

The Effectiveness Of Using Comic To Increase Pupils' Achievements And Higher Order Thinking Skills In Science

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Abstract: *This research focuses on the effectiveness of using comic as a learning tool in the process of teaching and learning of science in the primary school. The focus is to enhance the pupils' achievement, thus increasing their higher order thinking skills and making it easy for them to remember the Science facts and concepts. In Malaysia, the interest in Science among students is declining continuously, due to the perception that Science is difficult. Year 5 pupils from a primary school were selected as respondents for this study. This study is quasi-experimental type with a control and an experimental group. Pre and post test were conducted for both groups. The results show there was a significant increase in the achievement of the pupils in the topic of Energy, thus increasing the ability to remember the facts and also their higher order thinking skills. The main implication of this study is that comic is an effective teaching tool to enhance the teaching and learning process, thus making it interesting to learn Science. The pupils are able to sharpen their thinking skills, as they are will become active learners and the teachers are able to achieve the learning objectives effectively and easily.*

Key Words: *comic, achievements, higher order thinking skills, teaching and learning tool*

INTRODUCTION

According to the Minister of Higher Education, the declining interest in science is a major cause of why Malaysians are far from producing a scientific and progressive society, as suggested in the sixth challenge of Vision 2020 (Utusan Malaysia, 2012). To ensure that Malaysia has sufficient talents in the field of science and technology by 2020, setting a ratio of 60:40, i.e. 60% in Science field and 40% in the Arts field, is essential to be introduced right from schools.. Various efforts have been taken to ensure that this ratio is achieved. However, statistics published by the Ministry of Education shows that the percentage of high school students who participated in the Science field from 1981 to 2010 has not yet reached 60%. The highest percentage recorded was in 2005, accounting for 31.22%.

Although various measures have been taken in our country to achieve the ratio, but studies show we are far behind to achieve it . Ayob (2012) stated that the factors that contributed to the deterioration of student's participation in science is in terms of interests, attitudes, perceptions and concerns of students towards science subjects. Many students assume that the science curriculum is very difficult to learn.

Research by Rahman (2003) and Rahayu (2008) have proposed a number of measures that can improve pupils' ability to understand and master the concepts of science. Among these measures is to build pupils' ability to manipulate and control scientific concepts, manipulate the level of cognitive thinking, teaching strategies and the use of science process skills.

Sabu (2004) showed that a teacher-centered classroom is the main contributor to low academic achievements among pupils. Morrison, Bryan and Chilcoat (2002) stated that by including elements of pupils' interest in the teaching and learning, they will be attracted to the lesson. This study focuses on the use of comics in the classroom to encourage pupils to develop their knowledge effectively and also to gain their interest. Pupils will not feel discouraged when learning science. Comic is an ideal teaching tool used to increase the interest and motivation of pupils as they will be actively involved in their learning process. (Rasid & Norhayati, 2005). The use of comic alters the learning environment in the classroom and it becomes more fun and active. When the attitude of pupils to learn becomes positive, their achievements will also improve. Comics can be used to overcome the difficulties of the pupils to remember the facts of science because it simplifies the difficult facts and concepts .When they overcome the ability to remember the Science facts, pupils can also answer questions that require higher order thinking skills. Higher order thinking skills has become a basic requirement for the pupils to meet the challenges of the 21st century.

In Malaysia, there are very few studies involving the use of comics in teaching and learning, especially in primary schools. The study conducted by Nizam & Ong, (2009), focuses on the achievement of high school students in the subject of Biology. Their study showed that the pupils' achievements increased due to the use of comics in the lesson. However, their study did not examine the effects of the use of comics to enhance the higher order thinking skills among the pupils.

