The effects of Hayati Eksplorasi Berfikir Aras Tinggi (HEBAT)

Los efectos del módulo de Hayati Eksplorasi Berfikir Aras Tinggi (HEBAT)

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ABSTRACT

The primary purpose of the study was to determine the effects of the HEBAT module (Change in Matter) in improving the understanding of matter concepts and higher-order thinking skills (HOTS). A sample consisted of 90 of form one students from several schools in Melaka, Malaysia. This study used the mixed-mode method and sequential explanatory design to obtain the required data. The pre-test and post-test (understanding the concept of matter test and HOTS achievement test) derived for quantitative data. While qualitative data derived from the interview protocol. For the analysis of the understanding of the matter concept, the paired T-test analysis found that there was a significant difference between the pre-test and the post-test score. While for HOTS achievement test, paired T-test showed that there was no significant difference between pre-test and post-test score. The results of the qualitative data found that the HEBAT module helped improve the concept of matter but did not improve students' HOTS. Based on the findings, suggestions will be made to improvise the current HEBAT Module.

Keywords: Science education, Higher order thinking skills, Understanding of matter concepts, HEBAT module.

RESUMEN

El propósito principal del estudio fue determinar los efectos del módulo HEBAT (Cambio en la materia) para mejorar la comprensión de los conceptos de la materia y las habilidades de pensamiento de orden superior (HOTS). Se utilizó una muestra de 90 estudiantes de varias escuelas en Melaka, Malasia. Este estudio utilizó el método de modo mixto y el diseño explicativo secuencial para obtener los datos requeridos. La prueba previa y la prueba posterior (comprensión del concepto de prueba de materia y prueba de logro HOTS) derivadas de datos cuantitativos. Mientras que los datos cualitativos derivados del protocolo de entrevista. Para el análisis de la comprensión del concepto de materia, el análisis de prueba T emparejado encontró que había una diferencia significativa entre el puntaje previo y el posterior. Mientras que para la prueba de logro HOTS, la prueba T emparejada mostró que no había una diferencia significativa entre la puntuación previa y posterior a la prueba. Los resultados de los datos cualitativos encontraron que el módulo HEBAT ayudó a mejorar el concepto de materia pero no mejoró el HOTS de los estudiantes. En base a los hallazgos, se harán sugerencias para improvisar el Módulo HEBAT actual.

Palabras clave: educación científica, habilidades de pensamiento de orden superior, comprensión de conceptos de materia, módulo HEBAT.

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1. INTRODUCTION

The 21st-century education system is a transformation made in renewing existing educational standards around the world. Now education in Malaysia also moves towards 21st-century learning as outlined in the 2013-2025 Education Blueprint Malaysia. One of the 21st-century learning centres is through the application of Higher Order Thinking Skills (HOTS) elements. The Ministry of Education Malaysia introduced the implementation of HOTS in science subjects because of the bottom results of students' achievement in international assessments namely *Trends in International Mathematics and Science Study* (TIMSS) 2011 and *Programme for International Student Assessment* (PISA) 2009. Before starting the HOTS science program, a pilot test conducted to all school in October 2013. This pilot test used the TIMSS and PISA clone valuation instruments to assess the students' HOTS level for form one and form two students. Later, all schools have been ordered to start fully practicing HOTS in teaching and learning of science in 2014, starting with form one students. Introduction of some HOTS activities in teaching and learning of science subjects are by the use of 8 types of thinking map (iThink), project-based learning, discovery-based learning, inquiry-based learning, socio-scientific issue and problem-based learning.

Students' understanding of the concept of matter is usually logical but inconsistent with the right scientific concept (Denis et al., 2005). The problem of understanding the concept of matter becomes critical when the students are unable to answer the latest assessment questions regarding the concept of the matter when the application of HOTS questions introduced. The higher-order thinking skills (HOTS) refer to the thinking process of using high intellectual skills and the ability to master more than just read, write and count.

