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Effects of Counters on Concept Formation on Addition on Primary One Pupils with Arithmetic Difficulties in Otana Integrated School Jos, Nigeria

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Abstract
T*he research aimed at finding out the effects of counters on concept formation on addition on primary one pupils with arithmetic difficulties in Otana Integrated School, Jos. The work focused on the early primary educational experiences of pupils. The study used the true experimental research design, with a sample of ten (10) pupils randomly shared into experimental and control groups. This means five (5) sample each for the experimental and control groups. The experimental group was taught using counters, while the control group was taught without using counters. The instrument used was teacher-made test for both the pre-test and post-test. The generated data was analyzed using t-test for related sample, mean, percentages and standard deviation. The results indicated that the experimental group performed better than the control group. Provision of counters is recommended for pupils with arithmetic difficulties since it enabled them to recall basic arithmetic procedures.*
Keywords: Counters, Concept, Formation, Addition, Arithmetic, Difficulties

Introduction

People of many different civilizations in ancient times have used physical objects as counters to help them solve every day mathematical problems. Counters are defined as "physical objects that are used as teaching tools to engage pupils in the hands-on learning of mathematics" (Furner & Worrell, 2017). Balka (1993) stated that counters help pupils at all grade levels to understand processes, communicate their arithmetical thinking, and extend their mathematical ideas to higher cognitive levels. Fierro (2012) and Butterworth and Laurillard (2010) opined that Counters can be purchased at a store, brought from home, or teacher- and pupil-made. They range from dried beans and bottle caps to unfix cubes, olive seed and base-ten blocks. They are used to introduce, practice, or remediate a mathematical concept.

The experience of one of the researchers as a pupil, on how arithmetic was taught far back in the primary school days was very discouraging. The mood on the teachers' faces scared this researcher and her classmates. The subject was boring; the teachers were not smiling and were not friendly. Teachers were always talking to the blackboard; would write the subject and topic, then begin to solve some problems alone and a pupil dared not talk, let alone question the teacher, after which the teacher would give class work. The class work always looked different from what he/she had taught earlier. This made the subject more abstract and complex. It was not concrete and had no teaching aids, and the like. This created in the pupils fear and hatred for figures and the subject. Things changed a little in the few years of junior secondary school. At that time, the teacher was a little friendly but the teaching was still abstract. The senior secondary school was no better at all, because the pupils failed mathematics. However, this researcher re-registered and with the help of her sibling who coached her, she started developing interest in it. The opinion of this researcher is that if arithmetic was taught concretely and with some interaction with pupils, it will not be dreaded and pupils will not opt out of the subject. It is on this ground that this researcher feels that using concrete objects like counters, which should begin from the primary school, would be of help as that is the foundation of education. It is a crucial foundation upon which future mathematics will be built. It has also become increasingly clear that young children's early educational experiences have an impact on later outcomes (Sylvia, 2009), both in terms of educational achievement and also in the attitudes towards subjects. Glauert and Manches (2013) assert that early numerical skills are accurate predictors of later arithmetic achievement. The researchers intend to use counters to improve addition for primary one pupils with arithmetic difficulties.

Addition, according to Fierro (2012), is the basic operation of arithmetic. In its simplest form, addition combines two numbers, the *addends* or terms, into a single number; this implies the *sum* of the numbers (such as 2 + 2 = 4 or 3 + 5 = 8). Adding more than two numbers can be viewed as repeated addition; this procedure is known as summation and includes ways to add infinitely many numbers in an infinite series; repeated addition of the number 1 is the most basic form of counting. Addition is written using the plus sign "+" between the terms; that is, in infix notation. The result is expressed with an equals "=" sign.

Arithmetic, according Gumut (n.d.), is defined as a science of numbers and computation with them; more specifically, addition, subtraction, multiplication and division. He went on to say that arithmetic is concrete in nature. It deals with concrete entities, and the symbol system of arithmetic is far removed from actual manipulation of objects. Among the concepts embodied in this are quantity, size, order, relationship, space, form, distance, and time. It is the elementary branch of mathematics. Arithmetic is the bedrock of science, technology and development. Unfortunately, despite its importance, it has not been given the required attention. This has resulted in the misconception that the subject is difficult; as a result, negative emotional problems are experienced by struggling learners.

