

Effectiveness Of Teaching & Learning Mathematics Using Children's Home Language And Cultural Tools

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Abstract: The purpose of this research paper is two-fold. First, the aim is to prove the effectiveness of using children's home language and cultural tools in teaching and learning mathematics at primary school level in Fiji. For privacy reasons, the actual name of the participating school is not mentioned in this paper. Secondly, this paper also demonstrates how practicing teachers can use the problem-solving approach and selective analytics to do research in order to improve their own teaching and learning in the classroom. We believe that the new findings and methods demonstrated in this paper will help improve mathematics teaching & learning processes and motivate teachers to collaborate with fellow teachers and do more researches in their classrooms and to publish their works.

Index Terms: Teaching & Learning, Mathematics, Language, Culture

1 INTRODUCTION

This research uses a problem solving approach to show the effectiveness of using children's home language and cultural tools in teaching and learning mathematics. The research is a Case Study of *year six* students at a primary school in the district of Nadi in Fiji. First, the statement of the problem is highlighted. Second, how the problem is manifested is discussed. Third, possible hypotheses about the problem are generated. Fourth, literature has been reviewed briefly to see what researchers say about the use of culture in teaching and learning mathematics. Fifth, the methodology used to gather information is discussed. Sixth, all data has been stipulated and analyzed and the hypotheses have been prioritized. Seventh, plausible conclusions are drawn highlighting that children's home language and use of cultural tools in teaching mathematics enhances children's performance in mathematics. Eighth, recommendations are made for the improvement of mathematics teaching. Finally, implications of the solutions to the stakeholders are highlighted.

2 BACKGROUND

2.1 Problem Statement

Children in this primary school are not doing well in mathematics. From the internal and external exam results of the children, it is noted that children had difficulties in acquiring good marks in mathematics. Being a multicultural school, where Fijian and I-Taukei children are in majority, mathematics is usually taught using English language. Even teachers in teaching mathematics are confined to texts and teaching aids that are supplied by Ministry of Education and children's home language and materials from children's cultural background (cultural tools) are neglected. As a result of this, children do not find any connection between learning mathematics and their everyday life and thus perform poorly in mathematics.

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We believe that poor performance in mathematics in the school could be due to negligence of children's home language and materials from children's cultural environment.

2.2 Problem Manifestation

I, as the Assistant Head teacher of this school, usually randomly check children's exercise books, teacher's examination and short test files and provide feedback to them. It is noted through children's activities in their book and test results that some children are not able to carry out mathematical problems correctly. Children find it difficult to understand mathematical concepts as they are not able to make connections to their daily life. The terms used in the text books and activities do not resemble children's culture. In addition, teaching aids used by teachers are unfamiliar to children and thus they lose interest in learning mathematics. To show that mathematics teaching and learning is a problem due to neglecting children's culture and mother tongue, a problem solving approach was used on Year Six students.

2.3 Hypothesis

1. Primary school children learn mathematical concepts easily using their home language.
2. Children learn mathematical concepts well when children's culture is embedded in mathematics concepts and ideas.
3. Using materials from children's cultural environment in teaching and learning mathematics to year six children has significant effect on their performance.
4. Mathematics ideas are learnt well when it is related to everyday life of children.

3 BRIEF LITERATURE REVIEW

This research work plans to support the existing literatures on using children's home culture in education. To show the importance of using home language as medium of instruction in teaching and learning process, numerous studies have been conducted. Benson [1] and Effiong [2], highlights that when children's home language is used to teach them, they understand concepts better. Matang [3], states that in order to gain interest in mathematics and make meaning out of what children are learning, their culture needs to be embedded in mathematics. He emphasizes that materials from children's cultural background needs to be used as teaching aids to

make more meaning to mathematics concepts and ideas taught. He also highlights that contextual meaning to abstract ideas needs to be provided in mathematics through culturally inclusive curriculum. In addition, mathematics teaching and learning at primary school level should be made user friendly to the students through incorporating children's home language. According to Israel and Thomas [4], children understand mathematics better when they are taught using their mother tongue. Learning using mother tongue also helps to develop mathematical vocabularies that could be easily used and remembered by students. Furthermore, Vygotsky's Cultural Historic theory highlights that knowledge from children's culture and cultural background should form basis of teaching and learning process [5], [6]. The importance is given to children's mother tongue which helps children to develop mentally and use the ideas learnt from culture to enhance their performance. Niesche (2009), sees the need to embed children's culture in teaching mathematics. From his research in Western Australia, he found out that children performed better when the native language (Kriol) was used instead of English to teach mathematics to the children. He realized that using children's mother tongue in teaching mathematics can become a powerful tool for learning mathematics [7]. I also support the ideas of the respective authors that using home language and materials from children's culture can enhance the teaching and learning of mathematics at primary school level.

