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Evaluation of the Knowledge and use of Abacus on the Academic Performance of Pupils with Visual Impairment, Ganaka International School Jos, Metropolis

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Abstract
This study carried out on an evaluation of knowledge and use of abacus on the academic performance of pupils with visual impairment in Mathematics, Ganaka International School Jos, Metropolis. The aim of the study was to evaluate the knowledge and use of abacus on the academic performance of pupils with visual impairment in Mathematics. The descriptive survey research design utilized for this study. Two research questions were formulated to guide the study. The population for the study comprised of 80 pupils with visual impairment in Ganaka International School Jos, Metropolis. The sample size of this study comprised of fifty (50) primary three (3) pupils with visual impairment. One instrument was used for this study which is questionnaire on evaluation of knowledge and abacus usage (EKAU). The findings of the study showed that pupils with visual impairment did not have much knowledge on the use of abacus in mathematics in Ganaka International School Jos, Metropolis. The level of abacus usage in teaching mathematics among pupils with visual impairment in Ganaka International School Jos, Metropolis is low because it is not available in the school. To a great extent abacus influence the addition and subtraction knowledge of numbers among pupils with visual

impairment Ganaka International School Jos, Metropolis when they are exposed to the used it. To a great extent abacus affect the academic performance of pupils with visual impairment in mathematics. Based on the findings, the researcher recommended that Pupils with visual impairment should be adequately taught the used of abacus to solve mathematics. The government or school management should ensure that abacus are available for teachers to use in other to expose the pupils with visual impairment to learn. The government should organised training and retraining for teachers on the usage of abacus.

Key Words: Evaluation, Abacus, Academic Performance, Visual Impairment

Introduction

Mathematics science is a core subject in Nigeria where pupils were performing well in calculation and also a core subjects in all levels of education. It has a lot of valuable benefits in all human endeavour. Mathematics is a daily experience or actions exercised on things in the environment. Thus**,** Mathematics is a subset more practical than theory. It involves a lot of mental constructions which are derived from actions performed on or with materials which may be concrete, semi-abstract or abstract progressively as the pupil matures and the concept becomes complex. Mathematics is simply concerned with the science of structure, order, numbers, space and quantity. It is concerned with the elementary practice of counting, measuring and describing of shapes and objects (Dowson, 2019). Descriptive mathematics is a branch of mathematics which deals with the study of properties of figures and shapes, and the relationship between them. Basic mathematics allows us to determine properties such as the areas and perimeters of two-dimensional shapes and the surface areas and volumes of three-dimensional shapes. However such concepts can only be known to a person with visual impairment through direct contact.

The term visual impairment covers a wide range of uncorrectable visual disorders including low vision and total blindness. According to Dutton (2023) visual impairment is defined as a reduction in visual acuity (age-adjusted) or field loss as a result of a problem within the visual pathway (a problem within the eye, optic nerve, or occipital cortex). The eye is considered as an extension of the brain by so many

authors. Visual impairments that are related to the optic nerve or occipital cortex or the brain are usually not seen on the eye of the child. It is difficult for many teachers to believe that such a child does not see because the eyeballs seem intact. The researcher observed that most children with mental retardation also experience visual problems.

According to Bob, (2022) states that, the visually impaired born blind may have restricted concept development because of lack of vision. This is because vision plays an important role in environmental input. What children see, they assimilate and integrate in the brain. Another way of visual impairments typically slow development is by making it harder for children to learn from experience without their parents or teachers doing anything out of the ordinal, to teach them. This is called accidental learning. What pupils with visual impairment experience are that they are often fed with symbolic materials through text-books where available or the teacher talks. The consequence is that concepts are not properly formed. Pupils with visual impairment in Jos Plateau State, have not been given the proper, relevant and adequate exposure to teaching and learning of mathematics using Abacus that will enable them to have concepts and skills. The researcher is of the view that usage of abacus as an adapted strategy could first be presented practically and through other sensory modalities and eventually transfer these information through embossed form to abstract form or mental imagery for better task performance in mathematics.

Abacus is a classic tool consisting of a simple wooden frame with beads, making it portable and flexible in usage. It is used worldwide for teaching basic arithmetic in elementary classrooms. Abacus is useful because it helps to develop speed and accuracy of calculations (Stigler, 2019). It can be used to provide a sound basis for mathematical calculations like addition, subtraction, multiplication, and division. It can also be used to carry out calculations involving fractions and decimals, as well as an aid in completing arithmetic operations included in higher level mathematics (National Research and Development Institute NRDI, 2016). According to Tanaka (2022), research has showed that skilled Abacus users are able to perform quick and accurate mental calculations using visual imaging of the manipulative. Several studies have reported improvements in the numerical ability of subjects trained to use an Abacus. For instance, Hatano and Osawa (2019) reported that elementary school pupil trained to use an Abacus, performed significantly better on tests of calculation speed and accuracy compared with those

who were not so trained. The numerical ability of Abacus users has inherently been better, as pupils tend to benefit from Abacus training. In addition, it was found to boost confidence in pupils and consequently increase their interest in maths (Foong, 2019).