Learning about science subjects helps students to enhance the ability to use HOTS compared to most other subjects in school. It is because science subjects are not just about the facts, but science also represents the proposal process to improve the explanation of our world. Scientific knowledge is the result of the activities of scientists from ancient times to the present which comprise science process skills and manipulative skills (Nordin & Muhamad, 2010). Besides, the process of science skills emphasizes the findings of inquiries, problem-solving and scientific skills. Its enables the student's interest to stimulate, especially when conducting science experiments. This science process skill allows students to question something and find a precise answer.

In order to achieve the Ministry of Education's intention to improve the student's understanding of concept matter and HOTS in science, every school have introduced with the *Hayati, Explorasi, Berfikir, Aras, Tinggi* (HEBAT) modules in science subjects. HEBAT module contains 30 selected topics for science subjects. The topics contained in this HEBAT module are based on the curriculum syllabus of science subject from form one to form 3. One of the topics in the module is the change in the matter for form one. HEBAT module has just been implemented in all schools throughout Malaysia beginning in 2017. So, the effect of its use in improving understanding the concept of matter and HOTS for science learning still needs to be studied.

The preliminary study had been conducted on six science teachers in January 2018 about the use of HEBAT modules in science subjects. From the study reported that in secondary schools, teachers are less likely to used HEBAT module in the teaching and learning of science. Science teachers are more comfortable using their pedagogical approach, which also implements the HOTS elements in the teaching and learning process in the classroom. They love to use their ideas in planning daily lessons because they can adapt to the teaching aids supplied by the school and more appropriate to the environmental factors of the school.

From the preliminary survey also found that teaching and learning for the topic (the change of the matter concept) to the form one students in secondary school are usually through the use of textbooks, science practices, and reinforcement training. Teacher presentation techniques in explaining remarkable contents in textbooks are usually traditionally teacher-centred such as through oral descriptions without teaching aids or by using teaching aids such as using PowerPoint slides and fewer animations video.

One of the problem that student face during learning this topic are hard to understand about substances (except water) expand when heated and contract when cooled. This phenomenon is about the change in intermolecular distances but not with the change in volume or size of atoms and molecules. However, Griffiths and Preston (1992) found that 40% of students hold onto the conception that water molecules in solid-state (ice) are the largest. Some others believed that water molecules in the solid phase or the gaseous phase are the smallest. Many students who participated in Lee et al. (1993) study confused about observable properties of matter with properties of particles and attributed macroscopic changes to the changes in the particles themselves.

Higher-order thinking skills associated
with applying, analyzing, evaluating and creating
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Students are having problems to solve HOTS questions associated with analyzing, evaluating and creating. This statement support by the inferior science performance of Malaysian students in international student's tests, TIMSS and PISA (Ngah et al., 2017). It is due to analysis, evaluation and creation activities rarely trained to the students. According to Retnawati et al. (2018), the majority of students still did not know the whole concept of HOTS because their daily routine in class just sits, listen and note. Students also love to memorize facts and retelling something that heard which included in low-level thinking skill. That will make them have difficult to answer HOTS questions that need the process of deep thinking (Thomas & Thornes, 2009).

1.1 Research objectives

The objectives of this study are to:

1) Study the effect of using the HEBAT module in enhancing the understanding of the concept of matter (change of matter topic) among form one students in Malaysia.
2) Study the effect of using the HEBAT module in improving higher-order thinking skills (change of matter topic) among form one students in Malaysia.
3) Study the strengths and weaknesses of HEBAT modules in enhancing the understanding of matter concepts and higher-order thinking skills science (change of matter topic) among form one students in Malaysia.

