4)	1. Project -Based Learning Methods through STEM integration can improve students' HOTS. 2. Project -Based Learning Methods through STEM integration can increase students' creativity. 3. Project -Based Learning Method through STEM integration can increase students' interest in learning Science.

T = Teacher

In conclusion, the results of the analysis of the interviews that have been conducted have shown that the development of HOTS modules should take into account various learning strategies and use learning methods through STEM integration in Project -Based Learning to improve students' HOTS.

Analysis of Student Needs in Developing HOTS Modules

The problem arises when students are found to not be able to master the level of HOTS starting from assessing. Results from the interview against 30 students while they were producing water rockets have gathered found that they were less certain and could not give reasons to the following questions: Give your opinion on whether a water rocket can fly if it is not filled with water?. Students was also found to be unable to come up with suggestions for improvements that need to be made to water rockets created to be able to fly high by linking them to STEM elements. This shows that the level of KBAT students have not reached the level of KBAT assess (Science Practice Module, 2020)

In other situations, it is found that students had difficulty in answering paper 2 questions of Science subjects related to the item of Higher Order Thinking Skills. In the topical test of 1 Science subject, only 12 out of 30 students were equivalent to 40 %in the taught class can answer 4 items of Higher Order Thinking Skills questions accurately. Among the items that students could not answer were the items that tested the level of assessing associated with predictive and inferential questions. Apart from that, the student also did not succeed in answering questions related to designing and sketching where the student was not able to design and sketch. objects given by incorporating STEM elements in sketches and designs (Science Exercise Book, 2020).

To answer the first research question that is what is the need of users to develop KBAT development modulesbased on STEM integrationin Project -Based Learning in terms of student needs, a mean score scale as in Table 5 was used to analyze and interpret the findings of the study.

Table 5: Mean Score Scale and Interpretation

Mean	Interpretation Score
1.00 – 2.33	Low
2.34 – 3.67	Moderate
3.68 – 5.00	High

Source: Adapted from Augustine (2012)

Table 6: Aspects of the Assessed in the HOTS module

Development Aspects of KBAT Module	N	Mean	Standard deviation	Interpretation
Application of Project Based Learning	30	3.03	0.718	Moderate
STEM Integration	30	5.70	0.836	High

Module Development Requirements	30	4.63	0.490	High
Overall	**30**	**4.45**	**0.681**	**High**

Table 6 shows the mean scores related to the aspects assessed in developing the KBAT module in terms of the application of project -based learning, STEM integration and the need to develop the module. The mean score for the application aspect of project -based learning is the lowest at 3.03 indicating that the need for project -based learning in developing modules is at a moderate level. Meanwhile, the mean score of the STEM integration aspect is 5.70 which also shows that it is needed in developing the KBAT module. Furthermore, the mean score of the need to develop the module is 4.63 which also shows the students' desire for the KBAT development module to be developed is high. Overall, the average mean score for the need to develop HOTS is 4.45 which is high which indicates that students need the HOTS module to improve their HOTS by implementing STEM integration through project -based learning.

The results of the analysis showed that there was a significant mean difference in the need to develop KBAT modules by gender ($t = 13.548$; $p < 0.01$). The mean needs of male students (mean = 3.5714) were not the same as the mean needs of female students (mean = 3.1250). Therefore, the results show that there is a significant mean difference of the need to produce KBAT modules according to gender ($P \leq 0.05/0.01$).

The results of the analysis showed that there was a significant difference in the need to develop the KBAT module according to the monthly test grade ($F(3,26) = 4.758$; $p < 0.01$).

To verifies the modules that have been built, researchers have selected 2 expert teachers who have expertise in science as well in designing modules. Both selected experts have more than 10 years of science teaching experience.

The basis in developing the activities in the KBAT development module is based on Needham's five -phase constructivism approach. After the prototype of the KBAT development module was completed in the development phase, an expert review was conducted to obtain expert feedback for the purpose of improving the prototype of the module that had been produced. The results of the expert review on the module prototype have shown that there are some comments and suggestions that need to be taken into account by the researchers to further improve the module. Table 7 shows the results of the expert review of the module prototypes that have been developed.

Table 7: Expert Evaluator Feedback on HOTS Development Module Through Internal STEM Integration Project Based Learning.

Expert Assessor	Views/Comments/Suggestions for Improvement
Expert Assessor 1	1. The content of the module is appropriate to the level of the student 2.Activities carried out by students can increaseHOTS level among students and increase student creativit Suggestions for improvement; 1. Increase the number of questions related to the HOTS construct in order to test the HOTS and improve t students' HOTS.
Expert Assessor 2	1. The content is appropriate to the level of student learning 2. The activities provided can be understood and can be carried out by students. 3. The questions are appropriate to the level of the student

Pre and Post Test Findings of KBAT Questions

To assess the achievement of HOTS among students through the integration of STEM in Project -Based Learning, Pre and Posttest HOTS questions have been implemented against students. Table 8 shows the Pre and Post test analysis of the HOTS questions.

Table 8 : Analysis of Pre and Post Test Results of HOB Questions

Students	Pre test scores (%)	Percent (%)	Post test scores (%)	Percent (%)	Percentage (%) Increase/ Decrease in Marks
1	10	50	9	45	-5
2	13	65	13	65	0

3	8	40	11	55	+15
4	13	65	14	70	+5
5	11	55	14	70	+15
6	11	55	13	65	+10
7	11	55	14	70	+15
8	12	60	12	60	0
9	12	60	11	55	-5
10	12	60	16	80	+20
11	12	60	15	75	+15
12	10	50	11	55	+5

Based on the analysis, eight students have shown an increase of at least 5% and above while two students have shown no increase or decrease. From the data collected, it was found that only two students did not show an increase in score as targeted by the researcher but the percentage of marks for one of them exceeded 50 % that is (55 %). Meanwhile, another student was only able to get a score of 45% which was less than the set passing score.