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Primary Education is the education given to pupils in primary school from age 6 to 12. The primary level, in particular, primary one, is the key to the rest of the education system as well as key to the success or failure of the whole system. The National Policy on Education (FRN, 2004), states one of the goals of primary education to be "to inculcate permanent literacy and numeracy, and ability to communicate effectively". The researchers intend to use counters to improve addition for primary one pupils with arithmetic difficulties.

Several studies conducted in different countries over the past decades have consistently showed that difficulty with arithmetic is a common problem (Dowker, 2013), leading to pupils leaving school with insufficient skills (functionally illiterate in the domain of arithmetic), restricted employment options and menial, often low-paying jobs. While arithmetic achievement differs between countries, arithmetic difficulties seem to be a problem everywhere.

Arithmetic is one of the areas of deficiency among learners. Arithmetic or mathematics has been a dreaded subject by many Nigerians. The effects of mathematics failure throughout the years of schooling coupled with mathematics illiteracy can seriously affect both daily living and vocational prospects, as many have opted out of the sciences due to their inability to do Arithmetics.

Recently, increased attention has been focused on pupils who show challenges learning mathematics skills and concepts that are taught in schools across levels. Beginning as early as preschool, parents, educationists and researchers are noticing that some pupils seemed perplexed learning simple mathematics skills that may be taken for granted. Diane (2008) holds that some young pupils have difficulty learning number names, counting and recognizing how many items are in a group. Some of these pupils continue to demonstrate problems learning mathematics as they proceed through school. However, using counters can help to promote the concept formation of addition for pupils with arithmetic difficulty, and counters can also help to improve the reasoning levels of these pupils.

It was from this point that the researchers understood that pupils in primary one, which is the foundational stage of education, should not be left out, hence the need to catch them young and to start at that level. As such, the researchers investigated the effect of using counters to develop concept formation of addition.

Objective of the study

The main aim/objective of the research work is to examine:

1. The effects of counters on concept formation on addition on pupils with Arithmetic difficulties in primary one.

Research Question

1. What will be the effects of counters on concept formation on addition on pupils with Arithmetic difficulties in primary one?

Hypothesis

Ho1: There is no significant mean scores difference of counters on concept formation on addition on pupils with Arithmetic difficulties in primary one after treatment.

Research Methodology

The research design adopted for this study was the true experimental design. In this design, there were two groups. The experimental group was exposed to treatment, while the control group was not exposed to treatment (Awotunde & Ugodulunwa, 2004). The population of this study comprised of all primary one pupils who were twelve (12) in number. The pupils were those who had not acquired arithmetic skills using counters. The researchers used Primary School book 1 test to establish the base line and got the sample (10), out of the population. These were pupils identified as having arithmetic difficulties. The sampling technique that was used in this study was the simple random sampling techniques. Therefore, ten (10) pupils identified with arithmetic difficulties were selected for the study. The pupils were again randomly shared in two groups to form the control and experimental groups. This means that there were five pupils each in both groups.

The study employed the teacher-made tests, for the pre-test and post-test, to collect data for the study. There were twenty questions which carried five marks each. The pre-test was used to determine the extent to which pupils had acquired arithmetic skills involving basic operations without using counters. The post-test was used to measure the extent to which pupils with arithmetic difficulties acquired addition skills after intervention using counters. The results of the pre-test and post-test assessments were used to show the difference. To ascertain the validity of the instrument, the instrument was subjected to expert judgment and scrutiny. The researchers ensured the degree of validity, which the instrument kept by measuring what it is supposed to measure.

The researchers wrote to seek the consent of the head teacher of Otana Integrated School, Jos. While delivering the letter, the investigators took time to explain the purpose of the study. The investigators also took permission from the head teacher to use all pupils in primary one and subsequently those with arithmetic difficulties. Permission was granted to conduct the research at a very convenient time that did not interfere with pupils' academic activities.

The study was an experimental research. The type of the experimental design used was the pretest-posttest control group design. The motive for using pretest–posttest design was that it helped evaluate the changed scores of the Experimental and Control groups.

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The treatment in this study was counters and the dependent variable was Concept Formation in Addition. The treatment lasted for six weeks. In this study, the subjects were randomly assigned to experimental and control groups. Both experimental and control groups were administered the pretest before the commencement of the treatment, then the experimental group was exposed to the treatment (X) to establish the effects of counters on concept formation on addition on primary one pupils with arithmetic difficulties. At the end of the treatment, a posttest was administered to both groups; those were, experimental and control groups on the teacher made test.