1.2 Literature review

1.2.1 Status of students' understanding of matter concepts

According to Fisher and Lipson (1986), the concept of science that students formally bring to the classroom often misunderstood and inaccurate with the actual concepts mastered by scientists. One of the most critical concepts in science subjects is about the matter. According to the definition of science, the matter is something that has mass and occupies space. In secondary school, the matter hardly understood as something made up of very discrete particles. Students also do not understand the order, movement, and energy of particles in explaining phenomena involving matter state. They lack the basis for the concept of matter, which is the lack of understanding about matter that can categorize into solid, liquid and gas (Arshad & Soh, 1999). Griffiths and Preston (1992) asked 12th-grade students to sketch what they would see if they could look at a molecule of water under a microscope. Some of these students thought that a water molecule is spherical with particles spread throughout. While, some others believed that water molecules have different shapes depending on what phase they are in. The findings of another study revealed that 80% of students attributed a macroscopically observed color of various substances to their single particles (Albanese & Vincentini, 1997). Students also have a poor understanding of the state of matter which is when the matter is in hot and cold conditions. They though the particles contained in the matter to be heated and cooled, too (Chabalengula & Banda, 2014). Besides, most students also have problems describing the basic concepts of matter and particles. It is because the students involve in many elements that are abstract and invisible to their naked eye. It supported by a study conducted by Koba and Taylor (2011), the concept of matter being an abstract topic for primary school students and thus making students unable to imagine the concept through the senses, and having difficulty understanding the terms contained in the topic.

1.2.2 Status of students' higher order thinking skills

Implementation of the Higher Order Thinking Skills (HOTS) program in science subjects started when students were unable to answer HOTS questions. It resulted in the deterioration of student achievement in TIMSS 2011 and PISA 2009 for the science subject. Before the introduction of the HOTS program, a pilot test was conducted in October 2013 on form one and form two students in all schools using the TIMSS and PISA clone assessment. This instrument used to assess students' level of competency. The results of this pilot test show that students are still unable to master in HOTS (PPPM annual report, 2016). Next step, all schools have been ordered by the government to start fully implement the HOTS program in 2014, starting with form one students for science subject. The students have introduced with HOTS activities through the use of 8 types of mind maps (iThink), project-based learning, discovery-based learning, socio-scientific, and problem-based learning.

1.2.3 HEBAT module

HEBAT Module is available in the form of downloadable documents online via the link (bit.ly/HEBATSCbm) for Malay language and (bit.ly/HEBATSCbi) for English provided by the Secondary Science Unit, Science and Mathematical Sector, Development Division of Ministry of Education (MOE) as a guide in carrying out curriculum for the teaching and learning of science subjects. Teaching and learning resource materials contained in the HEBAT module referred from the British Council's Sheffield Hallam University source. This module has been developed using Model 5E (Engage, Explore, Explain, Elaborate, Evaluate) based on constructivism theory. This module contains 30 topics which covered science topic according to the science syllabus from form one till form three.

1.2.4 Use of modules in teaching and learning

A functional and complete module must meet some specific features. According to Hughes et al. (2002), a good module should have the following features:

a) Individualize - Modules can be used personally or provide uniform instructions to individual groups individually depending on how the module used. The module provides learning based on the ability level and time to suit the needs of the students. The module requires external control according to the criteria or performance level.
b) Freedom - The module can give students the freedom to learn according to their wants. Students take responsibility for learning. More emphasis on student learning over the teaching of teachers as content and self-teaching.
c) Active participation - A module should provide an atmosphere where students are actively involved in passive reading or listening to teacher information only. The self-taught modules format allows students to control the alignment of whether to continue the lesson, repeat, do the exercises, and so on.
d) Immediate reinforce responses - A good module can provide immediate feedback on each student's achieve-

ment, and these benefits will stimulate motivation to continue learning.

e) Utilization of a variety of media – A good module should be used in conjunction with other media, whether printed, audio and visual material, original material including human interaction. The use of these various media will make learning more interesting, fun and useful.

f) Student interaction - A module can be designed by providing learning activities that encourage interaction among students such as teamwork activities, discussion, game simulations, and seminars. Through this interaction, students can help each other to master certain materials and skills.

g) Teachers' role - Teachers can act as facilitators that promote learning as well as helping students to solve problems faced by them. Additionally, the role of the teacher will be more independent of repeat teaching activities using the same material. With a good module, teachers can focus on more essential teaching activities such as inspiring, preserving interest, determining the orientation and personal relationships.