4 METHODOLOGY

This problem solving approach employed quantitative and qualitative methodologies. The sample size for this research was forty (twenty (20) students and twenty (20) teachers. The students were randomly selected from two different streams of year six at a Primary School having ten students per stream keeping in mind that all the students were Fijians from Indo-Fijian background. One year six stream was taught by a Fijian teacher from Indo-Fijian background (Experimental Group) where the teacher used children's home language, cultural ideas and materials and everyday life experiences and the other stream was taught by an I-Taukei teacher (Control Group) who did not have much knowledge about student's culture. Quantitative statistics emerged from Pre-Test and Post-Test results which was used to assess children's mathematics test scores of both Year Six streams. Qualitative statistics emerged from oral interviews and observations of students and teachers and the written questionnaires that were disseminated to a sample of twenty teachers at the same Primary School.

5 DATA COLLECTION

Pre- test and Post-test were used as the main form to collect data. Children were given a pre-test on the topic 'Fractions' and the results were noted. After studying for two weeks in Control and Experimental groups, the post-test was conducted. The results of the two tests were later analysed. This method was used so that the performance and progress of the students could be easily monitored. To get the views of teachers on how they teach mathematics to the children in their classrooms and the reason for poor performance of children in mathematics, written questionnaires were directed to the teachers. This method was used so that the participants had ample time to think and express their thoughts carefully. Semi-structured interviews of teachers and students were also

taken and penned down.

6 ETHICAL CONSIDERATIONS

- All the participants' details were kept confidential.
- Head Teachers consent was taken prior to the commencement of the study.
- All the participants targeted for the study were informed in advance.
- No misinterpreted and fabricated data was listed.
- Throughout the research, all participants were treated fairly.

7 DATA ANALYSIS & DISCUSSIONS

7.1 Pre-Test and Post-Test

TABLE 1
EXPERIMENTAL GROUP

STUDENT	PRE-TEST (15marks)	POST-TEST (15marks)
1	7	12
2	12	15
3	5	10
4	6	10
5	10	14
6	8	14
7	6	12
8	11	14
9	13	15
10	7	13

A Conditional-formatting of test scores using color codes is applied in Tables 1 and 2. Colors scale is applied from *dark red* through varying depths to *dark green* in the number scale of 0 to 15 respectfully. Score of zero is coded dark red while a score of 15 is coded dark green. Color coding improves visibility of analytics as demonstrated in Table 1. It can be clearly seen that the post-test results are much better than the pre-test results in the *experimental* group, unlike in the control group in Table 2.

TABLE 2
CONTROL GROUP

STUDENT	PRE-TEST (15marks)	POST-TEST (15marks)
11	6	6
12	12	11
13	11	10
14	6	7
15	8	7
16	7	9
17	13	12
18	9	10
19	5	6
20	5	5

Fig.1 and Fig.2 shows the Pre-test and Post-test results of the students in the experimental group and control group respectively using linear charts and as linear equations. Fig.1, where the teacher is familiar with the home language of the children showed great improvement in children's performance. All the children attained better marks in the post-test compared to the pre-test.

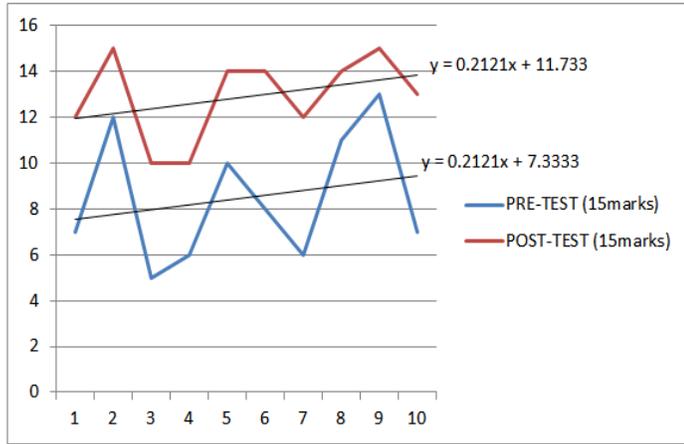


Fig.1. Pre and Post test results of Experimental Group

In the control group, where the students were taught by the teacher who was unfamiliar with children's home language, did not show much improvement. In the control group, 3 out of the 10 students showed improvement by one mark, 2 out of the 10 students did not show any improvement (marks remained constant) and 5 out of the 10 students mark went down.

