

# Efficacy of Adapted Teaching Materials on Mathematics Performance for Primary School Pupils with Visual Impairment in Kano and Katsina States, Nigeria

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| Article History   | Abstract   |
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| Original Research Article   | <p><i>This study investigated the efficacy of adapted teaching materials on mathematics performance for primary school pupils with visual impairments in Kano and Katsina states, Northwest, Nigeria. Four objectives, hypotheses and research questions were formulated each, to guide the study. The design of the study was experimental research of the pre-test post- test two treatment groups design. The total population for the study was one hundred and fifty (150), while the sample size was sixteen (16). Purposive sampling was used in selecting the sample, data was collected using researcher design mathematics achievement test for primary 3 pupils with visual impairment titled “Jaw achievement test”. The validity of the test was determined by content validity as the test items were extracted from UBEC approved school textbook, while the reliability was determined through test re-test reliability and calculation of Cronbach alpha co-efficient whose result was 0.78. The test was administered and marked before and after intervention, the results were analyzed using independent samples t-test and paired sample statistics. It was found out that both the experimental groups of Kano and Katsina were at the same level of performance before the intervention, and both groups performed better and scored higher marks in the post-test than the pre-test. The study had developed adapted teaching materials that can be used for teaching pupils with visual impairments in learning mathematics and developed an achievement test. Recommendations given from the study include teachers of pupils with visual impairment should be adapting teaching materials for better learning outcomes, special education teacher training institutions should introduce or improve courses that would equip would-be teachers with skills that would enable them to learn how to adapt and develop teaching materials from simple local resources.</i></p> <p><b>Keywords:</b> <i>Efficacy, Adapted teaching materials, Mathematics performance, Visual impairment.</i></p> |
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| <p>Copyright © 2026 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.</p> <p><b>Citation:</b> Abba, J., &amp; Jada, H. M. (2026). <i>Efficacy of adapted teaching materials on mathematics performance for primary school pupils with visual impairment in Kano and Katsina States, Nigeria.</i> UKR Journal of Arts, Humanities and Social Sciences, 2(7), 30-37.</p> |  |

## Introduction

Educating pupils with visual impairment centered around teaching materials to be used in teaching various concepts of the school curriculum effectively. It requires the teacher to adapt and use materials that can impart knowledge and concepts through the use of other senses other than vision. Therefore, these materials should be adapted mainly to impart and stimulate listening, touching, smelling as well as tasting. As such, teachers and researchers have over the years been adapting many strategies and tools in teaching different school subjects. Hallahan and Kauffman (2000)

said “without the use of appropriate teaching materials teachers, especially special educators, may become more frustrated because they do not have all the necessary solution to the child’s problems”.

Adaptation is the act of changing objects from its original usage or format to something new that could be used in the teaching-learning process for pupils with visual impairment. In this context, those teaching materials designed for use with ordinary normal pupils could be

transformed and re-designed by changing the receptor sense, for example, from visual to tactual, such that a picture or diagram can be copied in form of thermoform so that the pupil with visual impairment, since he cannot visualize it due to absence or malfunction of vision, can touch and feel the contours through the thermoform diagram by touching to understand the tactual design and make meaning out of it. Pupils with visual impairment will typically need adaptation to access printed information that will allow them to access all areas of the curriculum. It is the role of the teacher of pupils with visual impairments to determine the adaptations that the pupil needs. Material adaptation needs will vary, depending on the degree of functional vision, effects of additional disabilities and the task to be done.

Willings (2018) said adaptation of teaching materials refers to making teaching materials to be suitable for a particular category of pupils, which in this paper refer to pupils with visual impairments. Teaching materials can be adapted for use by pupils with visual impairments through modifications, such as modifying printed materials into various media such as braille, large print, audio and/or digital. Adaptations vary, and may include adaptation of large prints, photocopying, font legibility, increase visual acuity, light box use etc. These adaptations can be appropriate for pupils who can learn with residual vision, while materials for blind pupils, who do not use vision in learning, but use other senses and mediums such as braille code, tactile graph, tactual graphics and other tactile materials can be adapted to other appropriate formats as explained above. Teaching materials adaptation also involve adapting assistive technology devices for pupils with visual impairments which include making IOS devices accessible, magnifier applications for accessing books, identification applications, navigation and location, cause and effect applications, application for children with visual impairment, braille applications, android applications and host of other applications for communication. All other types of teaching materials can be adapted for pupils with visual impairments through changing the receptor sense for learning, meaning that materials such that are meant to be used through vision can be modified to be used using other senses such as audio, tactile, taste and smell. Therefore, adaptation should mainly focus on the use of other senses in learning other than vision.