1.2.5 The previous studies on the effect of using teaching and learning modules on understanding the concept of matter

The Tatar (2011) study through the development of the teaching and learning module, help to reduce the existence of an alternative student framework in the 'Basic matter concept'. He indicates that some respondents have an alternative framework in density concept. Density often regarded as a higher position concept (Kohn, 1993). Through this module can also overcome one of the most common alternative frameworks in the classroom that involves the amount of water and the soaked material. Students will state that if we put something substance into a more significant amount of water such as a pool, the material will float. It is in line with the study conducted by Duckworth (2001) on the concept of buoyancy and drowning, the idea that large amounts of water will affect the object. It is due to the existence of a student's alternative framework to the concept of density which is the fundamental nature of matter that students should associate with the concept of buoyancy and drowning. According to Kohn (1993), most students consider that the weight of an object affects the density of the object. Students assume that heavy and large objects have a high density, while lightweight and small objects have low density. So, Tatar (2011) study concluded that the existence of this alternative framework is because students do not take note of the weight per size of the object.

Bunce et al. (1991) have used learning strategies to facilitate students to understand the concept of matter through the construction of modules. This module using points or circles to represent atoms, ions and molecules as particles at the submicroscopic level. Other researchers also found that modules using submicroscopic animation strategies to represent the concept of matter could contribute to a better understanding of the nature of material matter (Stains et al., 2011). This opinion is also supported by Rodrigues (2004), which considers the creation of a mental model of the concept of science at the submicroscopic stage can pose a big problem to the students. Instead, submicroscopic animation is more appropriate to encourage understanding of the concept of change in matter. The use of information technology modules also benefits pupils to understand the content of science learning better because technology approaches are more appealing to students and teachers. Information technology is a motivational tool and enables higher quality science teaching (Sarabando et al., 2016).

1.2.6 The previous studies on the effects of teaching and learning modules in improving higher-order thinking skills

The previous studies by Abu (2016) developed a learning module to improve the achievement of the HOTS among students. This mathematical learning module on the topic of Money and Time for standard one of primary school using the Autonomic Assessment Module (M-PA) developed by using Russell model, Sharifah Alwiah model and Sidek Model involving 20 lesson plans. This study used a survey design involving a questionnaire and interview methods. A quasi-experimental design used to determine the effectiveness of teaching using the M-PA module. Teacher's opinions on that module are complete, structured and in line with the proposed authentic assessment process and can improve student HOTS achievement in Mathematics.

In a study conducted by Budiman (2008) using the Conflict Management Module (PKK) integrated with Cognitive Acceleration through Science Education (CASE). This study used the quasi-experimental approach to the 'unequal control group' of 130 students at a school in Negeri Sembilan to see the effects of the module on cognitive development, the achievement of the HOTS in science and cognitive conflict level stages. Three modes of instruction were carried out on the sample of the study namely PKK integrated with CASE (Module 1), CASE module without PKK (Module 2) and conventional teaching. The experimental group follows rooting either using Module 1 or Module 2, while control groups follow conventional teaching. His findings showed that both experimental groups showed a more significant improvement in cognitive development and science HOTS testing than the control group. At the same time, in comparison, the teaching using Module 1 was able to improve cognitive development and better HOTS test than Module 2. The conclusions of this study showed that the teaching using Module 1 helped to improve the cognitive level and the achievement of HOTS, especially students with the intermediate levels of operating concrete.

The study on the development of multimedia software modules for secondary students about the nature of the matter was conducted by Zuraidah (2006) as a teaching aid. In this study, researchers developed a module-based ASSURE-based software. The samples were 62 pupils (32 treatment groups and 30 control groups). The student's response to the use of the software is positive, and more than 72% agree that this software makes it easier for them to understand the concept. All interviewed teachers also showed a positive response and agreed that the developed software could be adopted in teaching and learning to improve students' HOTS.