Based on the problem statement that has been discussed, the pupils become less interested in science when they have difficulty in remembering the facts in science, which in turn affects their performance in this subject. This study aims to find a solution to the problem by inserting comic in the process of teaching and learning. Given the importance of higher order thinking skills, the study aims to determine the suitability of comics to enhance these skills among primary school children. The research questions of this study are as follows:

- Determine whether comic can improve pupils' achievement in science subject compared with conventional methods.
- Determine whether comic can improve pupils' ability to remember facts of science compared with conventional methods
- Determine whether comic can increase the level of higher order thinking skills compared with conventional methods

This study is important in primary school because of the interest to learn science should be cultivated from young. The target group in this study is Year 5 pupils, who are 11 years old. Two classes were selected for these studies, where one class is a control group and the other is an experimental group. The key factors that were focused in this study are the pupils' achievement in science, the ability to remember facts of science and the ability to enhance higher order thinking skills.

LITERATURE REVIEW

A. Comic as a teaching aid

Comics are popular in all walks of life, no matter young or old, However, it's very popular among children. This fact has been proven by Whittle, 1997, showing small children and young people spend most of their time with the media, especially on television cartoons. Science is a subject of interest in the primary because it is fun, useful and exciting. But studies show the interest in science among students decreased from age 11 years onwards. (Osborne, Driver & Simon, 1998). A study by Lowery (1967) showed that the science in the minds of students aged 11 years is associated with difficult vocabulary. Many recommendations were proposed in the teaching and learning of science that enable teachers to make it interesting and effective, especially in primary schools.

Comical reading materials are lightweight and suitable for children, especially primary school pupils in general. (Frey & Fisher, 2008). The use of comics as a teaching and learning tool is popular in Western countries, especially in the developed countries. Thorndike said:

"Children who love to read comic can master the vocabulary two times greater than children who do not like reading comics"

Statement of Thorndike shows that the use of comics as a teaching tool is effective in improving pupils' vocabulary.

The comic is suitable to be used as an effective teaching tool in the classroom. However, the use of comics by teachers in Malaysia is still lacking, as noted in the study by Abdul Rasid et al, 2012.

B. Comic for enhancing the achievements and ability to remember Science facts

In Malaysia, a study was conducted by Ong & Nizam (2009) to see the effectiveness of the comic module in the teaching and learning of Biology among Form 4 pupils. Their study showed that the pupil's interest increased when the comic module was used. This increase is caused by the humour elements that were injected into the teaching and learning process, which made learning fun.

Comic uses simplified text where a person uses the graphics to easily understand the content. This is according to Jacobs (2007) in his book entitled 'More Than Words: Comics as a Means of Teaching Literacies'. He supports the argument by Wertham (1954) that visuals is more easily understood and interpreted compared with writings. Psychologist Albert Mehrabian has proven in his study that 93% of communication is non-verbal. This is because the human brain interprets the visual elements at the same time, compared with an interpreted language text in a linear and sequential. Visual stimuli are processed 60,000 times faster than text. The visual communication can overcome the language barrier and allows pupils to think without words.

A study done at the University of Oklahoma in 2003 has shown that the graphic novel improves memory among pupils compared to traditional methods, which use only text book. This study also demonstrates that if pupils have little motivation to learn with textbooks, then their ability to remember an important fact will be low too.

Keskin, 2015 in his book 'The Evolution and Importance of Visual Communication' mentioned some of the strengths of comics in education. Comics can increase the understanding, easy to remember, attract attention, influence the ability to make decisions and have an emotional impact. According to Yang (2003), the power of comics in education includes motivation, visual enhancement, gives a permanent impact and is also popular. The comic can be used as a teaching aid in the teaching and learning process that can increase pupils' achievement in science. Performance will be improved if the pupils' interest is increased. This is because the pupils' motivation to learn increases. Studies by Rasid & Norhayati (2005) showed that comics could increase the interest and motivation of students so that they are actively involved in their learning. The use of comic alter the learning environment in the classroom becomes more fun and be more active.