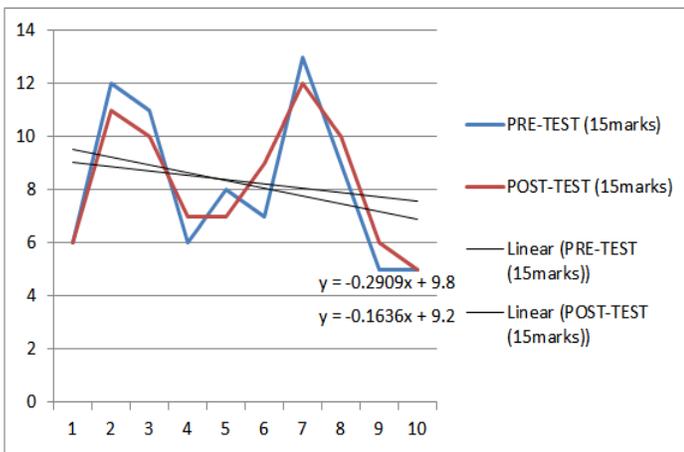


Fig.2. Pre and Post test results of Control Group

The hypothesis that primary school students learn mathematical concepts well using their home language was proven also through statistical analysis. More importantly, in Fig.3 the t-test on experimental group (Table 1) revealed that the difference in performance is not by chance.

t-Test: Paired Two Sample for Means		
	Variable 1	Variable 2
Mean	8.5	12.9
Variance	7.833333333	3.4333333
Observations	10	10
Pearson Correlation	0.889148497	
Hypothesized Mean Difference	0	
df	9	
t Stat	9.731169106	
P(T<=t) one-tail	0.000002	
t Critical one-tail	1.833113	
P(T<=t) two-tail	0.000004	
t Critical two-tail	2.262157	

Fig.3. Experimental Group Pre and Post- test statistical analysis

Thus, the hypothesis that primary school students learn mathematical concepts well using their home language is true.

7.2 Questionnaire

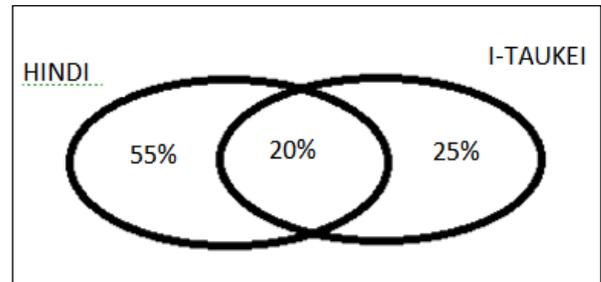


Fig.4. Teachers familiar with children's home language

According to the all the teachers that were interviewed, they had *Fijian*, *I-taukei* and *Other* children in their class. The three major ethnic groups in the school are *Muslims* in majority and having *Christians* and *Hindus* in minority. The home language of the children is *Hindi* and *I-Taukei* language (Fig.4). 20% of the teachers interviewed said that they were familiar with their children's home language. 55% of the interviewers said they were only familiar with the Hindi language whereas, 25% were only familiar with the I-Taukei language (Fig.4). 13 out of the 20 twenty teachers interviewed said that they mostly use English language for teaching mathematics as they have a multicultural class.

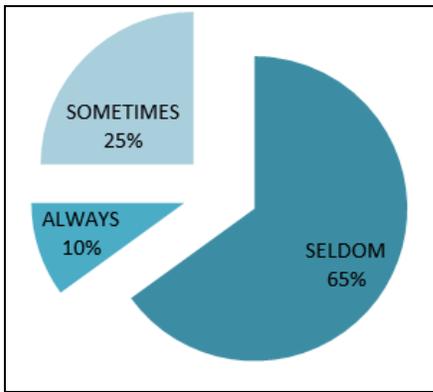


Fig.5. Teacher's Use of children's home language in teaching Mathematics

Fig.5 shows the percentage of teachers who always, sometimes, or seldom use children's home language, cultural ideas and concepts in the mathematics class. Some of the cultural tools used by the teachers in the classroom are Leaves, stones, sticks, bottle tops, beads, coconut mats and fan, coconut shells, seeds, fruits, glass, cup, bowls, and spoons. All the respondents suggested that mathematics teaching and learning should be culturally inclusive. They mentioned that culturally inclusive curriculum brings more meaning to children's learning of mathematical ideas and concepts. 80% of the respondents also suggested that Teacher Training Institutions should offer courses that prepare a teacher to become competent in the cultures present in the Fiji classrooms.

