Malaysian Journal of Mathematical Sciences 13(2): 211–229 (2019)

MALAYSIAN JOURNAL OF MATHEMATICAL SCIENCES

Journal homepage: http://einspem.upm.edu.my/journal

Effects of Higher Order Thinking Module Approach on Pupils' Performance at Primary Rural School

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Received: 31 August 2018

Accepted: 29 April 2019

ABSTRACT

This study was to investigate the use of HOTS-based module approach on the performance of primary school pupils. This module was developed systematically using ADDIE model with adaptation on Cognitive Apprenticeship Model (CAM) as the framework to enhance Higher Order Thinking Skills (HOTS) among year five pupils. For the purpose of the study, a quasi-experimental, nonrandomized control group, pre-test-post-test and post delayed-test design was conducted on two intact groups. This study was conducted in two national schools located in the rural area, in one of the states in Malaysia. Two primary schools were selected to get a better view on the effects of using HOTS-based module in teaching and learning mathematics. Sample in school1 was a total of 76 pupils (38 pupils in the treatment group and 38 pupils in the control group), while for school2, 51 pupils (28 pupils in the treatment group and

23 pupils in the control group) participated in this study. The instrument used in this study was the twelve items problem solving test on the topic of Measurement and Geometry developed by the researcher. Reliability of the tests were .78 for pre-test, .79 for post-test and .71 for post delayed-test. The analysis of covariate (ANCOVA) indicated that no significant difference in the post test and post delayed test for both schools. This study showed that HOTS in mathematics is still new in Malaysia, even though module approach was used especially for those pupils in rural area. More time need to be given to the teachers and pupils in rural area school to be familiar and practice using HOTS. Hence it is recommended that HOTS-based module approach should be continued in teaching and learning Mathematics in the future.

Keywords: HOTS-based module approach, conventional approach, rural school.

1. Introduction

Education in Malaysia is aimed at developing individual potential through the quality in education by providing a generation with thinking capability. Ministry of Education continuously review their curricula to ensure the implementation of the curriculum in schools equip pupils with the knowledge, skills and values to face current and future challenges. *Kurikulum Standard Sekolah Rendah* (KSSR) for Mathematics is revised and reorganized. The restructuring is taking into account the ongoing sustainability to the next level. The revision is appropriate to pupils who have a wide range of capabilities and background, since it offers the knowledge and skills of mathematics. With knowledge and skills provided, they are capable of exploring knowledge, make adaptation, modification and innovation in facing and dealing with the changes and challenges in the future (Ministry of Education, 2013). The aim of KSSR for Mathematics Education is to build pupils' understanding of number concepts, basic skills in computing, mathematical ideas that are easy to understand and are competent to apply mathematical knowledge and skills to effectively and responsibly in everyday life (Malaysian Ministry of Education, 2014a).

Since 1994, thinking skills were stressed in the curriculum with the introduction of Critical and Creative Thinking Skills (CCTS) (Ministry of Education, 2001). KSSR has emphasized on higher order thinking skills (HOTS). According to Ministry of Education (2014b), the definition of HOTS is the capability to relate knowledge, skills and values, generating reasoning and reflection in solving problems, making decisions, innovate and try to produce something. HOTS are a reference to the skill of apply, analyze, evaluate, and create according to revised Bloom's taxonomy by Anderson and Krathwothl (2001).

In 2015, Malaysian students recorded better results in TIMSS with the highest increase of 25 points among 18 nations that have shown improvements for mathematics (Aziz, 2016). Even though, Malaysia is now at mid-table in the list of participating countries, the aimed to achieve a score of 500 points in TIMSS 2019 is still continued ("Better 2015 UPSR results", 2015). A lot of studies have been conducted on mathematics achievements across the globe, among the factors influencing mathematics achievement among Malaysian eighth graders was lacking of HOTS (Nor'ain & Mohan, 2015; Tajudin, & Chinnappan, 2016) and not familiar with open ended questions (Ministry of Education, 2014c). Hence, various efforts must be continued in promoting of HOTS among students in schools in order to achieve the government's desire for world-class education.

One of the important skills in the 21st century is HOT which is acknowledged as accelerative skills in this changing era. Individual needs to be not only educated but also hold the important ability; being able to think effectively and to make right decisions as well as creative in many way, in order to live well or even merely exist in this highly competitive world (Huang, 2011).

