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The Use of Concrete Material in Teaching and Learning Mathematics

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Abstract: This research is done as an approach to improve or enhance the quality of education. It is also to encourage teachers to become more aware of their own practice to be critical of such practices and to be prepared to change it. It involves teachers in the inquiry and conducted by them and other teachers involved in together. Accordingly, this study explores the effectiveness of teaching aids (concrete materials) in the teaching and learning process of mathematics in primary schools. Eighty six people from Sekolah Kebangsaan Rawang consisted of eighty three pupils year four, five and six and three teachers who taught mathematics have been selected to participate in this research. Data collections are based on questionnaires to determine the effectiveness on teaching aids that have been used in schools. Besides, the respondent's perceptions of the importance and role of teaching aids in teaching and learning of mathematics also the frequency of certain teaching aids usage. The measures used are based on the value of percentage and mean. The result shows that mathematics teachers have been using concrete materials as the main ingredient in starting a new methodology to pupils. Hopefully, they will found it easier to absorb any new topic after applied this approached.

Key words: Concrete materials, teaching and learning, percentage and mean, Sekolah Kebangsaan Rawang, new methodology

INTRODUCTION

Primary School New Curriculum (KBSR) is one of the teaching methods that centralize student-based materials and activities. It has been the major focus of teaching and learning mathematics in primary schools since, it was implemented in 1982 and 1983 as a whole. Students need to be taken out of the cocoon of a narrow understanding of mathematical thinking to a more practical and analytical understanding of the concept of need. The Ministry of Education Malaysia have gradually introduced an educational transformation by replacing KBSR with the Primary School Curriculum Standard (KSSR) in 2011 which also emphasizes the use of resources in the teaching and learning phases so the students not only could read and write but also could calculate and present their skills with their own creativity and critical thinking.

In order to achieve this objective, students are supposed to know how to answer any questions by thinking and interacting with mathematical concepts. The only way to avoid misunderstanding of concept is through discussion and interaction. A problem shared in discussions of mathematics can solve a problem. Teacher's characteristics leave huge impact to this issue. Effective teachers should expert in their subject and have interactive teaching skills to attract students. Besides, they should have excellent instructional strategies supported by methods of goal setting, instructional planning and classroom management. They know how to motivate, communicate and work effectively with students with different levels of skills and might come from culturally diverse backgrounds. Effective teachers should understand on how to use an appropriate level of technology in the classroom (Santrock, 2006).

According to Jean Piaget in 1896-1980, cognitive development in children is different and change through four stages according to changes in their lives. Piaget divides the four stages of Sensory Motor Level (0-2 years), Pre-Operational Stage (2-7 years) and Concrete Operational Stage (7-12 years) and the Formal Operational Stage (after 12 years). Each child cognitive development is important factors that influence the formation of the concept of either concrete or abstract. At the concrete operational level, effective learning objects

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depends on the concrete and direct experience. Based on Piaget's theory, it can be concluded that the use of concrete materials is very important in the early stages of teaching. However, Piaget states that this age is not fixed because it is in the ability of the learner's themselves (Wadsworth, 2004).

The question frequently asked is how far the method of teaching is and learning through teaching aids (concrete materials) is to build understanding of the concepts by the teacher to his pupil. Whether, it is the teacher in teaching and learning in the classroom is influenced by other factors such as equipment resources and teaching materials, class size and the time factor. Teachers must be prepared to face the challenges and changes in the expected changes in management practices in the classroom learning, especially in skills to use teaching aids effectively and also change the mind set of importance and role of materials in teaching and learning mathematics. Fuson and Briars (1990) reported astounding success in the use of base-ten blocks in teaching addition and subtraction algorithms. Wearne and Hiebert stated that consistent success in the use of concrete materials to aid student's understanding of decimal fractions and decimal numeration (Hiebert *et al*., 1991).