The abacus calculation methods help individuals with visual impairment in learning in number manipulation skills, decimal grasp and digit correlation among other skills. In this regard, pupils with visual impairment can use the abacus skills to calculate arithmetical problems rapidly. The level of abacus usage is very high dew to its importance in solving mathematical problems to the pupils with visual impairment. The researcher has observed that later on, the pupils can also perform the calculations without using the abacus, by just visualizing the abacus in their minds. The Abacus education also helps them develop new and innovative methods of mastering arithmetic, rather than being dependent on just the orthodox methods of learning calculations otherwise taught by the conventional education system. Abacus answers the primary need of the pupils to make fast and accurate calculation.

However, it is becoming normal expectation in some parts of Nigeria for pupils with visual impairment not to offer mathematics. To suggest teaching mathematics to pupils with visual impairment was like talking about impossibility. This situation became a cause of worry to the Nigerian federal ministry of education. The federal government had to send letters to all heads of special integrated primary and secondary schools and teacher colleges stating that mathematics had been made compulsory for "blind" pupils (Federal Ministry of Education (FMOE, 2004). This was to compel teachers and pupils with visual impairment to take deliberate steps to teaching and learning mathematics. It further stated that pupils with visual impairment must have a pass in the subject before they were admitted into any tertiary institution. After many years now this order from federal government could not be complied with.

The teaching and learning of mathematics for pupils with visual impairment in Nigeria has remained a great challenge to both the teachers and their children. In the past pupils with visual impairment in most cases are exempted from offering mathematics but few primary schools in Plateau State like School for the Blind Gindiri, Otana Integrated School, Ganaka International School Jos Plateau State, Nigeria and the likes have given room for pupils with visual impairment to display their ability in studying in mathematics. Though the main problem faced in teaching pupils with visual impairment is that some teachers lack the adapted

strategy or methodology to use in teaching the pupils mathematics. Experience has also shown that lack of adapted materials or assistive devices they would use in teaching the subject and the skills to operate the devices is problematic. These materials include adapted mathematics kits, are embossed protractors, brailled T-Squares, rulers, rubber mat and polythene sheet for drawing. This has resulted in low participation pupils with visual impairment in Nigeria.

Jurmang (2016) opined that pupils with visual impairment require is modification or adaptation of the strategies or teaching methods and devices used by teachers enable them develop their full potential. Pupils with visual impairment live in a three Dimensional world e.g their system of writing the Braille (has to be three dimensional in nature). The traditional oral method of instructions and writing on the board during mathematics lesson are difficult and challenging for pupils with visual impairment to be used with them in the classroom.

In comparison, the results of pupils with visual impairment with their sighted peers in Nigeria, the West African Examination Council (WAEC) (2021) reported that although pupils with visual impairment had better results than their sighted peers, in its 2021 examinations, pupils with visual impairment did not write mathematics in the examination. Similarly in November/December 2021 results, WAEC reported that only 37.97% (150,615) sighted candidates pass with five credits including English and mathematics. Their peers with visual impairment in the same year and the same examination had 46.93% (49) pass which was a higher percentage result than their sighted peers. These 46.93% (49) candidates with visual impairment who obtained five credits including English language unfortunately did not sit for mathematics and science practical in the WAEC examination (National Research Development Institute (NRDI, 2022). This situation of pupils with visual impairment not writing mathematics in such a national examination has been on for quite some times in the country. When teachers omit pupils with visual impairment from offering mathematics as is the case often, they have omitted them from the regular syllabus. This may be due to the poor knowledge and used of Mathematical devices such as abacus. Therefore it is light of the above that the researcher intent to evaluate the knowledge and use of abacus on the academic performance of pupils with visual impairment, Ganaka International School Jos, Metropolis

Statement of the Problem

The problems that necessitated this study is the poor performance of pupils with visual impairment in primary schools this may largely be due to inadequate used

of devices such as the abacus. The teaching of addition subtraction, multiplication and division of numbers in mathematics can take several forms and can be carried out through different aids as well as situations or through the use of abacus. Unfortunately sometimes lessons depend too much on exposition from the teacher's part and a passive style of learning from the part of the pupils which promotes rote learning or non-participation in the subject. The researchers view that lack of experience with concrete objects for manipulation with hands and fingers, the use of abacus, embossed diagrams and the opportunity to experience in real life constitute some problems being face by teachers in teaching mathematics to pupils with visual impairment.