Many studies on HOTS had been done using different definitions of HOTS. Among the definitions used are transfer and flexible reasoning over memorizing of facts, (Richland & Simms, 2015); skill that is above the level of memorizing facts (Thomas & Thorne, 2009); deep thinking process which include critical and creative information processing when solving complex problems (Brookhart, 2010; Conklin, & Manfro, 2012; Lewis, & Smith, 1993; Resnick, 1987). Although different definitions were used in the studies, the result of the findings led to the achievement of pupils and the pedagogy used in teaching and learning. Effective pedagogy is not only important to develop pupils' HOTS, nevertheless it is also able to improve pupils' achievement (Boaler & Staples, 2008; Franco, Sztajn, & Ramalho Ortigao, 2007; Gutierrez, 2000). Boaler and Staples (2008) claimed that mathematical achievement will improve when pupils are exposed to instructions that focus on problem solving, conjecturing, explanation and justification of ideas. These skills are very important in learning mathematics. Teachers need to focus on the development of these skills in the form of assignments and assessments. Brookhart (2010), indicated the increment of pupils' achievement is related to the use of tasks and assessments that need higher order thinking skills and critical thinking. Furthermore, according to Sulaiman, Ayub and Sulaiman (2015), curriculum should undergo some changes in the aspect of content, teaching strategies or assessment in order to prepare pupils facing the future challenges.

Many studies had been done to enhance HOTS among pupils through different strategies and tools. Among the tools used is the i-Think map. Owi, Azhar, Mazlini, and Ang (2017) conducted a study on identifying pupils' proficiency by the using i-Think map in solving HOTS Mathematics questions; they indicated there was a significant improvement in the post-test. They claimed that when applying i-Think map, the pupil's ability to solve HOTS questions was enhanced. Authentic instruction which integrated different subjects is one of the strategies that can be considered in enhancing HOTS among pupils. Althauser and Harter (2016) conducted a study on grades K-5 pupils that integrated economics into mathematics in order to go a step further than traditional teaching by combining teaching materials to infuse higher-order thinking skills. They found that by combining these teaching materials, pupils' higher order thinking skills had been improved. They claimed that authentic instruction could produce knowledge that is applicable to the real world situations. In other words, this transfer of knowledge and skills was critical if we want our pupils to apply classroom learning to their everyday lives.

Other study by Lopes and Macedo (2013) who conducted experimental studies on the non-traditional instructional strategies including cooperative and collaborative learning models showed that the pupils in the non-traditional teaching strategies group could contribute to the development of problem solving and higher order thinking skills. The pupils had adopted the strategies and they could overcome some of the difficulties faced during problem solving. From the above confab, it can be summarized that in order to enhance HOTS among pupils, teacher should make changes in teaching strategies, resources and assessments.

In Malaysia, about 58% of teaching and learning process is dominated by explaining, and practicing in mathematics; the rest goes for reviewing homework, re-teaching, taking tests, and participating in activities that are not related to the lesson content (Zabit, 2010). Mullis, Martin, and Foy (2008) claimed that Malaysian mathematics teachers gave more attention to the product of thinking and less emphasize on the outcomes of the learning. Moreover, traditional method of teaching mathematics still exists and will continue to exist in Malaysian classrooms Zanzali et al. (2011). Research shown that teacher-centered teaching using textbooks and emphasized on procedural understanding in mathematics was related to student's achievement in mathematics (Zanzali, 2011; Bayat & Tarmizi, 2010; Lim, 2007). Thus, the raised concern calls for more effective techniques and alternative teaching and learning approaches in infusing HOTS in mathematics contents. Other factor that influenced student achievement was the learning environment.

1.1 HOTS in Rural Schools

Pupil achievement depends on several factors. Among the factors that led to the achievement of the pupil achievement gap was locality. The achievement gap of urban and rural pupils is a debate issue. As is known, the achievement of pupils from rural school pupils is far different from the achievement of pupils from urban schools. The review of TIMSS report stated that a school's location can give a significant effect on whether the pupils attending schools that can provide access to important additional resources such as libraries, media centers and other facilities or schools that is relatively isolated (Mullis, Martin, Foy & Arora, 2012). From the result of TIMSS 2015, pupils in the urban schools achieve 470 points, whereas pupils in rural schools obtained 442 points in mathematics. Even though there is an increment of points in both locations from TIMSS 2011, the scores are still considered moderate in achievement. According to the Ministry of Education (2014a), in the *Ujian Penilaian Sekolah Rendah* (UPSR) examination, the gap between urban and rural pupil was almost 4 % higher for urban schools. Thus, early intervention is really critical.