Concrete materials are used appropriately for two purposes. First, they enable teacher and students to have grounded conversations. Their use provides something "concrete" about which thing they can talk. The nature of the talk should be how to think about the materials and on the meanings of various actions with them. Second, concrete materials provide something on which students can act (Hiebert *et al*., 1991). There are other researchers in Malaysia who did a study in mathematics education field, especially in concrete material included an application in mathematics through games and simulations (Rusiman *et al*., 2016; Landell, 1997).

This study aims to examine the effectiveness of teaching aids (concrete materials) in the process of teaching and learning of mathematics teachers in primary schools focused on the type of concrete materials, teacher's perceptions of use, frequency of use and the problems faced by teachers in the use of concrete materials.

MATERIALS AND METHODS

There are several methods that used to ensure this research succeeds. This study involved survey questionnaires of an open question. The findings are interpreted in the range of the mean for the research responded in Part B-D. It shows if the used of teaching aids (of concrete) level is essential in teaching and learning in schools as in Table 1. The data collected was analysed by using percentage as delegates. Interpretation of the mean for each item in section B(S), B(T), C and D will determine the effectiveness and importance of teaching aids (concrete materials) in the construction of mathematical concepts. Descriptive method was used to describe this research as a whole. Table 2 shows the method of analysis used in questionnaires parts.

Table 1: The mean score range with interpretation

Mean score range	Assessment
1.00-2.39	Low
2.40-3.79	Medium
3.80-5.00	High

Adapted from Landell (1997)

Table 2: The method of analysis used in questionnaires

Section	Items	Methods of analysis
A	Basic information on school	Observations
B	Effectiveness of the concept of building	Mean
C	Perception	Mean
D	Frequency of use	Mean
E	Opinion related to the problem	Description/response

RESULTS AND DISCUSSION

Section A (basic information of school): Sekolah Kebangsaan Rawang is categorised as Type B rural schools with a total of 188 pupils. The study involves the participation of 19 teachers of various options that are sufficient for the needs of the school.

Section B(S) (effectiveness of concrete materials in the construction of mathematical concepts): Table 3 presents the percentage, mean and overall mean for each items evaluated by students to indicate the effectiveness and the importance of concrete materials in teaching and learning process. It was found that the average mean for the use of teaching materials (concrete materials) to students shows a high level of effectiveness with 4.41 as an average. This may be due to factors such delivery methods or acceptance of students with different levels of academic achievement. In the survey, resource management related factors to be among the most important reason in making teaching aids (of concrete) has been fully utilised. Besides, abacus item become lowest item on the effectiveness of the student admission process in established the concept of a title. An extra exercise on the use of abacus among pupils should be arranged in future to look at the effectiveness as a teaching aid to improve student's skill. Table 3 percent and mean of items evaluated by students. The Likert scale code from 1-5 refers to:

Table 3: The percentage, mean and overall mean for each items evaluated by students

Items	1	2	3	4	5	Mean
Counter tool	0	4	4	10	65	4.64
Percentage	0	5	5	12	78	
Abacus	0	22	18	33	10	3.37
Percentage	0	26	22	40	12	
Money toys (false)	0	4	6	10	63	4.60
Percentage	0	5	7	12	76	
Length devices	0	2	10	23	48	4.41
Percentage	0	2	12	28	58	
Measuring instrument	0	4	14	21	44	4.27
Percentage	0	5	17	25	53	
Volume measuring device	0	4	14	19	46	4.29
Percentage	0	5	17	23	55	
Solid model 3 dimension	0	6	6	13	58	4.48
Percentage	0	7	7	16	70	
Place value chart	0	6	11	8	58	4.42
Percentage	0	7	13	10	70	
Sets of math game	0	4	4	14	61	4.59
Percentage	0	5	5	17	73	
Model geometric shapes	0	4	7	13	59	4.53
Percentage	0	5	8	16	71	
Fraction kit	0	5	11	11	56	4.42
Percentage	0	6	13	13	68	
Hour mini kit	0	3	4	19	57	4.57
Percentage	0	3	5	23	69	
Multiplication tables chart	0	0	4	12	67	4.76
Percentage	0	0	5	14	81	
Basic facts flash cards	0	4	10	14	55	4.45
Percentage	0	5	12	17	66	4.41