The study conducted by Ali and Dalhar (2010) also involves computer-assisted teaching modules (CALs) for subject matter in science for the use of form four pupils. This software is developed based on cognitive theory and using the

ADDIE design model. Researchers use various interactive multimedia elements such as text, animation, audio graphics, and videos that have integrated into the software. The conclusions from this study show that students exposed to this module demonstrate the brighter achievement of HOTS.

In the subject of chemistry, there is a study conducted by Johari Surif (2010) regarding the effectiveness of learning using the Model of Scientific Thinking Development. This module helps in improving students 'achievement, understanding and the level of mastering of students' scientific skills towards teaching and learning of science to improve their scientific thinking. The module also aims to help overcome the problem of the existence of an alternative student framework in the basic concept of matter, the kinetic theory of matter and the principle of mass immortality. This study was conducted qualitatively by using descriptive and experimental designs. The experimental approach was carried out using the Scientific Thinking Mastery Test Set. This module involved two groups of experiments, namely the experimental group and the control group involving 80 of form four students. The conclusion from this study shows that the experiment group is more successful in the scientific thinking mastery test set than the control group.

The teaching modules about the heated topic have also developed by Ismail et al. (2005). His study involved the use of conceptual teaching concepts in the topic of heat to improve student achievement. Problem-based Learning Module (PBM) that integrates cognitive deflection (PK) is developed systematically based on McGinn's teaching design model (1994). His research finds that the use of PK in PBM provides significant improvement in metacognition to high cognitive students but not for low cognitive students. Besides, PK in PBM did not provide significant increases in scientific reasoning towards the two groups of students. They also noted that there had been an increase in students' achievement in heat topics through PK in PBM. He recommends using a systematic module that integrates cognitive deflection in the PBM approach. However, should care about the student's personality differences in terms of the student's ability.

In biology, there is a study to study the effectiveness of building the BIO-I-THINK module in cell division and nutrients topic developed by Karagaratnan and Kavitha (2015) on the achievement and HOTS towards form four students. A quantitative approach with a quasi-experimental research method was selected to answer eight research questions and six hypotheses. The three sets of instruments used in this study are BIO-I-THINK Module, achievement questions and higher-order thinking skills questions (CogAT questions) to measure the teaching titled 'Cell division' and 'Nutrition'. A total of 30 students randomly selected as respondents. The results of these 30 students showed that the use of BIO-I-THINK modules could improve student achievement in HOTS.

The previous studies on the use of modules in learning are the study conducted by Saripah et al. (2013) on the effectiveness of the organic chemistry multimedia modules. These modules help students to visualize organic mechanisms and stereochemistry of nucleophilic fibre converters. The sample of the study consisted of two groups, namely the experimental and control group (conventional method). Involved 74 students from Universiti Pendidikan Sultan Idris, who took the course of chemical identification II. The findings show positive implications in which respondents have a positive perception of the suitability of IMCM modules for use in teaching and learning to enhance students' understanding of organic chemistry subjects.

1.2.7 Theoretical framework of the study

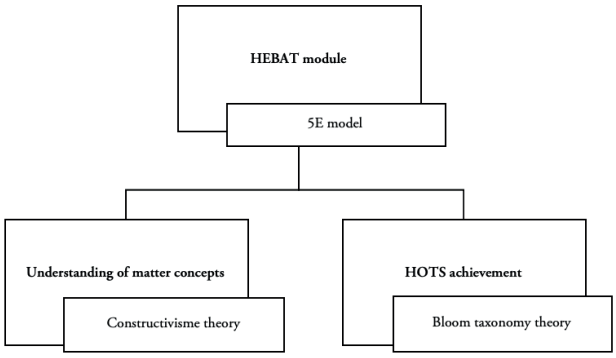

Figure 1. The theoretical framework of the study

Figure 1 shown the theoretical framework proposed in this study. First of all, the HEBAT science module in the change of matter topics for form one built by the Ministry of Education Malaysia based on the design of the 5E model. Furthermore, in assessing the improvement of understanding of the concept of matter, the conceptual understanding of the concept was constructed based on the theory of constructivism tested for the students. HOTS's achievement test was built by researchers based on Bloom's review of Bloom's taxonomy theory to evaluate the aspects of higher-order thinking skills,