Weitkamp and Burnet (2007) found that the use of comics can increase the interest and involvement of primary school pupils in studying science in the United Kingdom. Rule and Auge (2005) found that the use of funny cartoons about the concept of minerals and rocks have positive effects on attention, attitude, and also involvement in the use of higher order thinking skills among students in grade 6. In addition, there are studies that are conducted to show that comics encourage reading comprehension. Anuar, (2003), stated that comic is able to increase the rate of reading as his students understand comics quickly as they learning. This is because the language normally used in the comics is simple and easy to understand.

The use of comics can enhance interest in learning, reduce passive behaviour and promote active student involvement. Thus, class control becomes easier for the teacher. Comics can help understand the contents easily, not boring and helps to explain a concept easily.

C. Comics for increasing higher order thinking skills

The desire to create a scientific, progressive, innovative and collaborative society in Malaysia requires more people to be able to think critically. (Marlina, 2006) The concept of higher order thinking skills is the top agenda of education in Malaysia, based on Bloom's Taxonomy (1956). These skills are needed by pupils to face the future. Robinson (2000) has stated that the high level thinking skills are the skills needed to obtain employment, in addition to basic skills.

Comics can be used to bring awareness to pupils about certain issues, such as environmental or health issues. For example, studies by Kruger and Watson (2001) managed to boost South African teenagers to think about issues of science and health by using comics. Russell and Murry (1993) was also able to prove that comics have a positive impact in raising awareness in children of developing countries on environment and health issues. Pupils can think outside the box to solve problems in their environment.

Jennifer Haines has stated in her book that comics are capable of stimulating the ability of students to achieve a higher level of thinking based on Blooms Taxonomy that is the skills to analyze, evaluate and eventually create. When students learn to use the comic, they will use the skills to analyze because they must translate the visual signals, process them and explain the information implicitly in the comic. Pupils will be actively involved in the teaching and learning process.

A study showed that the graphic novels make learning relevant to students. (Alvermann Xu, 2003). Short et al. (2013) explains that when comics are used students are encouraged to engage in the storyline, assess the situation with regard to the contents. Cary, 2004 shows that comic help pupils to improve their ability to predict and infer the visual aids. Comics give room for students to think creatively and critically because the text is minimal. From the comic strip students can give various arguments accordingly.

Traditional teaching and learning methods, for example using textbooks and teacher-centered classroom is not effective to trigger higher order thinking skills. Flores et al. (2012) describes the method of teaching higher order thinking skills traditionally focused on memorising.

Mohd Ali Ibrahim (2003) also noted that the current emphasis on teaching and learning in Malaysia focuses on low level skills such as memorization, recalling and comprehension.

Therefore, these methods must be reformed and must be able to meet the needs of pupils to face the challenges of the 21st century. Comics have started to gain attention as a teaching tool that can nurture and enhance those skills. Duncan and Smith (2013) suggests the use of comics began

to rise in the academic field as it is able to address the need for different teaching literacy and it's appropriate in today's world, a culture that uses text and visual stimulation to convey information.

In conclusion, it can be said that comic is an effective teaching tool for both teachers and pupils. When comic is used appropriately, the learning outcomes can be achieved and it will be meaningful to the students. However, comic is minimally utilized in Malaysia, especially in the classroom. This may be because there is a stigma in the minds of the public that comics are just for entertainment only and will not give any benefits to the readers. Many studies have shown comics to increase interest in learning, especially in science, where there are a lot of abstract concepts.

RESEARCH METHODOLOGY

This study is based on a quasi-experimental design. In this study, pre-post test design groups are used. Pre-post test design is appropriate because it consists of two groups of respondents, one as a control group and another experimental group. The control group will not receive any intervention, while the experimental group will be exposed to the intervention in the study. In this study, the intervention was using comics in the teaching and learning process in the topic of Energy for two weeks. Meanwhile the control group used the conventional method, the textbook.