Mathematics is a core subject in the Nigerian education curriculum that enable the learners to develop problem solving, logical reasoning, brain development to improve cognitive abilities, memory and concentration. Mathematics performance, according to Pandey (2017), refers to “the competency shown by the student in mathematics, its measure is the score in a performance test

in Mathematics”. Therefore, mathematics performance to a pupil with visual impairment will refer to the ability of the pupil to display, manipulate, and translate into competency in using concepts and knowledge in braille codes. Interestingly, this may not be achieved until the teacher of the pupil with visual impairment is able to adapt teaching materials, as continued by Dantata and Gwarzo (2018) that “adoption of suitable teaching methodologies, proficiency in mathematics braille codes, and skills in using mathematical devices, knowledge of adaptation techniques with relevant instructional strategies supplemented by right teaching-learning materials will certainly transform the teaching-learning process of mathematics, to be visual impairment friendly, thereby transforming learning of mathematics effective and enjoyable.

This study investigates the efficacy of adapted teaching materials on the mathematics performance of pupils with visual impairment. Educating pupils with visual impairment requires a lot of efforts, materials, manpower, technology, skills and much more. Therefore, before going much further there is need to explain who the pupils with visual impairments are: Dantata & Diso (2012) explained that the visually impaired are generally classified into two major groups: the blind and the partially sighted or low vision. Explaining further that the blind are those who have only light perception or have no vision and must use braille and related media for learning. While the low - vision are those who have limitations in distant vision but are able to see objects and materials when they are within a few inches or at a maximum of two feet away. While the International Classification of Diseases WHO (2010) said the current definition applies to people who have an irreversible lack of perception of light but are nevertheless under 3/60 in the better eye (the notation 3/60 indicate that a person can see an object at 3 meters that which could be seen by a normal sighted person at 60 meters).

### Concept of Visual Impairment

Visual impairment is a broad term that comprise of multiple conditions and problems related to seeing, inability to see, as well as ineffectiveness or malfunctioning of the visual apparatus in the eyes and the brain. It consist of many eye conditions and disorders, including blindness. Scholars have defined it from different perspectives, the Centre for Disease Control (CDC, 2013) and the World Health Organization (WHO, 2013) defined visual impairments as a condition of eyesight that cannot be corrected to a normal level. Thus, visual impairments are the functional limitation of the eyes or eye, or the visual system which leads to:

- i. Loss of visual acuity (a term used to refer to how a person sees from specified distances) and the inability of an individual to see objects as clearly as a healthy person.

- ii. Loss of visual field; meaning an individual to see as wide an area as the average person, without moving their eyes or turning their head.
- iii. Photophobia – inability to look at light.
- iv. Diplopia – double vision.
- v. Visual distortion – difficulties of imaging.
- vi. Visual perception difficulties
- vii. Or any combination of the above features.

According to Williams (2021) visual impairment refers to when you lose part or all your ability to see (or vision). The impairment must persist even with the use of glasses, contact lenses medication or surgery. While Carney, Engbretson, Scammell & Sheppard (2003) said visual impairment refers to significant loss of vision, even though the person may wear corrective lenses. Visual impairments involves different conditions of the eye which include both eye diseases and eye defects; eye defects refers to any distortion to the sense of sight or loss of power of accommodation, while eye diseases refer to diseases affecting the eyes, some of which Carney, Engbretson, Scammell, & Sheppard (2003), explained as the most common eye conditions teachers may encounter. Eye defects are conditions of the eye such as albinism, amblyopia, cortical visual impairment, retinal detachment, hyperopia, myopia, nystagmus, optic atrophy, retinis pigmentosa and strabismus. While eye diseases are such as cataract, glaucoma, retinopathy of prematurity, and conjunctivitis.