8 PRIORITIZE THE HYPOTHESIS

1. Primary school children learn mathematical concepts easily using their home language.
2. Using materials from children's cultural environment in teaching and learning mathematics to year six children at a Primary School has significant effect on their performance.
3. Children learn mathematical concepts well when children's culture is embedded in mathematics concepts and ideas.
4. Mathematics ideas are learnt well when it is related to everyday life of children.

9 CONCLUSION

From the problem solving approach that was used to gauge the performance of year six students in mathematics, it was found out that children learnt mathematics concepts well using their home language and when teaching and learning was mediated by cultural tools. Children enjoyed doing mathematics when the teaching aids used by the teacher were familiar to the children. By incorporating knowledge from children's cultural background, the mathematical ideas and concepts were very well grasped by the students which were evident in the tests scores and the activities in their book. Children managed to get more correct answers for the oral and written activities. From this study, it was also noted that children who were taught without using their home language and materials from their cultural environment, did not perform well. Their test scores were not good and they got less correct answers for the oral and written activities. Therefore, it can be concluded that the poor performance of students in

mathematics at this Primary school is due to the negligence of incorporating children's home language and materials from children's cultural environment (cultural tools) in teaching and learning process. We need to incorporate culture in mathematics for the better understanding of the concepts and ideas and to make mathematics look realistic to our primary school students who are still going through the development stages of acquiring mathematics skills and ideas.

10 RECOMMENDATIONS

Thaman [8], highlights Lawton's definition of curriculum as 'a selection of the best of a culture'. This definition points out the fact that to bring more meaning to teaching and learning process, curriculum needs to be derived from children's culture and previous knowledge. From the data generated through this problem solving approach, some recommendations can be made regarding improving mathematics of primary school students. Firstly, teachers should use children's home language (mother tongue) apart from using English, to teach mathematics to primary school children. This would enable students to understand instructions and explanations better as they are familiar with their home language. Secondly, teaching aids used by teachers to teach mathematics should be materials from children's cultural background. Using familiar materials would bring more meaning and enable children to learn better. For example, the concept of patterns in mathematics can be taught using mats as weaving mats form patterns. Moreover, geometry can be taught using household items such using a cup for a cylinder, box (carton) for cube and cuboids, funnel for a cone, etcetera. In addition, activities and exercises given to children should relate to their everyday life. It should not be merely numbers as it does not make any meaning to children rather concrete materials should be used. For example, to teach $3 + 3 = 6$, teachers can use 3 mangoes + 3 mangoes = 6 mangoes. Furthermore, knowledge from children's cultures should form basis of their learning. For example, the concept of Fractions can be taught to children of a Muslim Primary School using Islamic culture. In Islamic culture, roti is divided into four (4) parts before eating and water is drank in three (3) sips, which resembles quarters ($1/4$) and thirds ($1/3$) respectively in mathematics. Moreover, teachers should be given a chance to do refresher courses on different cultures that form their classroom so that they can use ideas and knowledge from these cultures to teach their students effectively. In addition, teacher training institutes in Fiji should provide adequate and relevant training courses on the different cultures that are found in the multicultural classrooms in Fiji schools. Finally, teachers need to incorporate more hands-on activities in classrooms so that children explore the mathematical ideas themselves. As Fiji school classrooms consists of large number of students, teacher helpers who are familiar with children's culture needs to be planted in the classrooms who can guide children in carrying out mathematical activities.

11 IMPLICATIONS OF THE SOLUTIONS FOR STAKEHOLDERS

The recommended solutions also have implications on the stakeholders (the students, parents, teachers, school managements, community members and The Ministry of Education) of Fiji schools. Firstly, as teachers need to be competent in children's home language in order to bring more meaning to teaching and learning process, refresher courses

on children's home language needs to be organised for the teachers by the school. This would mean extra burden on the school to see that appropriate knowledge is disseminated to teachers through such courses. Secondly, teachers would need to find time in order to upgrade themselves so that they become competent in their children's culture. This would mean that teachers would have to sacrifice their time and money for the betterment of their children's learning. Moreover, the school would have to supply adequate teaching materials and aids from children's culture so that mathematics teaching makes more meaning to the children. In addition, encouraging hands-on experience would mean availability of adequate resources, resulting in more expenses for the school. Furthermore, having teacher helpers in each classroom would increase the expenses of Ministry of Education as they would have to pay for the extra teachers. Finally, the Teacher Training institutes would have to incorporate courses which would teach about the different cultures present in Fiji schools classroom so that upcoming teachers are competent in these cultures.

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