International Journal of Multicultural and Multireligious Understanding

http://ijmmu.com
editor@ijmmu.com
ISSN 2364-5369
Volume 2, Issue 5
October, 2015
Pages: 18-24

The Level of Mastering Forces in Equilibrium Topics by Thinking Skills

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Abstract

The aim of this research is to determine the level of mastering Forces in Equilibrium topics according to thinking skill for Form Four Physics students. 189 Form Four Physics students from secondary school at Kuala Kangsar district in Perak involved in this research. All students are 16 years old. Questionnaire method has been conducted in order to perform this research. Descriptive statistics namely mean and standard deviation has been used in this research. The findings showed the level of mastering Forces in Equilibrium topics according to thinking skills was unsatisfactory.

Keywords: Mastery level, Forces in Equilibrium, Higher Order Thinking Skill (HOTS), Lower Order Thinking Skill (LOTS), Physics.

Introduction

The progress of a country lies on the knowledge and skills of citizens. Thus, development in teaching and learning (P&P) system are important in producing skilled and proactive society in facing competition in global level (Awang & Mohamed, 2011). Therefore, Malaysia has experienced transformation in education field. Malaysian Education Development Blueprint 2013-2025 had given emphasis to high level thinking skills concept to produce students that are able to compete toward 21st century.

Higher Order Thinking Skills (HOTS) is ability to apply knowledge, skills and values in making reasoning and reflection to solve problem, decision, innovation and ability to create something (Malaysia Examination Syndicate, 2013). In order to provide opportunity to students in practicing HOTS, students should be in an active learning environment to increase curiosity and understanding in every subject learnt (Madhuri *et al*., 2012; Peter *et al*., 2011; Pawani, 2002). Active learning is a teaching method which is also called 'learning by doing'.

Teachers must complete syllabuses according to examination calendar set by the upper management. This is because Malaysian education system is more to examination oriented. This system seems students will only be given exercises and memorize important facts which finally will be forgotten (Razalia Ismail, 2002). Student who only memorize can only manage to store the information within short period (Aminah Ayob, 2008). Thus, high level skill application should be trained since students in primary level as it can be a determinant of success in any policy during secondary level (Molly, 1996). Traditional teaching method that often practise by teachers should get change on how they deliver the knowledge because this

method will limit the thinking way of student from being creative and innovative (Akinbobola, 2008; Madu, 2004).

Problems Statement

Malaysian students achievement in Trends in International Mathematics and Science Study (TIMSS) Exams and Programme for International Student Assessment (PISA) were unsatisfactory. This is because HOTS questions have been implemented in both examinations which required student to apply what they have learned.

Deputy Education Director-General (Policy and Education Development), Datuk Dr Amin Senin realized the weakness and suggested in PPPM which HOTS must be emphasized. Currently, HOTS implementation focus in Science, Mathematics and History that involve T&L process, exam question, provision of teaching support equipments and cocurriculum activity such as quiz and competition are government initiatives so students no longer memorize, on the other hand they know how to apply what has been learned.

Physics often have been assumed as hard and uninteresting subject which affect the mastery and students achievement (Agwagah, 2005). Unable to understand the concept, lack of creative and critical thinking, unsufficient exposure of concept during exercises, lack of modern learning facilities and boring teaching method are the factors that influenced the mastery level of student in Physics (Ifeanacho, 2012; Agommuoh, 2010; Ogbonna 2007; Agwagah, 2005; Esiobu, 2005; Iji & Peters Harbour, 2005; Agommuoh, 2004; Kurumeh, 2004; Khatim Hasan, 2001; Peters Harbor, 2000). Besides, education system which is examination oriented give many effects and cause Physics unable to be seen and hard to be applied in student's daily life.

Forces and Motion topic in Form 4 Physics syllabus quite difficult to learn as this topic contain many subtopics (Pusat Perkembangan Kurikulum, 2005; Lilia *et al*., 2002). Noor Izyan (2006) founds that Forces in Equilibrium topic was the hardest topic to be mastered. Students have limited time to master this topic as each topic teaching session in school is according to the academic calender which indirectly hard for the student to fully understand the topic content in such short time especially for those who has poor achievement.