### Statement of the Problem

The standard of teaching and learning in Nigerian schools has been drifting over the years, the ineffectiveness of teaching and learning was caused by variety of factors, one of which is the lack of adaptation of teaching - learning resources to suit the needs of the learner. To enhance the quality of lessons and improve learning outcomes, teachers should make use of materials which further engage pupils, ease the learning task, develop creativity and critical thinking, as well as make learning fun and enjoyable to learners, especially while learning difficult subjects and concepts, such as in mathematics. Pupils with visual impairments are not out of this predicament, thus the reason why this study investigates the efficacy of an enriched lesson using adapted teaching materials for pupils with visual impairments in the learning of mathematics in Kano and Katsina states, North-West, Nigeria.

### Purpose of the Study

The purpose of the study is to investigate the efficacy of adapted teaching materials on the mathematics performance of primary 3 pupils with visual impairment. The specific objectives of the study include:

1. To find out whether or not there is a significant difference in the mathematics performance of primary 3 pupils with visual impairment in Kano and Katsina before intervention.
2. To find out whether or not there is a significant difference in mathematics performance of primary 3 pupils with visual impairment taught using adapted teaching materials in Kano and Katsina states after the intervention.
3. To find out whether or not there is a significant difference in the mathematics performance of primary 3 with visual impairment taught using adapted teaching materials in Kano before and after the intervention.
4. To find out whether or not there is a significant difference in the mathematics performance of primary 3 pupils taught using adapted teaching materials in Katsina before and after the intervention.

### Research Questions

The following research questions were formulated to guide the study:

1. What is the difference in the mathematics performance of primary 3 pupils with visual impairment in Kano and Katsina states before the intervention?
2. What is the difference in the mathematics performance of primary 3 pupils with visual impairment taught using adapted teaching materials in Kano and Katsina states after the intervention?
3. What is the difference in the mathematics performance of primary 3 pupils with visual impairment taught using adapted teaching materials in Kano before and after the intervention?
4. What is the difference in the mathematics performance of primary 3 pupils with visual impairment taught using adapted teaching materials in Katsina before and after the intervention?

### Research Hypotheses

1. There is no significant difference between the mathematics performance of primary 3 pupils with visual impairment in Kano and Katsina states before the intervention.
2. There is no significant difference between the mathematics performance of primary 3 pupils with visual impairment taught using adapted teaching materials in Kano and Katsina states after the intervention.
3. There is no significant difference in the mathematics performance of 3 primary pupils with visual impairment taught using adapted teaching materials in Kano before and after intervention.

- There is no significant difference in the mathematics performance of primary 3 pupils with visual impairment taught using adapted teaching materials in Katsina before and after intervention.

## Research Methodology

This study adopted the experimental research design of the pre-test post-test two independent treatment groups design. The sample for the study consist of eight (8) class 3 pupils with visual impairment of special education school T/Maliki Kano and eight (8) class 3 pupils with visual impairment of Katsina school for the blind. Purposive sampling was used in selecting the samples.

### Data Collection Instrument

The instrument used for collecting data was a self – developed mathematics achievement test titled “Jaw Achievement Test”. After pupils were taught the appropriate curriculum content for the term (12 weeks) using adapted teaching materials and the recommended school textbook. The content of the test instrument were developed based on the content taught during the treatment period.

### Validity and Reliability of the Instrument

The instrument after construction was given to experts in special education and mathematics for critique and their suggestions were incorporated into the draft of the test instrument. The reliability of the instrument was measured using test re – test method, a separate group was selected

for piloting, the test was administered to them before and after teaching them the content. It was administered and marked, the two sets of scores were compared using Cronbach Alpha correlation in which 0.78 was the obtained correlation score, thus, the instrument was found to be reliable for the study.