The data generated was analyzed; the research questions were answered using mean and simple percentage, while t-test statistics was employed in testing the hypotheses at 0.05 alpha level. The control group was pre-tested but was not given treatment; it was also post-tested. The formula for computing the t-test for two related samples is:

$$t = \frac{\sum d}{\sqrt{\frac{n\sum d^2 - (\sum d)^2}{n-1}}}$$

Where:

d= Difference between each paired observations

d^2 = The square of the difference between each paired observations

$\sum d^2$ =Sum of the square of the difference between each paired observations

n = Total number of paired observations

n- 1 = Number of degrees of freedom.

$$\text{Formula for percentage} = \frac{\text{No}}{\text{total No}} X \frac{100}{1}$$

Presentation of results

Research Question 1: What will be the effects of counters on concept formation on addition on pupils with Arithmetic difficulties in primary one?

Table 1: Analysis showing pre-test/post-test scores and mean gained by pupils with arithmetic difficulties on addition by the experimental group

Pre-test Experimental Group	**Post-test Experimental Group**	**Mean Gained** (d)	**d^2**	**Pre-test Control Group**	**Post-test Control Group**	**Mean Gained** (d)	**d^2**
20	80	60	3600	30	30	00	000
00	80	80	6400	20	30	10	100
40	70	30	900	40	30	-10	100
40	80	40	1600	10	20	10	100
20	90	70	4900	30	30	00	000
400/5=8		120/5 =2.4		280/5 =7.6		$\sum d^2$ = 174 00	

Table 1 revealed the scores and mean gained by pupils with arithmetic difficulties on addition by the experimental and control groups. Before intervention, both experimental and control groups had low scores. On the other hand, after treatment, the experimental group showed high gain of scores, while the control group still showed low gain of scores after treatment. This implies that majority of the pupils with arithmetic difficulties on addition in the experimental group showed high score gain after being exposed to treatment; indicating effect of counters on concept formation on addition on pupils with Arithmetic difficulties in primary one.

Hypothesis

Ho1: There is no significant mean scores difference of counters on concept formation on addition on pupils with Arithmetic difficulties in primary one after treatment.

$$t = \frac{\sum d}{\sqrt{\frac{n\sum d^2 - (\sum d)^2}{n-1}}}$$

$$t = \frac{280}{?\frac{8600}{4}}$$

$$t = \frac{280}{?\frac{2150}{4}}$$

$$t = \frac{280}{46.37}$$

$$t = 6.04$$

$$df = n-1 = 5-1 = 4$$

$$\text{critical region } \alpha = .05$$

$$t = 6.04 \text{ (calculated t value)}$$

Therefore table value/critical t value, where df =4 and level of significance =0.05 will be 2.776. Therefore critical t value = 2.77 (2 decimal places). Since the calculated t (6.04) is greater than the critical t (2.77), the decision is to reject the H_0. This means there is significant difference between the mean score gained by pupils in the experimental and control groups in addition.

Discussion of the findings

Analysis and interpretation of data collected for the research study on the effects of counters on concept formation on addition for primary one pupils with arithmetic difficulties, revealed that pupils taught using counters performed better than those taught without counters in basic computation skills involving the use of addition. This is

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in line with Balka (1993), who reported that "counters help pupils at all grade levels to understand processes, communicate their arithmetical thinking, and extend their mathematical ideas to higher cognitive levels." In conclusion, it is understandable that counters, an arithmetic resource, can be used to acquire basic arithmetic skills in primary schools. Therefore, calculations using counters require a mastery over a period of time anywhere and at any time to allow proficiency in operations with counters in addition.

Conclusion

The usefulness of counters to learners can never be over emphasized. Counters often help pupils, especially at the early primary school level, to understand arithmetic processes, communicate arithmetical rationales and extend mathematical ideas to higher cognitive levels. Counters have significant effects on concept formation on addition on primary one pupils with arithmetic difficulties.

Recommendations

It is important for professional bodies such as National Association for Special Education Teachers and Counselling Association of Nigeria to run programmes encouraging the use of counters in primary schools, homes and in the general society. Counters should be provided to schools by Government and school administrators for pupils with arithmetic difficulties since it enables these pupils to recall basic arithmetic procedures.

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