On the other hand inability of using adapted strategies and devices can make learning of mathematical concept difficult for pupils with visual impairment. Thus, unfortunately the restriction visual impairment imposes on the life of pupils with visual impairment makes their contact with the environment difficult and thus teaching learning generally. Teachers hardly understand or take the risk of exposing the pupils to the environment to experience and manipulate concrete objects for the purpose of teaching and learning addition and subtraction numbers in mathematics. Similarly inadequate instructional tools/devices and inactive teaching methodologies can cause mathematics anxiety in pupils. Pupils with visual impairment like their sighted peers have negative attitude towards mathematics and perform poorly in the subject. This was largely one of the reasons why they were exempted from offering the subject over the years. More so, pupils with visual impairment also strongly believe that they cannot do mathematics is a wrong notion as acclaimed. The first pupils with visual impairment to write a national examination made a Division 1 in his West African School Certificate (WASC) did not offer mathematics (Jurmang, 2019). Unfortunately the effective used of abacus in mathematics classroom for teaching and learning amongst pupils with visual impairment is lacking. Based on the problems stated above, the researcher want to find out that could be the problem why pupils with visual impairment performed poorly in Ganaka International School Jos, Metropolis.

Aim of the Study

The purpose of this study is to evaluate the knowledge and use of abacus on the academic performance of pupils with visual impairment, Ganaka International School Jos, Metropolis. Specifically the objectives of the study are to:

1. Determine the extent to which pupils with visual impairment knowledgeable in abacus usage in mathematics in Ganaka International School Jos, Metropolis.
2. Identify the knowledge of abacus usage in mathematics among pupils with visual impairment in Ganaka International School Jos, Metropolis.

Research Questions

The following research questions were investigated and answered in this research study:

1. To what extent are pupils with visual impairment knowledgeable in abacus usage in mathematics in Ganaka International School Jos, Metropolis?
2. What is the level of abacus usage in teaching mathematics among pupils with visual impairment in Ganaka International School Jos, Metropolis?

Methodology

Research Design

The descriptive survey research design was utilized for this study. The survey design seeks to obtained information from a presentation of a population. The survey research design is suitable for the description of abacus knowledgeable and usage in teaching mathematics. It is also appropriate because it aided the researcher in collecting first – hand information to answer the research questions raised for the study.

Population

The population of this study consist of eighty (80) pupils with visual impairment in Ganaka International School Jos, Metropolis. The ages of the pupils ranges from 10-16 years. The reason for selecting primary three pupils of the school, it is because it a foundational class. The sample size of this study comprised of fifty (50) primary three (3) pupils who were screened sing snail charts and confirmed that they are children with visual impairment. Other means to identify pupils with visual impairment through their case history and which they will constitute the sample size of the study. The total sample population of twenty fifty (50) pupils in primary three (3) pupils was drawn from eighty (80) pupils in Ganaka International School Jos, Metropolis.

The purposive sampling technique was used for this study. This sampling method relies on data collection from population who are conveniently available to

participate in the study. Convenience sampling techniques it been used because it allows the researcher to obtain basic data and trends regarding this study without the complication of using randomize sampling techniques. And also it is quick and easy to deliver result. The purposive sampling technique was used for all the twenty fifty (50) pupils with visual impairment in primary (3) for the study.

Convenience sampling further stated that a group of non-probability sampling technique in which a units are selected because they have characteristic that the researcher need. This is to ensure that the different groups of which the population is comprised were properly represented in the sample. The primary three pupils with visual impairment will be subjected to snail chart to select those with visual impairment. One instrument was used for this study which is questionnaire with 10 tem and Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD) as responses on evaluation of knowledge and abacus usage (EKAU).

Results

Research Question 1

To What extent are pupils with visual impairment knowledgeable in abacus usage in mathematics in Ganaka International School Jos, Metropolis?

Table 1: The Extent to which Pupils with Visual Impairment Knowledgeable in Abacus Usage in Mathematics

S/N	Items	Responses					
		SA	A	U	D	SD	Mean
		5	4	3	2	1	
1.	Primary three pupils has limited knowledge about the use of abacus.	29	6	5	4	6	3.92
2.	Primary three pupils has no knowledge of abacus.	6	5	6	10	23	2.22
3.	Primary three teachers has no knowledge about the use of abacus so they don't use it.	6	5	6	9	24	2.22
4.	Primary three teachers are knowledgeable about the use of abacus.	36	4	4	3	3	4.34
5	I am completely lost when using abacus to solve mathematics questions.	6	5	6	9	24	2.22

Source: Field Data (2025).

From table 1 above, item 1 with mean of 3.92 indicates that the statement that "Primary three pupils has limited knowledge about the use of abacus" is accepted.