Literature Review

Thinking is an activity where mind used to decide and solve problems based on information and experiences in our daily life. Thinking is an abstract activity which usually happens during half conscious condition in order to solve problem.

Thinking skill is ability to process mental operation includes knowledge, perception and creation (Mayer, 1983; De Bono, 1976). Suriyana (2004) states that thinking skill is an ability in using mind to find meaning and comprehension on something, exploration of ideas, making decision, problem solving with best consideration and revision on the previous thinking process. Thinking skills is a knowledge discipline that can be learned and practised until form norm or experience (Sharifah Maimunah, 2004). Thinking skill can be divided into two categories; LOTS and HOTS.

LOTS can be defined as limited usage of potential mind that focus on common application. When student solve problem by using algorithm and normal situation there were LOTS happened (Thompon, 2008; Senk, Beckman & Thompson, 1997; Resnick, 1987). Schmal (1973) states LOTS as recollected

fact, carrying out easy operation, or solve problems routinely. Student do not has to solve problem unconventionally. There are two level of cognitive domain in LOTS;

a) Remembering : memorizing and recollecting information
b) Understanding : explaining idea or concept

HOTS is the highest level in cognitive process hierrachi. HOTS do not use algorithm and can consists many problem solving. HOTS focus more on unusual questions. Thus, according to Onosko & Newmann (1994), HOTS can be defined as the use of potential mind to handle new challenge. This situation can make a person to be more creative in facing vague problem. On the other hand, Ministry of Education Malaysia define HOTS as ability to apply knowledge, skill and value in making reasoning and problem solving reflection, making decision, innovation and invention ability. There are four level of cognitive domain in HOTS and shown in Figure 1;

a) Applying : application of information in new situation
b) Analyzing : analyzing data into components to comprehending the organisational structure and relationship between components
c) Evaluating : making judgement based on specific criteria
d) Creating : uniting elements to form idea or new structure

