RELATIONSHIP BETWEEN NUMBER CONCEPTS AND COMPUTATIONAL PERFORMANCE AMONG PRIMARY SIX PUPILS IN BAUCHI STATE

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Abstract

The study investigated the relationship between number concepts and computational performance among primary six pupils in Bauchi State. The design for the study was purely correlational and the instrument used were test items. The correlation coefficient between "number concept and computational performance was found to be very low, but significant at 0.05 level of significance. Boys and girls performed at different levels on computation. Interview results revealed that pupils tended to rely more on rule-based technique than on non-computational approaches. The findings of the study support the claim by Mclntosh et al (3992) that high skill in written computation is not necessarily accompanied by number concept. Hence the need for teachers to look beyond correct answers to ensure that pupils understand the numbers they compute.

Introduction

There is a general consensus among mathematicians and mathematics educators that more emphasis should be placed on proper understanding of basic mathematics concepts and processes and their application to every day life in the schools (Foxman et al, 1978; Ann, 1981; Lassa & Paling, 1983; Renate, 1987; Ibeaja & Nworgu, 1989). This is so, because the ability of a pupil to recall and manipulate formula in mathematics does not by itself indicate a thorough understanding of mathematical concepts and processes.

Ann (1981) explained that emphasis should be placed not only on mechanical memory but also on memory that is assisted by reasoning and understanding. Foxman et al (1978) noted that even though eleven year old children were seen to solve mathematical problems involving fundamental concepts and skills to which they have been introduced, there was sharp decline in their performance as their understanding of the concepts was probed more deeply.

According to Harbor- Ibeaja & Nworgu (1989) the recent primary and post primary schools mathematics curricula seem to place sufficient premium on the proper understanding of basic mathematical concepts and processes, and the application of these to every day problems.

The National Policy on Education (FRN, 1981) revised edition states among others the general objectives of primary education in section 3, paragraph 14; as

(a) The inculcation of permanent literacy and numeracy.
(b) The laying of a sound foundation for scientific and reflective thinking.

This notion of numeracy has been misconstrued by many practicing teachers to mean ability to compute only. Ann (1981) emphasized that the notion of numeracy should certainly include more than accurate computation, it should include among others the ability to apply knowledge in fresh circumstances. Some pupils and students alike have a quick way of learning standard answers to standard questions, and this gives a false impression of knowing a concept.

Odili (1986) noted that a student may be conversant with the technicalities of linear equation without having much idea what sort of a thing a linear equation is. This is an indication that there is absence of conceptual learning in our schools.

The need for conceptual learning and mastery of skills is emphasized in the mathematics curricula of both primary and secondary schools (Lassa & Paling, 1983; Harbor-Ibeaja & Nworgu, 1989). A successful problem solver must acquire relevant conceptual and procedural knowledge (Oladunmi, 1998), which are essential in the learning of mathematics (Lorna, Peter & Rosemary, 1988).

This study was earned out to determine the relationship between conceptual procedural and knowledge. Harold (1987) stated that research needs to be carried out to determine the relations between computational proficiency and conceptual understanding. Reys & Yang (1998) stated that even though pupils were highly skilled in paper /pencil examinations,-their performance on number sense was very weak, especially when their understanding of the numbers computed was probed through interviewing some of those who scored high on both computation and number sense items.

It is obvious from what has been documented by researchers that there is problem with the learning of mathematics. There seems to be absence of conceptual understanding among pupils and students alike hence the need for a study of this nature.

Hypotheses: The following hypotheses were tested:

HOi: There is no significant relationship between scores obtained on number concept and those o written computation.

HO_2: There is no significant difference between the means performance of boys and girls on number concept.

HO_3: There s no significant difference between the means performance of boys and girls o -written computation.

Methodology

In the study one thousand two hundred and sixty (1,260) pupils were directly involved. This number was selected by cluster sampling technique from four local Government Areas in the state. The instrument used for data collection included a 35 item Number Concept Test (NCT) and a 25 item Written Computation Test (WCT). Both instruments were constructed in line with the national mathematics curriculum. The items on NCT included fill in the blanks, multiple choices with short answer and a variety of others, while the WCT items were open-ended.

The reliabilities of the test items were established by Kuder-Richardson formula 20, and they were found to be 0.81 for NCT and 0.92 for WCT. Gronlund (1985) stated that teacher made tests commonly have reliabilities between 0.6 and 0.9. These values are in line.

Results

The table below is a correlation table, showing the frequencies in each class interval. It shows the frequency distribution of marks of the pupils in Computation and Number concepts.

Table 1: Frequency Distribution of the Marks of the Pupils in Computation and Number Concept

Comput.	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	Total
Concept										
3-7	65	110	90	45	15					20-24
8-12	19	90	50	236	80	20				495
13-17	21	45	15	100	35	32	83	7	7	345
18-22	0-4	25	10	13	10	2				60
23-27				11	5	3	-			19
28-32					5	3	7			15
33-37								1		1
	105	270	165	405	150	60	90	8	7	1260

From Table 1, the performance of the pupils on computation is seen to concentrate within the class interval 15 - 19 with a frequency of 405. On the other hand, the performance of the pupils on number concept clustered in the class interval 8-12 with a frequency of 495. Thus the model class is 15-19 for computation and 8-12 for number concept.

The correlation coefficient between the performance of pupils on computation and number concept was calculated using the Pearson product- moment correlation and the correlation coefficient was found to be 0.42. This indicates positive or direct relation between the variables under study.