Students who do not show improvement are relatively weak students in answering HOTS questions in Science subjects and need more guidance from teachers to improve HOTS through STEM integration learning methods in Project Based Learning. Overall, learning methods through STEM integration in Project Based Learning HOTS achievement among students.

Referring to the table above, it was found that the mean test score had increased from 11.25 to 12.75 with an increase of 1.5. This clearly shows that the use of STEM integration learning methods through Project -Based Learning can improve students' HOTS. Apart from that, the standard deviation (SP) for the pre -test was 1.42 and for the post -test was 1.75. A small standard deviation indicates that the score findings are homogeneous, meaning the gap between low and high student scores.

In conclusion, the increase in the mean scores of students in the pre -test and post -test showed that the improvement in students' performance in answering KBAT questions after this learning method was introduced.

The results of t -test showed that there was a significant difference ($t = -3.00$, $p = 0.01$ between pre -test and post -test with a value of $p < 0.05$. The results showed that there was a significant difference in the mean of pre -test scores with post -test scores for respondent. This proves the method STEM integration learning through project -based learning can improve HOTS among students.

DISCUSSION

As a result of the module needs analysis, it was found that the need for HOTS development modules based on STEM integration in Project Based Learning was developed to help teachers diversify teaching and learning strategies and methods appropriate to students' cognitive levels and student centered teaching methods. In addition, it is to prepare students to face challenges and should be able to compete globally in line with the aspirations of the Ministry of Education Malaysia.

Apart from that, it is also in line with the findings of Abd Rashid (1999) who stated that each stage of Piaget's cognitive development is characterized by a new cognitive development of abilities that allows for great development in children's thinking. These findings also support the findings of Sayuti et al. (2000) who stated that the learning curriculum should be adapted to the cognitive level of students and student centered teaching methods. Sneidma (2013), on the other hand, stated that the integration of several subjects, namely Science, Technology, Engineering and Mathematics is appropriate so that it becomes a more relevant field of education to be taught at the school level.

From the aspect of students, the results of the analysis of the questionnaire given to students found that they understand and are more interested in learning Science when they do project -based group activities. This finding is in line with the findings of Slavin R. E (2000) who stated that cognitive skills result from children's social interactions with peers. Apart from that, they are also able to master skills and knowledge as well as be able to reuse them in the same or different situations.

Module development uses Needham's five phase constructivism model because it emphasizes student centered learning. In addition, it can help teachers identify students 'existing knowledge and plan teaching methods based on students' existing

knowledge. This is in line with the findings of Syahida Nadia (2015) who found that through the use of Needham's five -phase constructivism learning model, teachers can identify students' existing knowledge and plan teaching methods with the basic nature of that knowledge.

The results of the study have also shown that there is an increase in the achievement of HOTS among students who follow the HOTS development module through the integration of STEM in Project Based Learning. These findings are in line with the findings of Nichola Harmer and Alison Stokes (2014); Cengizen (2007); Kater and Konstantopoulos (2010); Selcule (2010); Shih, Chuang and Huang (2010) who showed that Project Based Learning method can improve students' academic achievement.

The production of HOTS development modules has an impact on the strategies and methods commonly used by teachers. Based on the findings of the analysis of teacher needs, it is gathered that a variety of teaching strategies and methods can encourage the development of students' High LevelThinking Skills (HOTS). Through this developed HOTS development module, it can provide guidance to teachers to apply the HOTS construct to students during the learning and teaching sessions take place.

Furthermore, this module can help teachers to generate their ideas to produce their own strategies to improve students HOTS based on the activities and exercises in this module. The researchers also hope that the resulting modules can be a guide for teachers to design learning and teaching activities based on Needham's 5 phase constructivism approach and use STEM integration teaching methods in Project Based Learning.

The variety of activities in this module has implications for the development of students' knowledge of the topic of waste and they are also able to apply the use of waste in their creation of a product such as water rockets.

The production of this module can also be a source of reference for stakeholders involved in planning and implementing the curriculum in improving the existing curriculum from the aspect of teacher teaching strategies in improving student HOTS such as administrators, District Education Office and the Ministry of Education Malaysia.

This study also proves that the combination of Constructivism Theory, Cognitive Development Theory and Needham's 5 phase Constructivism Model can be applied in teaching and learning and can produce effective learning for students. This can be seen from the findings of the study of evaluating the level of students HOTS where the level of students KBAT increased after using the module.

CONCLUSION

In conclusion, the application of Higher Order Thinking Skills (HOTS) needs to be implemented by teachers to conduct teaching and learning sessions through the activities implemented. This study proves that students HOTS can be improved through the integration of STEM in project based learning. The combination of learning models and theories in developing the HOTS development module has been able to produce a module that can help teachers improve students HOTS.

Therefore, the role of teachers is to plan teaching activities that can encourage the involvement of each student to produce effective learning. The results of this research are expected to contribute to the improvement of the quality of teacher teaching to increase the level of students HOTS and subsequently to produce students who are creative, innovative and able to face the challenges of the 21st century technology world.

For future studies it is suggested that the interviews to be extended to study participants from other schools. The results of the study that will be obtained can help researchers know the need for module development from various aspects so that the content of the module can be adjusted for use purposes in schools under the Ministry of Education Malaysia. Apart from that, it is suggested, that the study of HOTS assessment to be extended to other subjects. Apart from that, the topic of teaching should be expanded to other topics that are difficult to understand and comprehend by students. Finally, it is suggested that the study be done through STEM integration learning methods in Problem Based Learning in order to help teachers integrate STEM in other learning methods.

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