N = 83

- Very ineffective
- Ineffective
- Moderately effective
- Effective
- Very effective

Section B(T) (effective use of concrete materials in the construction of mathematical concepts): Table 4 provides the percentage, mean and overall mean for each items evaluated by teachers to indicate the use of concrete materials by teachers in developing a concept for the introduction of mathematical topics at Sekolah Kebangsaan Rawang.

Based on Table 4, an average mean as a whole is at a high level with 4.93 as an overall mean. This shows the use of teaching aids (concrete materials) at the optimal choice of teacher in introducing the concept to be served before entering the steps of semi-concrete and abstract (Fig. 1). There are similarities between the analysis in Section B(S) and B(T) on the interpretation of the effective use of teaching aids (concrete materials) to build an understanding of a topic. This proves that the teaching aids (concrete materials) have achieved the important level in teaching and learning of mathematics in primary schools.

Table 4: Percentage and mean of items evaluated by teachers

Items	1	2	3	4	5	Mean
Counter tool	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Abacus	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Money toys (false)	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Length devices	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Measuring instrument	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Volume measuring device	0	1	0	0	2	4.00
Percentage	0	33	0	0	67	
Solid model 3 dimension	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Place value chart	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Sets of math game	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Model geometric shapes	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Fraction kit	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Hour mini kit	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Multiplication tables chart	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Basic facts flash cards	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	4.93

N = 3

Table 5: Perception of teachers in concrete materials

Items	1	2	3	4	5	Mean
Usage of concrete materials is very important to foster student curiosity	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Enhance student understanding of mathematical concepts	0	0	0	1	2	4.67
Percentage	0	0	0	33	67	
Increase the interest of students towards learning	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Increasing student participation in T and L activities in the classroom	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Directed students to generate creative thinking	0	0	0	1	2	4.67
Percentage	0	0	0	33	67	
It is important for rehabilitation activities only	2	1	0	0	0	4.67
Percentage	67	33	0	0	0	
It is important for students at level 1	2	1	0	0	0	4.67
Percentage	67	33	0	0	0	
Do not have a significant effect on student learning	3	0	0	0	0	5.00
Percentage	100	0	0	0	0	
It is a waste of time	3	0	0	0	0	5.00
Percentage	100	0	0	0	0	
Teaching aids must be used to teach some math skills	0	0	1	1	1	2.00
Percentage	0	0	33.3	33.3	33.3	4.57

N = 3

Section C (perception of teachers in concrete materials): Meanwhile, Table 5 shows the percentage, mean and overall mean for each items evaluated by teachers to indicate the perception of the used of concrete materials

Table 6: Frequency analysis of concrete materials in a particular topic or skill

Items	1	2	3	4	5	Mean
Counter tool	0	0	0	1	2	4.67
Percentage	0	0	0	33	67	
Abacus	0	0	0	2	1	4.33
Percentage	0	0	0	67	33	
Money toys (false)	0	0	0	1	2	4.67
Percentage	0	0	0	33	67	
Length devices	0	0	0	2	1	4.33
Percentage	0	0	0	67	33	
Measuring instrument	0	0	0	1	2	4.67
Percentage	0	0	0	33	67	
Volume measuring device	0	0	1	0	2	4.33
Percentage	0	0	33	0	67	
Solid model 3 dimension	0	0	0	1	2	4.67
Percentage	0	0	0	33	67	
Place value chart	0	0	0	2	1	4.33
Percentage	0	0	0	67	33	
Sets of math game	0	0	0	1	2	4.67
Percentage	0	0	0	33	67	
Model geometric shapes	0	0	0	1	2	4.67
Percentage	0	0	0	33	67	
Fraction kit	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Hour mini kit	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Multiplication table chart	0	0	0	0	3	5.00
Percentage	0	0	0	0	100	
Basic facts flash cards	0	0	0	1	2	4.67
Percentage	0	0	0	33	67	4.64

N = 3

by teachers at Sekolah Kebangsaan Rawang. There are five positive items and five negative items that included in the questionnaire section. An analysis is used to determine the overall mean of the two types of items.