This study was conducted in a primary school in a rural area in the district of Semenyih in Selangor. This school was selected for this study because of its position, the number of pupils and composition of the pupils. These schools are located in rural areas and the pupils come from various socio-cultural backgrounds. Most of these students have medium socio-economy status. The pupils of this school can represent the majority of pupils in primary schools in general in Malaysia.

According to Konting (1998), for the reliability and validity of the findings, a researcher must choose as many as 30 respondents. Therefore, a total of 30 pupils from one class represented the control group and 30 students of the second class represented the experimental group. These classes were taught by different but experienced teachers.

The instrument used in this study consists of two instruments, namely the comic instruments and the Achievement Test.

Comic Instruments

The comic Instruments were developed based on the topic of Energy, which is based on Curriculum Standard Documents and Assessment, Science Year 5. Daily lesson plans which is based on Needham's Five Phases and incorporated with comic elements were also provided, so that the teacher can use them in the teaching and learning process of the experimental group. Four lesson plans were proposed for the teacher who will teach the experimental group during

the two weeks of intervention. To improve the validity and reliability of the comic instruments, an evaluation was made by three Science experts to ensure the accuracy of the comic to its contents. The evaluation was performed twice to ensure accuracy of the comic instrument. The comic strip was chosen and modified from internet sources or designed by the researcher. The teacher who taught the experimental group was given guidance to use the comic strip properly and efficiently during the teaching and learning process. At the same, the teacher who is teaching the control group used the textbooks during the teaching and learning.

Achievement Test

The Achievement Test consists of 20 multiple-choice questions and 6 structure questions. This test is used to determine the pupils' achievements in the pre and post test. The questions symbolize the levels of the cognitive domain of Bloom's Taxonomy. Questions of low level and high level were included in this test. There were a total of 16 high level questions with a total of 22 points, whereas rest of the questions compromise low order thinking questions. Three experienced Science teachers, one from the research school and the other two from different schools assessed the suitability of the items in the instrument. They matched each item in the Achievement Test with the cognitive levels in the Bloom's Taxonomy. This improved the validity of the instrument. The total points of the achievement test are 30 point. Pre and post test were conducted simultaneously for one hour for both the control and the experimental group.

FINDINGS AND DISCUSSIONS

All datas in this study were analyzed using the Statistical Package for Social Sciences (SPSS) version 20.0 The dependent t-test was used to determine if there is a significant difference between the control group and the experimental group. The significance level is set at 0.05.

Table 1 : Data Analysis of the Pre test in Groups

Group	No. of respondents	Mean	SD	T value	Sig
Control	30	13.300	1.950	0.685	0.499
Experimental	30	13.033	1.755		

The pre test results showed no significant difference between the mean score of the pre-test for the control and experimental groups ($t = 0685$, $p > 0.05$). This means that the mean scores for both groups were similar in terms of prior knowledge about the topic of Energy. These results

qualify the quasi experiment requirement that both groups are similar. (Campbell & Stanley, 1963).

Table 2 : Data Analysis of the Post test in Groups

Group	No. of respondents	Mean	SD	T value	Sig
Control	30	22.200	1.808	-15.848	0.000
Experimental	30	27.933	1.574		

Table 2 shows that there is a significant difference between the mean score of the post test for the control and experimental groups ($t = -15,848$; $p < 0.05$). This shows that comics are an effective teaching tool in the classroom to increase the achievements of the pupils and the also the ability to remember the science facts.

Table 3 :Data Analysis of the Post test of Higher Order Thinking Items in Groups

Group	No. of respondents	Mean	SD	T value	Sig
Control	30	14.677	1.060	-18.766	0.000
Experimental	30	19.867	1.106		

Table 3 shows there is a significant difference between the mean score of post-test scores for higher order thinking questions in the control and experimental groups ($t = -18,766$; $p < 0.05$). Thus comic can increase the higher order thinking skills among the pupils.