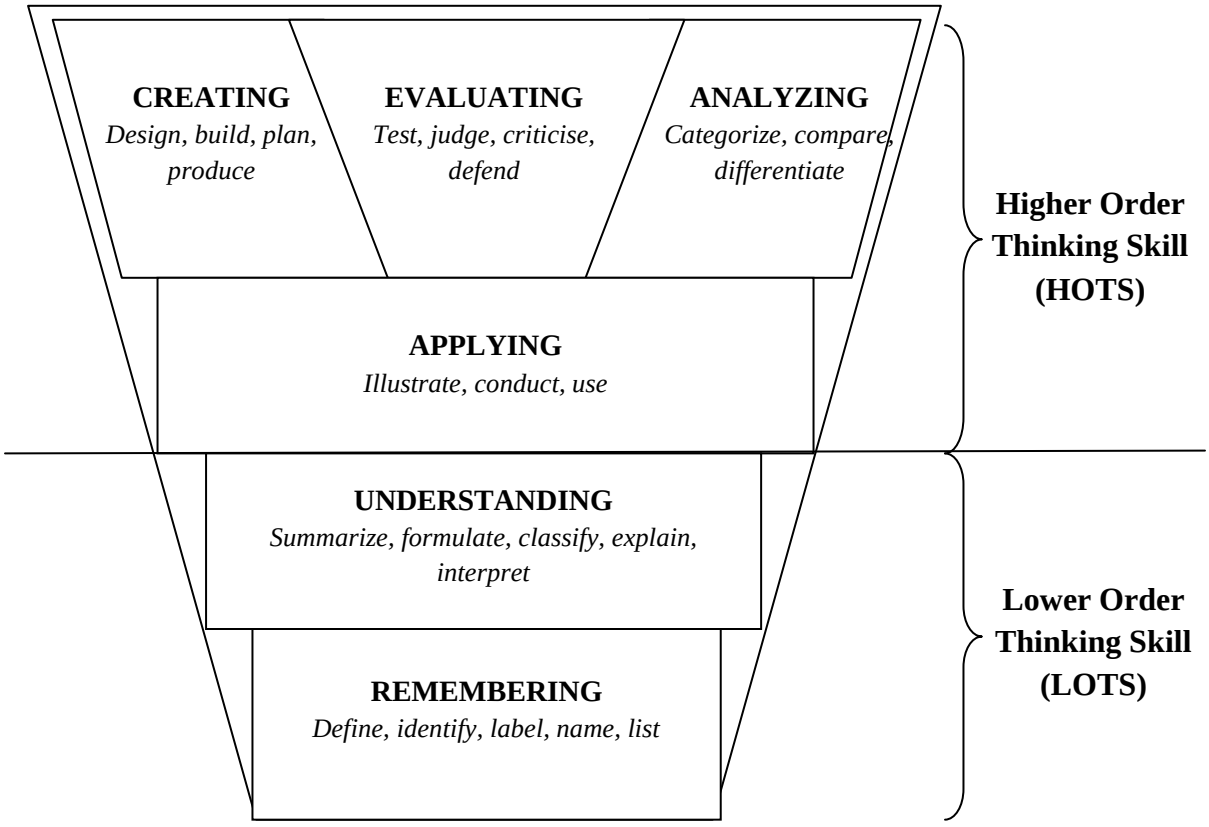

Fig 1. Revised Bloom's Taxonomy (Lembaga Peperiksaan Malaysia, 2013; Anderson & Karathwohl, 2001)

Objectives and Methodology

The objectives for this research are:
a) To determine the level of mastering Forces in Equilibrium topics.
b) To determine the level of mastering Forces in Equilibrium topics according to LOTS
c) To determine the level of mastering Forces in Equilibrium topics according to HOTS

A research sample of 189 form four Physics students from secondary school in Kuala Kangsar district was chosen. This group was selected because they have the same prior knowledge. Researcher built questions based on SPM Physics reference book and with the helped from form four Physics teacher. Questions consist of thirteen questions related to Forces in Equilibrium topic. Collected questions then were analysed according to correct and wrong answer. Besides, questions were grouped into two thinking skill level; HOTS and LOTS.

Results and Discussion

Table 1 shows mean, mode and standard deviation of student achievement for Forces in Equilibrium topic. A total of 189 students involved in this study. Mean, mode and standard deviation of student achievement were 10.74 marks, 4.00 marks and 6.52 marks respectively. Based on the result obtained, the mastery level of student in Forces in Equilibrium topic was unsatisfactory. Thus, it proved students still unable to master the concept of Forces in Equilibrium topic.

Table 1 Achievement score descriptive statistics

Achievement score	Marks
Mean	10.74
Mode	4.00
Standard deviation	6.52

Researcher analysed the accuracy of answers in each level of Bloom's Taxonomy in Forces in Equilibrium topic as shown in Table 2.

Table 2 Answer accuracy for each Bloom's Taxonomy level analysis

	LOTS				HOTS							
	Remembering		Understanding		Applying		Analyzing		Evaluating		Creating	
	True	False	True	False	True	False	True	False	True	False	True	False
Number of students	73	116	38	151	20	169	6	183	10	179	59	130
Total	189		189		189		189		189		189	

For LOTS questions, 73 students abled to give correct answers for remembering domain while only 38 students managed to answer understanding domain questions. This situation showed student merely memorized the definitions and only identified the force type but they could not reassert the meaning of the questions by using their own words. For HOTS questions, the number of students who could answer this kind of questions precisely was getting lower. This findings coherent to the research done by Sukiman *et al.* (2012), Seman (2005), Rosnani Hashim & Suhailah Hamzah (2003), Waheedawati (2003), Muhundhan (2002), Roselan (2001) dan Yildirim (1994). Research carried out by Supramani (2006), Seman (2005) dan Yildirim (1994) showed students always been given LOTS questions insteads of HOTS questions. This is because in the exams it is important to test the ability of students to remember the facts. Thus, this cause teachers choose to give lot of facts and on the hand they feel students have to memorize and know the concept of certain subjects first before they think how to solve problems (Sukiman *et al.*, 2012; Supramani, 2006; Rosnani Hashim & Suhailah Hamzah, 2003).

Conclusion

In conclusion, students need to be exposed to HOTS questions in order to widen their thinking skill. Besides, students can provide answers with various points of views. Furthermore, long period of learning impact require deeper understanding and concept consolidation especially when student face more abstract concept. Therefore, teachers need to encourage students to always think when confronted with problem solving. So, indirectly students will be able to form creative thinking, innovation and invention.

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