The overall mean interpretation of the perceptions of teachers on the use of concrete materials is at a high level with 4.57. This was evidenced by the results of the UPSR achievement (long term) which is at a level that convinced, after this concrete material used since the early education of students in this school. Respondents are very positive views about the role of teaching aids in teaching and learning of mathematics. About 67% of respondents agree that the use of teaching aids to enhance interest, involvement and student's understanding of mathematical concepts. The respondents also agreed that the teaching aids can also foster curiosity among students.

Section D (frequency of use of concrete materials): Table 6 shows the frequency analysis of concrete materials in a particular topic or skill. The calculated overall mean has achieved a high level of use in teaching and learning process. This has shown that teachers at Sekolah Kebangsaan Rawang are very committed to use concrete as a medium for delivery in the classroom.

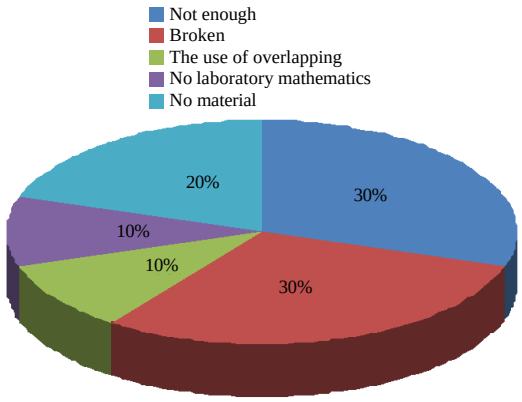

Fig. 1: Percentage of materials used in teaching and learning process

Section E (opinion related to the problem): Below are opinions of respondents to the root of the problem where sometimes concrete material cannot be used in teaching and learning process (Fig. 1):

- Concrete material is not sufficient (30%)
- Most of the teaching aids (concrete materials) have been damaged (30%)
- The overlapping use with other teachers (20%)
- There is no special room for the teaching aids (concrete materials) in mathematics (10%)
- Not in school (10%)

In general, this problem could be divided into two aspects; care management and concrete materials. For the management of the research problems that arise, researchers have to communicate directly with management to update the concrete materials found in this school to help facilitate the use of concrete materials that will remain as a medium of instruction teachers and students in building mathematical concepts. This can be identified when 30% of respondents stated that the opinion of insufficient material and defective in aspects of attention. For aspects of care, the committee necessarily involves mathematics help in conserving and preserving the existing concrete material that is in good condition and ready for use when requested by teachers who want to use it. With the cooperation of both sides, then the concrete material will be used by teachers at Sekolah Kebangsaan Rawang.

CONCLUSION

Based on the findings, it has been proved that the use of teaching aids (concrete materials) is very important in every introduction to the concepts of mathematics in

primary schools. Data analysis shows that teachers have played a proactive role in educate the students and developed an understanding of mathematics. Students also have plays a role that is sensitive towards the use of concrete materials. Interpretation of each survey has shown that Piaget's theory has been proven that the use of concrete objects in the primary school age is very important to develop the concept of a skill or topic. With the establishment of the concept of the concrete material from the beginning this was an opportunity to every child to enjoy the beauty of mathematics itself. Systematic management of materials also plays an important role in helping teachers to use at any time. As such, it can be inferred that concrete materials have shown the importance and effectiveness in the teaching and learning of mathematics in primary schools.

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