### Method of Data Collection

The researcher and an assistant conducted the study, administering the instrument before the intervention (pre-test), teaching the two groups concurrently for 12 weeks using the adapted materials as intervention, after which the test instrument was administered again (post-test), to the two groups in their respective schools and classes.

### Method of Data Analysis

The data collected were analyzed by testing the hypotheses formulated for the study using the independent t-test. The pre-test and post-test scores of the two independent groups were presented in tables, showing the number of pupils in each group, their mean scores, standard deviations, t – value, degree of freedom, and alpha value. The significant differences between them were compared to accepting or rejecting the null hypotheses.

### Data – Analysis

**Hypothesis One:** There is no significant difference in the mathematics performance of primary 3 pupils with visual impairment in Kano and Katsina states before intervention.

*Table 1. Independent Samples Test Pre-test*

| Pre-Test Scores | PUPILS' LOCATION | N | Mean    | Std. deviation | t-value | df | Level of sig. p-value | Decision   |
|-----------------|------------------|---|---------|----------------|---------|----|-----------------------|------------|
|                 | Kano             | 8 | 29.7500 | 6.15862        | 1.932   | 14 | 0.074                 | Accept Ho1 |
|                 | Katsina          | 8 | 23.1250 | 7.49166        |         |    |                       |            |

Table 1 showed the pre-test t-test result of primary 3 pupils with visual impairment in Kano and Katsina states before intervention. The mean score of Kano pupils who were eight in number was calculated as 29.75 with standard deviation as 6.15. The Katsina group’s pupils were also eight in number. Their mean score was calculated as 23.13, standard deviation was 7.49. The p-value was 0.074 while alpha score was 0.05 with degree of freedom as 14. Since

the P-value (0.074) is greater than the alpha value (0.05) we accept the null hypothesis.

**Hypothesis Two:** There is no significant difference in the post -test Mathematics Performance of Primary 3 Pupils with Visual Impairment taught using adapted teaching materials in Kano and Katsina.

*Table 2: Independent Samples Test Post-test*

| Post-Test Scores | PUPILS' LOCATION | N | Mean    | Std. Deviation | t-value | df | Level of sig. p-value | Decision   |
|------------------|------------------|---|---------|----------------|---------|----|-----------------------|------------|
|                  | Kano             | 8 | 40.5000 | 4.44008        | 3.167   | 14 | 0.007                 | Reject Ho2 |
|                  | Katsina          | 8 | 33.0000 | 5.01427        |         |    |                       |            |

Table 2 showed the post-test t-test result of primary 3 pupils with visual impairment taught using adapted teaching materials in Kano and Katsina. The mean score of the Kano group was 40.50 with a standard deviation of 4.44, while the Katsina group had a mean of 33.00 and standard deviation 5.01. The t – value was 3.17, p-value was 0.007 while alpha value was 0.05 with degree of freedom as 14. Since the P-value (0.007) is less than the alpha value (0.05)

we reject the null hypothesis and accept the alternative hypothesis.

**Hypothesis Three:** There is no significant mean difference in the Mathematics Performance of Primary 3 Pupils with Visual Impairment taught using adapted teaching materials in Kano before and after intervention.

**Table 3: Paired Samples Statistics Pre-test Post-test SES T/Maliki**

|  | Kano Pupils      | N | Mean    | Std. Deviation | t-value  | df | Level of sig. p-value | Decision   |
|--|------------------|---|---------|----------------|----------|----|-----------------------|------------|
|  | Pre-Test Scores  | 8 | 29.7500 | 6.15862        | -3.99491 | 7  | 0.005                 | Reject Ho3 |
|  | Post-Test Scores | 8 | 40.5000 | 4.44008        |          |    |                       |            |

Table 3 showed the mean scores of the pre- test which was calculated as 29.75 while that of post-test was 40.50, the standard deviation of pre –test was 6.16 while that of post-test was 4.44. Since the P-value (0.005) is less than the alpha value (0.05) we reject the null hypothesis and accept the alternative hypothesis.

**Hypothesis Four:** There is no significant difference in the Mathematics Performance of Primary three Pupils with Visual Impairment taught using adapted teaching materials in Katsina Before and after intervention.