2. METHODOLOGY

2.1 Research design

The study used mixed modes design through quantitative methods (understanding the concept of matter test and HOTS achievement test) and qualitative method (interview protocol). The explanatory design by Cresswell (2009) was used to analyze the findings of the study. This process involves the collection of both qualitative and quantitative data types one by one (consecutive) rather than simultaneously as shown in Figure 2.

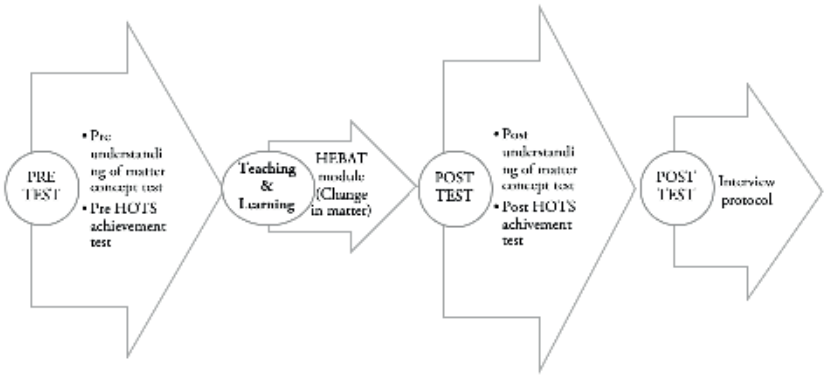

Figure 2. Sequential explanatory designs (Cresswell, 2009)

2.2 Sampling method

Group random sampling techniques used to select the students, where the sample of form one students involved in this study was around 90 students (quantitative studies) and three students (qualitative studies) in schools around Melaka.

1.3 **Research instrument**

2.3.1 Understanding the concept of matter test (UCM test)

Researchers developed this test from the adaptation of the concept of matter by Adadan (2006). This instrument contains seven subjective questions, with a total score of 100 marks. This test gives to students before and after the teaching and learning session of the HEBAT module. The reliability value of Cohen Kappa for the instrument is 0.89. The data obtained were then analyzed descriptively and inferred by using paired sample t-test. This t-test used to detect whether there is a significant difference in the students' achievement before and after using the HEBAT module in understanding the concept of matter.

2.3.2 HOTS achievement test

This instrument contains eight higher-order thinking skills questions with the total score of the test is 100 marks. This instrument gives to students before and after the teaching and learning session of the HEBAT module. The reliability value of Cohen Kappa for the instrument is 0.80. The data obtained were subsequently analyzed descriptively and inferred by using paired sample t-tests. The t-test used to detect whether there is a significant difference in the students' achievement of HOTS before and after using the HEBAT modules.

2.4 Quantitative data analysis techniques

Quantitative data were analyzed using SPSS version 24.0. Inference statistics used to test the study hypotheses paired sample t-tests.

2.5 Qualitative data analysis techniques (thematic analysis)

The qualitative data analysis was based on the approach by Bogdan and Biklen (1998) and using Nvivo 12.0 software to analyze the strengths and weaknesses of HEBAT modules from the interviews with students. The data analysis followed by Bogdan and Biklen (1998), as shown below.