Several researches have been conducted to investigate the effect of location on mathematics learning around the globe.

The findings from a recent study on HOTS discrepancies between rural and urban pupils are notable. Pupils from rural school seem to have lower HOTS in mathematics compared to pupils from urban schools. Among the factors that contributed to this were the motivation toward knowledge (Jayagandi, 2018; Hua & Ping, 2017), infrastructure and resources (Uwaezuoke & Ekwueme, 2015; Butt & Dogar, 2014; Weal, Mercuriani & Paidi, 2018), the level of pupil's thinking (Nepal, 2017), pupil's engagement (Mullis, 2012; Sigh, Rahman & Hoon, 2010) and school environment (Allokan & Arijesuyo, 2013). Although there are many factors contributing to the low level of HOTS achievement for rural pupils, there are studies showing rural pupils have a higher level of HOTS achievement than urban pupils. Among the factors that rural pupils scored higher achievement were the class size and school environment (Abdullah, Mokhtar, Halim, Ali, Tahir & Kohar, 2017) and school's management (Hemavathi & Reddy, 2016). While Firdaus (2017) in his study shows that there was no significant difference between urban and rural pupils towards HOTS in mathematics. Therefore, this study will focus on the development and effect of higher order thinking skills module in order to enhance HOTS among primary school pupils. This is in line with Ally (2005) recommendation that learning materials must be designed properly in order to engage pupils and promote HOTS in learning mathematics.

1.2 HOTS-based Module

The concept of modular approach has been used in educational software to upgrade the pedagogical skills in the teaching and learning (Isaacs, Walton & Nisly, 2015; Ozer, Kenworthy, Brisson, Cravalho & McKinley, 2003) of mathematics. Even though there are too many ICT based tools available as an alternative to textbook, it is not always possible and accessible for the pupils in rural area who go through their lives with poor access to educational technologies (Alordiah, Akpadaka & Oviogbodu, 2015; Graham & Provost, 2012) and having to face their own struggle. Furthermore, this module will fill in the gaps in the teaching and learning of mathematics using module for 5 years. Therefore this study had developed a low cost and convenient manual module that can be used to access and obtain basic knowledge Measurement and Geometry. It can be accessible even in rural areas.

This study focused on a group of Year five school pupils learning 'Measurement and Geometry' for a few reasons. They were (i) Analysis of the pupils' quality of answers in *Ujian Penilaian Sekolah Rendah* (UPSR) 2012, 2013 and

2014, found that pupils could not answer correctly in the topic of Measurement and Geometry. Pupils were not proficient in the conversion, calculating area, and perimeter, and solving word problem questions. (ii) A module for the topic of Measurement and Geometry in Year 5 was not supplied by the Curriculum Development Division and (iii) They have already experience the learning of this topic in a conventional classroom practices. Thus, they are significantly suitable selection of sample to experience the topic taught using Cognitive Apprenticeship Model (CAM) approach.

HOTS module is an instrument to promote HOTS among Year 5 pupils, for the topic of Measurement and Geometry. The module consists of four subtopics such as Length, Mass, Volume in Liquid and Space. They are produced in two versions, the pupil's version and also the teacher's version. The pupil's version consists of Lower Order Thinking Skills (LOTS) and HOTS practice questions, while in the teacher's version, explanation on how to implement the strategy of CAM in teaching strategies is included. Formative assessment is provided at the end of each topic.

1.3 Objective of the Study

The aim of this study was to determine the impact of HOTS based module on pupils' performance in learning mathematics year five. In order to achieve this aim two research objective were formed:

1. Compare the effects of the treatment and control group on Year 5 pupils' performances for post-test in the topic of Measurement and Geometry at school1 and school2.
2. Compare the effects of the treatment and control group on Year 5 pupils' performances for post delayed test in the topic of Measurement and Geometry at school1 and school2.

Research Hypothesis:

H_{01} There is no significant difference in the means of the pupils' performance test scores (post-test) between HOTS-based module and conventional group while controlling pre-test scores at rural areas (school 1) in the topic of Measurement and Geometry.

H_{02} There is no significant difference in the means of the pupils' performance test scores (post-test) between HOTS-based module and conventional group while controlling pre-test scores at rural areas (school 2) in the topic of Measurement and Geometry.

H_{03} There is no significant difference in the means of the pupils' performance test scores (post-delayed test) between HOTS-based module and conventional group while controlling pre-test scores at rural areas (school 1) in the topic of Measurement and Geometry.