The results show that comic can facilitate the pupils to improve their achievements, remember the Science facts and increase their higher order thinking skills. Pupils will gain knowledge due to their active involvement in the teaching and learning process. Thus, their motivation to learn Science increases. Their perception that science is something difficult to learn will change. Comic is able to stimulate pupils to think out of the box and not to limit their thinking ability. Finally, motivation and interest in learning science will improve their performance in the examination.

The responsibility of a teacher is to ensure that the planned activities can tap the potential of the pupils and prepare them for the challenges of the future. Teachers must constantly innovate their

teaching and learning to attract and retain the interest of their pupils. Comics have been demonstrated in this study as an effective teaching aid that is suitable for use in the classroom. The use of comics in teaching and learning is easier because the comics are readily available on the websites. Teachers also have the option to create the appropriate comic to match their pupils' cognitive level by using existing software or websites.

For future research, the study can be extended to a few schools in rural and urban areas. With this, the generalization made from that research is more powerful. The duration of the study can also be extended for a longer period to show the actual impact of comic in education. In addition, the effectiveness of comic can be tested among students at the university or college because at that stage, learning becomes more difficult and the students need to understand concepts that are more abstract. There is no research in Malaysia currently at these levels. Many people assume comics are only a hobby, without realising its hidden powerful effects on the pupils.

REFERENCES

Alvermann, D., Xu, S.H. (2003). Children's everyday literacies: Intersections of popular culture and language arts instructions. *Language Arts*, 81(2), 145-154.

Abdul, R. I. (2003) Kefahaman Konsep Sains dan Perhubungannya dengan Tahap Kognitif dan Jantina Pelajar Tingkatan 3. Tesis Sarjana, UM.

Ary, D., Jacobs, L.C., Razavieh, A., & Sorenson, C. (2006). *Introduction to research in education* (7th. ed.). Belmont, CA: Wadsworth.

Ayob, A. (2012). Cara meningkatkan minat pelajar terhadap sains dan matematik. Universiti Pendidikan Sultan Idris.

Bloom, B. S. (1956). *Taxonomy of educational objectives (Handbook 1: The Cognitive domain)*, New York, USA: Addison-Wesley

Briner, M., (1999). *Learning Theories- constructivism*. Denver : University of Colorado

Duncan, R., & Smith, M.J. (2013). *The power of comics*. New York, NY: Bloomsbury.

Flores et al. (2012). Deficient critical thinking skills among college graduate : Implications for Leadership. *Educational Philosophy and Theory*, 44, 221-230.

Frey, N. & Fisher, D. (Eds.). (2008). *Teaching visual literacy*. California: Corwin Press.

- Gardner, H. (1983). *Frames of Mind: Theory of Multiple Intelligences*. New York. Basic Books Inc.
- Gill, J., & Johnson, P. (2010). *Research methods for managers* (4th. ed.). London: Sage
- Hamid, N.A. (1981). Alatan mengajar dalam pengajaran bahasa. *Kertas Kerja Seminar Perguruan* pada 28-30 Disember 1981 di Universiti Malaya.
- Irwan, Fahmi & Anuar. (2003). The effectiveness of using comic strips to promote reading comprehension. Tesis Sarjana Muda yang tidak diterbitkan, Universiti Pendidikan Sultan Idris, Tanjung Malim.
- Jacobs, D. (2007). More Than Words: Comics as a Means of Teaching Multiple Literacies. *English Journal*.
- Jasmine, J. (1996). *Teaching with Multiple Intelligence*. Westminster: Teacher Created Materials
- Jennifer Haines. #####. Peak Objectives: Developing Critical Thinking Through Comics. Retrived from www.diamondbookshelf.com
- Keskin, Y. (2015). The Evolution and Importance of Visual Communication. The University of Economics, Prague.
- Kruger, L., & Watson, S. P. (2001). "Shoo—This book makes me to think!" Education, entertainment and "life-skills" comics in South Africa. *Poetics Today*, 22(2), 475–513.
- Lapp et al. (2012). Graphic novels: What elementary teachers think about their instructional value. *Journal of Education*, 192(1), 23-35.
- Lowery, L.F. (1967). An experimental investigation into the attitudes of fifth grade students towards science. *School Science and Mathematics*, 67, 569-579.
- Laporan Strategi Mencapa Dasar 60:40 Aliran Sains/Teknikal: Sastera. 2013. Kementerian Pelajaran Malaysia.
- McBrien, J.L. & Brandt, R.S. (1997). The language of learning : A guide to education terms. Alexandria VA: Association for Supervision And Curriculum Development.