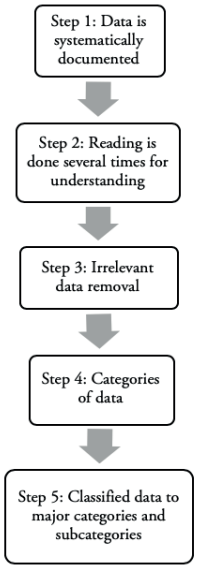

Figure 3. Data analysis (Bogdan & Biklen, 1998)

3. RESULTS AND DISCUSSION

3.1 The effect of using the HEBAT module in enhancing the understanding of the concept of matter among form one students in Malaysia

Table 1. The paired samples t-test between the pre-test and post-test (Understanding of matter concepts test)

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
UCM test	-11.333	9.309	.981	-13.283	-9.384	-11.550	89	.000

A paired-samples t-test was conducted to evaluate the effect of using the HEBAT modules in enhancing the understanding of the concept of matter on students' scores on Understanding of matter concepts test (UMC test). There was a statistically significant decrease in UMC test score from pre-test (M=37.76, SD=13.491) to post-test (M=49.09, SD=11.025), t (90) =-11.55, p<0.005). The eta square statistics (0.82) indicated a large effect size.

Based on the result obtained, it shows that the HEBAT module did affect the students' performance in understanding matter concepts. It is because of the learning strategies of the module using model activities. Bunce et al. (1991) show that the construction of the module using points and circles which presenting the ions and atoms helps the students to understand the concept matter more clearly. Other researchers also found that modules using submicroscopic animations strategies to represent the concept of matter could contribute to a better understanding of the nature of material matter (Stains et al., 2011). The only difference between the HEBAT module compare to the other researcher's techniques to increase the understanding of matter concepts was by using particle dance to represent the arrangement of solid, liquid and gas.

3.2 The effect of using the HEBAT module in improving higher-order thinking skills (for the topic of change of matter) among form one students in Malaysia

Table 2. The paired samples t-test between the pre-test and post-test (HOTS test)

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
HOTS test	-.133	.889	.094	-.320	.053	-1.422	89	.158

A paired-samples t-test was conducted to evaluate the effect of using the HEBAT modules in enhancing the HOTS on students' scores on the HOTS test. There was no statistically significant difference in HOTS test score from pre-test (M=25.27, SD=9.629) to post-test (M=25.40, SD=9.759), t (90) =-1.422, p>0.005). The eta square statistics (0.02) indicated a small effect size.

Based on the study, the result shows that the HEBAT module did not affect the students' HOTS performance. HEBAT module was designed to improve students' performance in terms of HOTS. However, the results show vice versa. It is because the pre-test and post-test that had been made by the researcher in this study were up to level 6 (creating) of taxonomy Bloom. While in the HEBAT modules questions tasks, the students had not been exposed to create a new thing. So, that means the HEBAT module was unable to guide students to improve their HOTS. According to Yee et al. (2014), HOTS was an intellectual process that should include the creating of information and generated through observation, experience, reflection, reasoning or communication. Robinson et al. (1999) also support by saying that higher-order thinking is a function of one's imagination of the ability to creatively design what has not yet become fact or knowledge.

3.3 The strengths and weaknesses of HEBAT modules in enhancing the understanding of matter concepts and higher-order thinking skills (subject matter change) among form one students in Malaysia

There were several strengthens of the HEBAT module. From the interview with the informants, one of the strengths was the HEBAT module able to improve students understanding of matter concept effectively. It is because the module has been developed by using Model 5E (Engage, Explore, Explain, Elaborate, Evaluate) based on the constructivism theory. This module involves the activities that access the students' prior knowledge. It helps them become engaged in a new concept through the use of short activities that promote curiosity and elicit prior knowledge. While in the engagement phase, the activity's plan in the module had shown the picture of some materials such as water, oil, balloons, and fruits to introduce students with the related topic. The pictures able to connect between past and present learning experiences, expose prior conceptions, and organize students' thinking toward the learning outcomes of current activities. Next, in

the HEBAT module, students had involved in the exploration phase. For example, during the density activities, students need to calculate the density of each material. This activity can help them use their prior knowledge to generate new ideas and explore questions. Then, the student had exposed to the explanation phase in the HEBAT module, which provides teachers to directly introduce a concept of ion, atom, and molecules to the students. So that students can explain their understanding of the concept. An explanation from the teacher may guide them toward a more in-depth understanding, which is a critical part of this phase. During this phase in HEBAT module, students have some outdoor class activities instead of the indoor class only. It showed that when using the 5E learning cycle model students can increase their learning levels, as well as a more positive attitude about learning new material (Hicks Pries & Hughes, 2012).