H_{04} There is no significant difference in the means of the pupils' performance test scores (post-delayed test) between HOTS-based module and conventional group while controlling pre-test scores at rural areas (school 2) in the topic of Measurement and Geometry.

2. Methodology

2.1 Research Design

In education, many experimental situations occur in which researcher need to use intact groups. This might happen because of the availability of the participants or because the setting prohibits forming artificial groups (Klassen, Creswell, Clark, Smith & Meissner, 2012). This study will use the quasi-experimental research design by using the existing class of year five pupils, designating one as the experimental group and one as the control group. Randomly assigning pupils to both groups will disrupt classroom learning. The research design is the pretest-posttest control group design. Figure 1 shows the research design model, which is used in this study.

School1	HOTS-based module	O_1	X_1	O_2	O_3
	Control group	O_1		O_2	O_3
School2	HOTS-based module	O_1	X_2	O_2	O_3
	Control group	O_1		O_2	O_3

X_1: Treatment group School1
X_2: Treatment group School2
O_1: Pre-Test
O_2: Post-Test
O_3: Delayed-Post Test

Figure 1: The Pretest-Posttest Control Group Design

In this study, two national schools were selected since national schools type was the majority schools in the district of Kota Bharu. These schools were the average academic achievement (band 3, 4, and 5). The samples were selected using simple random sampling technique for selecting the schools, selecting two classes from each school and selecting experimental groups from each class since it is easy and obtains accurate representation of a larger population. Lottery method (Acharya, Prakash, Saxena, & Nigam, 2013) was used where each school was assigned a number and, two numbers were drawn. Next, numbered classes involved (two classes with highest achievers and lowest achievers were excluded) in each selected schools. Again, two numbers represent classes were drawn from each school, and subsequently, the numbered class was chosen to determine groups for treatment and control. Two schools (school1 and school2) were selected in this study. Sample in school1 was a total of 76 pupils (38 pupils in the treatment group and 38 pupils in the control group), while for school2, 51 pupils (28 pupils in the treatment group and 23 pupils in the control group) participated in this study. Year five pupils are considered as practical and manageable within time and budget constraints since they are not involved in major public examination such as UPSR.

2.2 Data Collection Method

The purpose of this study was to investigate the impact of the use of HOTS-based module approach on the pupils' performance. It therefore required using the existing class of year 5 pupils, designating one as the experimental group and the other as the control group. A pre-test was administered to both groups to determine whether the means of both groups were significantly different. The experimental group utilized the HOTS-based module approach while the control group utilized the general approach on the same topics. After providing the HOTS-based module, a post-test was administered to measure the pupils' performance at the end of 12 weeks followed by the delayed post-test three weeks after.

The test paper on the topic of measurement and geometry consisted of 12 subjective questions. The test questions were designed to fulfil the expectations embedded in the new curriculum standards in mathematics-including the instructional shifts and higher order thinking skills. Questions developed were reviewed by three experts, two senior lecturers from the Institute of Teachers Education and a mathematics teacher. They were modified and arranged within the Malaysian context as desired after content validation by the professional experts.

2.3 Data Analysis

Analysis of data is divided into three steps which are preliminary analysis, descriptive statistics and inferential analysis. Descriptive Statistics and Exploratory Data Analysis (EDA) are employed as a preliminary data analysis technique. According to Pallant (2013), when it became clear that, there are no errors in the specific data set, the descriptive phase of data analysis could be started. This study used mean, standard deviation and frequency in describing its data. Descriptive statistics were used to describe the distribution of subjects according to treatment groups and control group. However, inferential statistics such as ANCOVA will be used to answer the research questions.

3. Findings

In this section, the findings were based on the stated research hypotheses. After conducting the experiment for 12 weeks, a one-way between group analyses of Covariance (ANCOVA) was carried out on the post-test scores to compare the effectiveness of the two different types of mathematics teaching approaches. The pre-test scores were used as the covariant in this study.

Table 1 shows the descriptive statistics (means and standard deviations) of the post-test scores of the groups undergoing the HOTS-based module and the conventional approaches in School1. The mean and standard deviation mean scores of post-test for both groups in School1 is as shown in Table 1. For the post-test scores, mean values for treatment group ($M = 12.26, SD = 3.531$) is higher as compared to control group ($M = 11.58, SD = 3.629$).

Table 1: Descriptive Statistics of Performance (Post-test) Scores in School1

Group of pupils	M	SD	N
treatment	12.26	3.531	38
control	11.58	3.629	38

Levene's test has been used to check for the equality of variances. Table 2 shows that the Levene's test $[F(74, 1) = .762, p = .385 > .05]$ was not significant, hence the assumption of homogeneity of variance was not violated.