**Table 4: Paired Samples Statistics Pre-test Post-test**

|       | Katsina Students | N | Mean    | Std. Deviation | t-value  | df | Level of sig. (p-value) | Decision   |
|-------|------------------|---|---------|----------------|----------|----|-------------------------|------------|
| Pair1 | Pre-Test Scores  | 8 | 23.1250 | 7.49166        | -5.16281 | 7  | 0.001305                | Reject Ho4 |
|       | Post-Test Scores | 8 | 33.0000 | 5.01427        |          |    |                         |            |

Table 4 showed the pre –test mean score as 23.13 and post-test mean score as 33.00, the standard deviation of pre-test was 7.49 while that of post-test was 5.01, while the degree of freedom was 7. Since the P-value (0.001) is less than the alpha value (0.05) we reject the null hypothesis and accept the alternative hypothesis.

hypothesis that there is a significant difference in the mathematics performance of pupils with visual impairment taught using adapted teaching materials in Kano was accepted. While the t-test result output for Katsina pre- test mean was 23.13 and the mean of the post-test was 33.00 a difference of 10.87 between the pre-test and post-test, the p-value was 0.001 which was less than the alpha value of 0.05, therefore null hypotheses was rejected for alternate hypotheses. These showed a good improvement in the performance of both groups, therefore, adapted teaching materials as an intervention enhanced the mathematics performance of pupils with visual impairment as it enable these pupils to learn mathematics in particular and may be applicable generally in all others subjects particularly the science oriented subjects, which was in line with the findings of study by Sonzibilir (2016) that the most important needs of these learners (with visual impairments) are instructional materials and activities which are designed according to the needs of visually impaired students with

**Discussion of Findings**

At baseline, the performance of the two groups of pupils in Kano and Katsina were tested to ensure that one group do not have an advantage over the other, results were shown in table one, there was no significant difference in the mathematics performance of the groups before the test. But after the test, the results of both groups had shown significant difference in their performances. In Kano the mean of the pre-test was 29.75 while the post-test mean score was 40.50, out of a total score of 50, the p-value was 0.005 which was less than the alpha value of 0.05, therefore the null hypothesis was rejected while the alternate

different visual acuities or tactile materials in case of blindness.

Therefore, the two independent groups' results showed clearly that both groups of Kano and Katsina recorded positive differences. This result was in line with Vroom's expectancy theory (1964) where it relates to valence which is the effort, value or strength that one place on a particular outcome, expectancy relates to performance while instrumentality is the belief that performance is related to reward. This could be the efforts in adaptation of learning materials, efforts that are envisioned to improve the performance of pupils with visual impairment in learning mathematics. While performance represents the efforts of pupils in learning the content, the reward was the positive result obtained in the difference between the pre-test and post-test of the two independent groups. Olayi, (2016) found that the deployment and use of assistive devices to teaching and learning enhance learning and social life participation. While Idris (2005) also confirmed a positive student performance when taught with instructional materials.

In addition, this study showed that pupils with visual impairment can learn mathematics when appropriate materials were presented and used in the learning process as Jurmang (2015) said the greatest problem in teaching and learning geometry in particular and mathematics in general for learners with visual impairments was the lack of adapted equipment for teaching in our schools. Abani (2015), Nasifore (2015) Ashaver & Igyuve (2013) all attested to the fact that teachers do not use or adapt teaching materials in teaching their students. In these studies teachers were said to lack competence in the use of assistive teaching devices even where the materials were provided in the schools. Adapting them for use with pupils or learners with visual impairment becomes a critical problem, due to non-inclusion of teaching materials development in teacher training curriculum, and non-exposure of trainee teachers to practical skills on production, improvisation and adaptation of teaching materials particularly to teachers at different levels of the education system and in different subject areas, particularly mathematics.