Mc Cloud, S.(1993). *Understanding comics : The invisible art*. Northampton, MA : Kitchen Sink Press.

Morrison, T., Bryan, G., & Chilcoat, G. (2002). Using student-generated comic books in the classroom. *Journal of Adolescent & Adult Literacy*, 45, 758-767.

Needham, R. (1987). *Teaching strategies for developing understanding in science*. The University of Leeds: Centre for Studies in Science and Mathematics Education.

Neuman, W. L. 2000. *Social Research Methods: Qualitative and Quantitative Approaches*, USA: Pearson.

OngEngTek, & Ahmad Nizam Abdullah. (2009). Keberkesanan Modul Kartun dalam Pengajaran dan Pembelajaran Biologi Tingkatan 4 (The Effectiveness of Cartoon Module in the Teaching and Learning of Form 4 Biology). *Journal of Science and Mathematics*, 1(2), 105-124.

Onosko, J.J, Newmann, F., (1994). Creating More Thoughtful Learning Environment in J. Mangieri & C.C. Blocks (Ed), *Creating Powerful Thinking In Teachers and Students Diverse Perspective*. ForthWorth : Harcourt Brace College Publishers.

Osborne, J., Driver, R., & Simon, S. (1998). Attitudes to science: Issues and concerns. *School Science Review*, 79(288), 27-33.

Peter, O.I., Abiodun, A. P. & Jonathan, O. O. (2010). Effect of constructivism instructional approach on teaching practical skills to mechanical related trade students in western Nigeria technical colleges, *International NGO Journals*, 5 (3): 59-64

Phang, F. A., Abu, M. S., Ali, M. B., & Salleh, S. (2012). Faktor penyumbang kepada Kemosrotan penyertaan pelajar dalam aliran sains: Satu analisis soroton tesis. Universiti Teknologi Malaysia dan Universiti Sains Malaysia.

Rahayu J., (2008). Pengaruh Gaya Pengajaran guru cemerlang Fizik terhadap Gaya Pembelajaran dan Pencapaian matapelajaran Fizik Pelajar Tingkatan Empat. Tesis Sarjana, UKM.

Rasid, A.J. & Norhayat, M., (2005). Persepsi guru terhadap penggunaan teknik permainan dan simulasi. *Prosiding Seminar Pendidikan : Pendidikan Untuk Pembangunan Lestari*. Tanjung Malim.