Although this module had some strengthen, however, this module also had some weaknesses. From the interviews that had done, the informant said the instruction of the questions inside the question sheets of HEBAT module were not clear. It resulting the students had faced problems and difficulties in answering the questions. This is due to undefined specific instruction. When the instructions become too general without the specific needs, it leads the students to answer in different perspectives or methodologies against the module requirement. It is supported by Meyer (1988), where a good module needs to have clear instructions (Meyer, 1988). Besides that, students are also having problems in doing modelling activities. It is because of the lack of provision in teaching and learning time. It is due to the HEBAT module only contain ten periods for the concept matter. According to Husin (1988), a student cannot learn if they are giving with too much material at a time. The other weaknesses of this module were inadequate teaching and learning activities between teachers and students in order to make students clearly understand the topic, for example, by using slideshows as a medium of teaching and learning. Teachers cannot attract the student's attention because of the slideshows are less interesting and lack of visualization. It is supported by previous research done by Thomas and Thorne (2009) which stated that visualization is a very useful instrument for developing HOTS among students such as visual images as the picture in mind that is more meaningful than words.

According to previous research done by Hughes et al. (2002), a good module should have an exciting variety of media like audio and visual material in supporting students' understanding. Besides, the elaboration phase in 5E that been used in the HEBAT module is not able to extend students' conceptual understanding and skills because the elaboration given by the teachers is only described in wording without visualization. For example, the teachers' elaboration about particle arrangement and submicroscopic particles such as properties of crystalline solids are not interesting enough to the students. Due to less visualization, creative activities and interactions, the student cannot apply their higher-order thinking skills in understanding the matter concepts. It supported by Hughes et al. (2002) which said that a useful module should have student's interaction to encourage participation among students such as game simulation, discussion and teamwork activities. Students should use previous information to ask questions, propose solutions and make a decision. Lastly, HEBAT module had an evaluation phase but did not encourages students to assess their understand and abilities in matter concepts by using higher-order thinking skill. It is because, during the evaluation phase, teachers do not have opportunities to evaluate student progress toward achieving the educational objectives. Students also are not encouraged to conduct future investigations. That is the reason why the HEBAT module does not effectively improve the students' higher-order thinking skills. The informant also said that they had less freedom to learn something because everything they did was under control by the teacher. A useful module can give students the freedom to learn according to their desire, which is more emphasis on self-directed student learning over their teacher teaching. of visualization, creative activities and interactions, the student cannot apply their higher-order thinking skills in understanding the matter concepts. It supported by Hughes et al. (2002) which said that a useful module should have student's interaction to encourage participation among students such as game simulation, discussion and teamwork activities. Students should use previous information to ask questions, propose solutions and make a decision. Lastly, HEBAT module had an evaluation phase but did not encourages students to assess their understand and abilities in matter concepts by using higher-order thinking skill. It is because, during the evaluation phase, teachers do not have opportunities to evaluate student progress toward achieving the educational objectives. Students also are not encouraged to conduct future investigations. That is the reason why the HEBAT module does not effectively improve the students' higher-order thinking skills. The informant also said that they had less freedom to learn something because everything they did was under control by the teacher. A useful module can give students the freedom to learn according to their desire, which is more emphasis on self-directed student learning over their teacher teaching.

4. CONCLUSION

Based on the findings of the study, the HEBAT modules (change of matter topic) are only sufficient to improve understanding of the concept of matter but cannot improve the students' HOTS. Through this study, it hoped that it would guide the Ministry of Education to formulate an educational policy of 21st-century teaching and learning strategy through the provision of appropriate teaching aids to students. This study is also expected to identify and create an alternative framework for strengthening the HEBAT module in the change of matter topic. The proposal for this module's HEBAT improvement proposal is expected to stimulate a first-rate pupil to study science, further enhancing the HOTS.

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