The positive results recorded by both independent groups have clearly ruled out any bias which may occur in a study with a single experimental group. Therefore, there is no doubt as to the efficacy of adapted teaching materials for pupils with visual impairments in the learning of mathematics as supported in the study of Sahim & Yorek (2009) that teaching tools provides same insight into how students with visual impairment learn and suggest that they should be provided with necessary tools and support to help them become scientists. Similarly, Vita (2012) also support this finding from her study that blind students have the same

potential to understand notions related to mathematics as sighted students especially since access is made by tools that can fulfill the function of the eye.

Mathematics being one of the core subjects in Nigeria's education curriculum has been dreaded by pupils and students both sighted and those with visual impairment, which as Kapperman, (2003) in Jurmang, (2015) said mathematics, especially Geometry is a field which has often been considered beyond the capacity of learners with visual impairment to master. But this research had proved this assertion wrong by clearly revealing the good performance of pupils with visual impairment in mathematics. They only need appropriate adapted materials, teaching strategies and learning activities to learn mathematics concepts effectively. Mathematics is a building block that lay solid foundation to higher level study skills, lifelong activities and better professional careers. Therefore, this study has shown the capabilities of pupils with visual impairment in learning mathematics.

On the other hand, Nebulize and Pasha, (2012) also found that there are exclusionary practices and restrictions to the course and career choice of learners with visual impairment and the reason for their poor performance and inability to further their educational pursuit. Therefore, conclusively, appropriate adapted teaching materials are one of the most important issues that pupils with visual impairment require to effectively learn mathematics with necessary support like their sighted counter parts and fulfill their life ambitions. Adapted teaching materials can suffice the absence and inadequacy of standardized teaching materials in Nigerian schools. But even where the teaching materials were present and available teachers do not use them because they do not have the skills and competency in using them effectively as was found in Shikden (2015), Nasiforo (2015) and Ashaver & Igyueve (2013). Adapted teaching materials can easily be sourced teachers only need to make little adaptations to use them for pupils with visual impairment. Adapted teaching materials are also inclusive, such that in an inclusive classroom where the teacher would, for example use a ruler or flashcard for sighted pupils, same could be made for the pupil with visual impairment with very little modifications. Therefore, the pupil with visual impairment can learn inclusively among his sighted peers

## **Conclusion and recommendation**

### **Conclusion**

The study was on the efficacy of adapted teaching materials on mathematics performance for primary school pupils with visual impairment in Kano and Katsina States, Northwest, Nigeria. Prior to the conduct of this research study, the researcher observed that pupils with visual impairment

were taught mathematics orally, teachers only explained concepts to the pupils. Based on the findings of this study, the researcher concluded that adapted teaching materials can be used conveniently to improve the performance of pupils with visual impairment in learning mathematics. Pupils with visual impairment's basic need in learning mathematics at primary school level was use of concrete learning materials they can touch, feel, learn, understand concepts from, adapted teaching materials had proved to provide these opportunities to these pupils. The study had proved the efficacy of the adapted teaching materials such that both the two experimental groups in the study based in different locations had recorded improved performance in mathematics after learning with these materials. Therefore, other pupils with visual impairment can also benefit from it and improve their learning outcomes in mathematics.

### Recommendations

Teachers of pupils with visual impairment should be adapting teaching-learning materials for their pupils' learning to enhance and improve their academic performance, especially in mathematics.

1. Special education teacher training institutions should include or improve courses dealing with production and adaptation of teaching materials for pupils with visual impairment and other areas of special needs, so that teachers will have adequate professional skills to enable them to teach pupils effectively.
2. As in-service teachers teaching pupils with visual impairment lack skills of local production and adaptation of teaching materials for pupils with visual impairment, during in-service trainings, seminars, and workshops such skills should be developed in teachers to improve their skills and enhance their productivity.
3. Government's Ministries of Education, boards such as UBEC and SUBEBS and other stakeholders such as non-governmental agencies who have an interest in education of pupils with special needs and visual impairment in particular should support teachers with trainings in upgrading their skills for adaptation of teaching materials because they are very critical in learning for pupils with visual impairment.
4. Producers of teaching materials should produce simple and affordable teaching materials with Braille inscriptions such as the 100-square chart, number Braille cards etc. used in this study for use of pupils with visual impairment.

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