To test the significance of the coefficient of correlation, i.e. null hypothesis 1,

$$Z = \sqrt{\left(\frac{n-3}{2}\right)} L_n \frac{1+r}{1-r}$$

was used. The results of the calculation are shown in Table 2.

the z -statistic

Table 2: Test for the Null Hypothesis (r = 0)

r- Value	z- cal	z - en	Dec
0.42	**15.88**	**1.96**	**S**

Since z -calculated exceeds z - critical, the null hypothesis I was rejected in favour of the alternative, The second hypothesis was tested using a two - tailed t - test of difference. The results of the calculations are shown below.

Table 3: Two -Tailed t-Test of Difference Between the Means of the Scores of Boys and Girls on Number Concept Test

	Mean	s.d.	N	Df	Std.erro	t-cal	t-cri	Dec
Boys	11.08	5.15	790	1258	0.29	0.34	1.96	NS
Girls	10.98	4.91	470					

The results in Table 3 shows t-calculated is less than t-tabulated. Hence the null hypothesis is upheld.

The third hypothesis was also tested using a two-tailed t-test of difference. The results of the calculation are shown in Table 4.

Table 4: T-tailed t-test of Difference Between the Means Performance of Boys and Girls on Written Computation

	Means	**s.d.**	**N**	**df**	**std err.**	**t-cal.**	**T-tcri**	**Dec**
Boys	**15.75**	**8.82**	**790**	**1258**	**0.47**	**2.25**	**S**	
Girls	**14.7**	**7.4**	**470**	**1.96**				

The results in Table 4 showed that t-calculated exceeds t-tabulated or critical. Hence the null hypothesis (HOB) is rejected in favor of the alternative.

Discussion

A closer look at the performance of the pupils on written computation and number concepts shows that they performed better on computation than on number concepts. This is an indication that the pupils have had some mastery of the procedural knowledge, A similar situation was found when Reys & Yang (1998) carried out a study on the relationship between number sense and computation among Taiwanese students.

The correlation coefficient found, even though low, was tested and found to be significant. Discussion with teachers and pupils revealed that the items on written computation were familiar whereas those on number concept were found to be challenging both to teachers and pupils as the format for the number concepts items was a new experience to them. This reveals that teachers have not been asking such questions as asked in the number concept test items,

It was found that boys and girls performed on the same level in number concept. And their scores were generally very low. Carmichael (1986) found that students performed poorly in cognitive areas, implying that there is no conscious effort by teachers to emphasize the teaching and learning of mathematical concepts.

The boys were found to perform differently on written computation from the girls, computation is the aspect that is stressed more in the teaching of mathematics. And it seems the emphasis placed on standard written algorithms in our schools influence pupils thinking and approaches.

Interview Results

Sixteen of the pupils involved in this study were randomly selected and interviewed. Ten of the pupils in the high level and six of those in the middle level on both variables were interviewed. During the interview, it was clear that there was a sharp distinction between the level of number concept possessed by the high and middle level pupils. For instance, in responding to the question, which is greater 1/2 or 1/3?", the pupils in the high level had no difficulty in giving satisfactory explanation. However, no middle level pupils responded correctly by giving satisfactory explanation .The common belief seemed to be that 1/3 is greater than 1/2 since 3 is greater than 2. Most of the high level pupils responded correctly to the ordering item, Arrange the number in order of size, beginning with the largest, 1/2, 0.6, 0.50,1,1/5'. However, they were able to do this only when the fractions were converted to decimals. A pupil responded that without changing fractions to decimals it would be impossible to compare them.

Comments from the pupils revealed the fact that they considered fractions and decimals to be different entitles and did not make any connections between them. This agrees with the finding of Reys and Yang (1989) with Taiwanese students who were much less successful in ordering fractions, but could order the decimals. It is also in agreement with Adetula (1989) and Harbor- Ibeaja and Nworgu (1989) who reported that in our schools, Mathematics facts are learnt in a disconnected manner and can lead to rote learning.

One of the pupils who said that 1/3 is greater than '/•>, because 3 is greater than 2, was able to simplify 2 % -l[l]/2 showing all workings. But this pupil could not make use of non-computational approach, which relies on number concept to solve the problem or a similar one even with additional encouragement from the researcher. Most of the responses of the middle level pupils relied on standard written algorithms that are taught in mathematics class. Any deviations from such were viewed as something entirely new or unfamiliar. The interviews helped to reveal the tendencies of the pupils to rely on specific approaches. Although the skill levels and specific responses to the questions differed among the 16 pupils interviewed, their reliance on standard written algorithms as their initial approach to each question was invariant. The written algorithms emphasized in the teaching of mathematics have impacted the pupils thinking and approaches to learning mathematics.

Recommendations

a. Workshops and seminars should be organized for teachers of primary schools to help them improve upon their methods of teaching.
b. Class teachers should look beyond correct answers; they should ensure that pupils understand the numbers that are being computed by them. Emphasis should be both on the ability to. compute and the understanding of the concepts involved.
c. It is recommended that teachers should practicalize their teaching as well as confront pupils with situations that would enable them conceptualize mathematical concepts

Conclusion

This study is purely a correlational one. It is not a cause and effect relationship. The findings could be used as basis for other studies as the interview results were most revealing, It is evident from the study that most pupils learn in a disconnected manner. Competence in mathematics is a combination of procedural and conceptual knowledge, hence there is need to pay equal attention to both aspects.

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