Table 2: Levene's Test of Equality of Error Variances of Post-test Scores in School1

F	df1	df2	Sig.
0.762	1	74	0.385

After adjusting mean scores of Pre-Test, Table 3 showed that there was no significant difference between the treatment group and the control group on post-test scores on the performance test $[F(1, 73) = 1.503, p = .224 > .05]$. Therefore, hypothesis 1 (H_{01}) was not rejected. This showed that pupils that exposed in both approach did not differ in their post-test performance in school1.

Table 3: Tests of Between-Subject Effects of Post-test Scores in School1

Source	Type III Sum of Squares	df	Mean Squares	F	Sig.
Corrected Model	140.44	2	70.22	6.27	0.00
Intercept	914.01	1	914.01	81.66	0.00
TPRE	131.54	1	131.54	11.75	0.00
GROUP	16.82	1	16.82	1.50	0.22
Error	817.08	73	11.19		
Total	11758	76			
Corrected Total	957.53	75			

The following analysis will test pupil's performance scores on post-test in school2. Table 4 shows the mean and standard deviation post-test scores for both groups in School2. As shown, control group has higher scores ($M = 13.26, SD = 4.731$) when compared to treatment group ($M = 12.43, SD = 2.755$).

Table 4: Descriptive Statistics of Post-test Scores in School2

Group of pupils	M	SD	N
Treatment	12.43	2.755	28
Control	13.26	4.731	23

Table 5 has shown that there was no significant on Levene's test $[F(1, 49) = 2.813, p = .100 > .05]$. Therefore, the assumption of homogeneity of variance was not violated.

Table 5: Levene's Test of Equality of Error Variances of Post-test Scores in School2

F	df1	df2	Sig.
2.813	1	49	0.100

Analysis ANCOVA in Table 6, indicated that there was no significant difference between treatment and control group $[F(1, 48) = 3.248, p = .078 > .05]$ which means that H_{02} was not rejected. This implied that pupils in both group did not differ in post-test scores in school2.

Table 6: Tests of Between-Subject Effects of Post-test Scores in School2

Source	Type III Sum of Squares	df	Mean Squares	F	Sig.
Corrected Model	238.58	2	119.29	12.25	0.00
Intercept	474.68	1	474.68	48.72	0.00
TPRE	229.84	1	229.84	23.60	0.00
GROUP	31.63	1	31.63	3.25	0.08
Error	467.46	48	9.74		
Total	9067	51			
Corrected Total	706.04	50			

The following analysis will test pupils performance scores on post-delayed test in school1. For that, the H_{03} will be tested. Table 7 shows the descriptive statistics of performance test of treatment and control groups in School1. Performance of treatment group has higher scores in Post-Delayed Test ($M = 13.82, SD = 5.239$) when compared to control group ($M = 10.68, SD = 3.120$).

Table 7: Descriptive Statistics of Performance (Post-Delayed Test) Scores in School1

Group of pupils	Mean	Std. Deviation	N
treatment	13.82	5.239	38
control	10.68	3.120	38

Levene's test has been used to check for the equality of variances. Table 8 shows that the Levene's test $[F(74, 1) = 9.126, p = .003 < .05]$ was significant. This means that null hypothesis was rejected. Hence the assumption of homogeneity of variance was violated. Analysis of covariance is an extension of analysis of variance which is reasonably robust to violations of this assumption, provided the size of the group is reasonably similar (Pallant, 2013). Table 7 indicate that the large group size is not more than 1.5 times greater than the small group size (38/38 = 1.00).

Table 8: Levene's Test of Equality of Error Variances of Post-Delayed Test Scores in School1

F	df1	df2	Sig.
9.216	1	74	0.003

After adjusting for Pre-Test of Performance scores, there was no significant difference between the two intervention groups on post-delayed test scores on Performance Test, $[F(1, 73) = 2.360, p = .129 > .05]$ (Table 9) which indicated that H_{03} was not rejected. This result showed that pupils in both groups in School1 do not differ in terms of their performance for post-delayed test.