Item 2 with mean of 2.22 also means the statement that "Primary three pupils has no knowledge of abacus" is rejected. Item 3; with mean of 2.22 shows that "Primary three teachers has no knowledge about the use of abacus so they don't use it" is rejected. While item 4; with mean of 4.34 stating that "Primary three teachers are knowledgeable about the use of abacus." is equally accepted. Item 5 depict that the mean score is 2.22 means the statement that I am completely lost when using abacus to solve mathematics questions using abacus.

Research Question 2

What is the level of abacus usage in teaching mathematics among pupils with visual impairment in Ganaka International School Jos, Metropolis?

Table 2: Level of Abacus Usage in Teaching Mathematics among Pupils with Visual Impairment in Ganaka International School Jos, Metropolis.

S/N	Items	Responses					
		SA	**A**	**U**	**D**	**SD**	**Mean**
		5	**4**	**3**	**2**	**1**	
6.	The level of abacus usage in teaching mathematics among pupils is low.	6	5	6	10	23	2.22
7.	The level of abacus usage in teaching mathematics among pupils is moderate.	6	5	6	10	23	2.22
8.	The level of abacus usage in teaching mathematics among pupils is high.	5	4	5	34	5	2.14
9.	The level of abacus usage in teaching mathematics by teachers is low.	1	8	4	1	36	1.74
10	The level of abacus usage in teaching mathematics by teachers is high.	6	5	6	10	23	2.22

Source: Field Data (2025).

The criterion mean in this case is 3.0; this means every item mean equal or greater than 3.0 makes the item significant. From table above, item 6; with mean of 2.22 indicates that the statement that "The level of abacus usage in teaching mathematics among pupils is low" is rejected. Item 7; with mean of 2.22 also means the statement that "The level of abacus usage in teaching mathematics among pupils is moderate" is also rejected. Item 8; with mean of 2.14 shows that "The level of abacus usage in teaching mathematics by teachers is low." is rejected.

While item 9; with mean of 1.74 stating that "The level of abacus usage in teaching mathematics by teachers is low" is equally accepted. In the end of the table, item 10; with mean of 2.22 stating that "The level of abacus usage in teaching mathematics by teachers is high" is equally rejected.

Discussion

In this study, the research questions were aimed at evaluation of abacus usage on the academic performance of primary three pupils with visual impairment in Mathematics in Ganaka International School Jos, Metropolis. Data collected were presented in a tabular form of mean scores and analysis of mean score. The criterion mean in this case is 3.0; this means every item mean equal or greater than 3.0 makes the item significant. Looking at research question one. What is the extent to which pupils with visual impairment knowledgeable in abacus usage in mathematics in Ganaka International School Jos, Metropolis? Item 1 indicates that primary three pupils has limited knowledge about the use of abacus. Item 2 mean that primary three pupils has no knowledge of abacus. Item 3; mean that primary three teachers has no knowledge about the use of abacus so they don't use it. While item 4; mean that primary three teachers are knowledgeable about the use of abacus. Item 5 depict that because the pupils not exposed to the used of abacus they are completely lost when using abacus to solve mathematics questions using abacus. This finding is in line with Hatano and Osawa (2021) abacus trained experts performed significantly better on tests of calculation speed and accuracy and had longer digit span compared with those who were not so trained.

Linking this discussion with research question three, what is the level of abacus usage in teaching mathematics among pupils with visual impairment in Ganaka International School Jos, Metropolis?, item 6; mean that the level of abacus usage in teaching mathematics among pupils is low" is rejected. Item 7; mean that the level of abacus usage in teaching mathematics among pupils is moderate" is also rejected. Item 8; mean that the level of abacus usage in teaching mathematics by teachers is low." is rejected. While item 9; mean that the level of abacus usage in teaching mathematics by teachers is low" is equally accepted. Osita (2022) who said inadequate abacus technical skilled manpower is a major problem in Nigerian schools. Item 10 mean that the level of abacus usage in teaching mathematics by teachers is high" is equally rejected.

Conclusion

Based on the outcome of the findings in the study, it is expedient to note that to pupils with visual impairment need knowledge about the use of abacus to aid them in solving mathematics problems. The teachers need to be exposed to the usage of abacus to that they can turned teach the pupils with visual impairment effectively. This is because abacus makes pupils with visual impairment to be successful in their educational pursuit and also help them in arithmetic calculation such as addition, subtraction, multiplication, division of numbers.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Pupils with visual impairment should be adequately taught the used of abacus to solve mathematics.
2. Government or school management should ensure that abacus should be available for teachers to use in other to expose pupils with visual impairment to learn.
3. Government should organised training and retraining for teachers on the usage of abacus.

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