- Rasid et al. (2012). Persepsi guru terhadap penggunaan kartun dalam transformasi pengajaran penulisan karangan Bahasa Melayu. *Jurnal Pendidikan Bahasa Melayu (MyLEJ)*. Vol. 2, Bil.1, Mei 2012.Hlm. 129-140.
- Reiber, L.P. & Kini, A.S. (1991) Theoretical foundations of instructional applications of computer generated animated visuals. *Journal of Computer Based Instructions*, 183(3), 83-88.
- Robinson, J.P. (2000). *The Workplace*. Alabama Cooperative Wxtension System. Tidak diterbitkan
- Rule, A.C., & Auge, J. (2005). Using Humorous Cartoons to Teach Mineral and Rock Concepts in Sixth Grade Science Class. *Journal of Geoscience Education*, 53(5), 548-558.
- Russell, T., & Murray, S. (1993). Popular publishing for environmental and health education: Evaluation of Action Magazine. Liverpool, UK: Liverpool University Press.
- Short et al. (2013). Graphic Presentation: An empirical examination of the graphic novel approach to communicate business concepts. *Business & Professional Communication Quarterly*, 76, 273-303
- Thorndike. R.L. 1941. Words and the Comics :Journal of Experimental Education.
- Utusan Malaysia. (2012). *Kemerosotan minat terhadap jurusan sains membimbangkan*.
- Versaci, R. (2001). How Comic Books Can Change The Way Our Students See Literature: One Teacher's Perspective. *English Journal*, Volume 19, Number 2, PP.61-67 Wiley.
- Weitkamp, E., & Burnet, F. (2007). The Chemedian Brings Laughter to the Chemistry Classroom. *International Journal of Science Education*, 29(15), 1911-1929.
- Whittle, C. (1997). Teaching science by television: The audience, education, history, and the future. Reports-Research (143), New Mexico. (ERIC Document ED 417 079)
- Wright, G., Sherman, R., (1999). Let's Create A Comic Strip. Reading Improvement; Summer 1999, Vol.36 Issue 2, pp66-72, 7p
- Wu, S.J. & Tuan, H.L. (2000). A case study of students' motivation a ninth grade physical science class. *Second International Conference on Science, Mathematics and Technology Education, Taipei*, January 10-13 2000.

Yang, G. (2003). Comics in Education. <http://www.humblecomics.com/comicsedu/index.html>

Higher-order thinking takes thinking to a whole new level. Students using it are understanding higher levels rather than just memorizing facts. They would have to understand the facts, infer them, and connect them to other concepts. Here are 10 teaching strategies to enhance higher-order thinking skills in your students.

1. Help Determine What Higher-Order Thinking Is. Help students understand what higher-order thinking is. Explain to them what it is and why they need it. Help them understand their own strengths and challenges.

Analyzing: students can examine the form and the uses of the tense, clarify why we use Present Simple in certain contexts, situations, describe the difference between tenses. Evaluating: students can change sentences to make them true to themselves; or make sentences in Present Simple using given patterns, examples. Creating: students can describe their daily routines or talk about their day.

It's obvious that it's better to teach with HOTS as your students are more involved in a lesson. When students use HOTS, they do something with the new knowledge, facts: apply it, compare, contrast. HOT involves metacognition: when you think about your thinking. use of Bar Model Method have improved the performance of pupils in Year 5 in answering HOTS level mathematics questions.

Keywords: HOTS, Bar Model, Teaching and Learning , Effectiveness, Pupils Achievement.

1. INTRODUCTION

A review on the education system as a whole by the Ministry of Education in 2011 has resulted in a transformation known as the Malaysian Education Development Plan (MEDP) 2013 - 2025. The transformation of the curriculum implemented in the MEDP focuses on the concept of Higher Order Thinking Skills (HOTS) which emphasize in producing a generation with creative and critical t... Higher Order Thinking Skills or HOTS are critical to success in the Future of Work. Education and Curriculum needs to focus on these. This case-study shows how it has been done in a Design College. Philosophers have used logical reasoning and perfections of thinking to decide what to believe and do, and psychologists have studied the thinking process and how this process can help people make sense out of their experience by constructing meaning and imposing structure. Psychologists emphasize problem solving and philosophers reflective thinking and logic. Educationists have built on these constructs to evaluate how to encourage and develop higher-order thinking skills the student community.

Abstract " Higher order thinking skills (HOTS) is a skill that should be present in every teaching. Teaching science particularly require teachers to be skillful in planning learning activities that can inculcate thinking skills among students. These approaches promote the use of higher order thinking skills as well as cognitive development. Among others, teachers could apply various strategies, such as questioning techniques, problem solving activities, project-based learning, thinking tools, simulations, discussions, role play and gradual increment of the level of difficulties of tasks. So, science experiments are an avenue where higher order thinking skills of analyses, synthesis and evaluation are applied by students in their learning process.