Table 9: Tests of Between-Subject Effects of Post-Delayed Test Scores in School1

Source	Type III Sum of Squares	df	Mean Squares	F	Sig.
Corrected Model	254.16	2	127.08	7.09	0.00
Intercept	1178.68	1	1178.68	65.78	0.00
TPRE	67.83	1	67.83	3.79	0.06
GROUP	42.29	1	42.29	2.36	0.13
Error	1308.09	73	17.92		
Total	12967	76			
Corrected Total	1562.25	75			

The following analysis will test pupil's performance scores on post-delayed test in school2. Table 10 shows the descriptive statistics of performance test of treatment and control groups in School2. Performance of control group has higher scores in post-delayed test ($M = 10.87, SD = 5.354$) when compared to treatment group ($M = 10.14, SD = 3.649$).

Table 10: Descriptive Statistics of Post-Delayed Test Scores in School2

Group of pupils	Mean	Std. Deviation	N
Treatment	10.14	3.649	28
Control	10.87	5.354	23

Levene's test has been used to check for the equality of variances. Table 11 shows that the Levene's test $[F(49, 1) = .375, p = .543 > .05]$ was not significant. This means that null hypothesis was not rejected; hence the assumption of homogeneity of variance was not violated.

Table 11: Levene's Test of Equality of Error Variances of Post-Delayed Test Scores in School2

F	df1	df2	Sig.
0.375	1	49	0.543

After adjusting for Pre-Test of Performance scores, there was no significant difference between the two intervention groups on post-delayed test scores on Performance Test, $[F(1, 48) = 2.347, p = .132 > .05]$ (Table 12). Therefore, the null hypothesis was no rejected. This showed that pupils that exposed in both approach did not differ in their post-delayed test for performance in school2.

Table 12: Tests of Between-Subject Effects of Post-Delayed Test Scores in School2

Source	Type III Sum of Squares	df	Mean Squares	F	Sig.
Corrected Model	324.51	2	162.25	11.59	0.00
Intercept	164.51	1	164.51	11.75	0.00
TPRE	317.84	1	317.84	22.70	0.00
GROUP	32.87	1	32.87	2.35	0.13
Error	672.20	48	14.00		
Total	6588	51			
Corrected Total	996.71	50			

4. Discussion

This study was conducted to determine the effect of HOTS on mathematical performance among primary school pupils in two different schools in rural areas. This study also compared teaching approaches using HOTS module and conventional teaching approach in teaching and learning year five mathematics. The findings showed that there was no significant difference in mathematics performance for both groups in School1 and School2 in neither post-test nor post-delayed test.

This finding was not consistent with the results of previous studies (Owi, Azhar, Mazlini & Ang, 2017; Lopes & Macedo, 2013) that indicated different in performance score after using HOTS module. Nevertheless, from the result, it was stated that there was an increment in the mean score between post-test and post-delayed test for pupils who was exposed to the use of HOTS based module in school1. This could be explained that teaching approach using HOTS based module is still new in Malaysia especially for those pupils in rural area. More time needed to be given to teachers and pupils in rural area schools to be familiar and practice using HOTS. Teaching and learning using HOTS based module that emphasized on pupil-centered method tend to feel uncomfortable when being tried first. This change can be overcome by time and this approach needs lots of commitments from the teacher (Hodge, 2006).

However, the result for school2 was different, there was a drop in mean score between post-test and post-delayed test for pupils who was exposed to the use of HOTS based module. The interpretation of this result was that teachers and pupils were not ready to accept changes in teaching and learning strategies since conventional teaching approach is familiar and easy to conduct or follow for both teacher and pupils (Mokhtar, Tarmizi, Ayub & Tarmizi, 2010). According to Hagerty, Smith & Goodwin, (2010), there are difficulties in converting from traditional teaching to new teaching approach. Thus a nonsignificance difference in mathematics performance for both groups of pupils might be explained by the limited time in familiarized the HOTS approach, since the duration of the study was in 12 weeks only. A longer duration of utilizing the HOTS approach in the instruction may provide different result. Other reason that could be contributed to this result was the selection of the topic in measurement and geometry.

5. Conclusion

Based on the result and discussion, it can be conclude that HOTS based module approach can be implemented as an alternative learning strategy for infusing HOTS in mathematics content. Given the importance of HOTS in providing a generation with thinking capability, the result of this study contribute to the body of knowledge in assessing pupils' HOTS in mathematics learning in rural area by using empirical evidence. Even though, the finding for pupil who was exposed to HOTS based module in both schools was not significant, pupils should be given an appropriate time to gasp new approach in learning mathematics. As well as teachers, the implementation of HOTS in mathematics teaching requires teachers to be familiar and change the paradigm to achieve the national education's goals. Changes need to be taken with caution so that pupils have the opportunity and support needed to become proficient in mathematics at an early age.

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