Effects of Ethnomathematics-based Instructional Approach on Primary School Pupils' Achievement in Geometry

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Authors' contributions

This work was done in collaboration between all authors. Author POA carried out the Field work with authors GO and JOU as the field assistants while author OSA supervised the study and handled the data analysis. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

This study investigated the effects of Ethnomathematics-based instructional approach on pupils' achievement in geometry. One research question and one null hypothesis, tested at 0.05 level of significance guided the study. The study adopted a quasi-experimental design. Specifically, a pre-test, post-test, non-equivalent control group was used for the study. A sample of four hundred and two primary 6 pupils comprising two hundred and two pupils for the treatment group and two hundred pupils for the control group were used. The instrument used for the study was Achievement Test in Geometry (ATG), which was developed and validated by the researchers. Two sets of instructional packages were prepared, one for the treatment group and the other for the control group. The treatment group was taught geometry using the Ethnomathematics-based instructional approach while the control group was taught using the conventional instruction approach. Adjusted mean and standard deviation were used to answer the research question,

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whereas analysis of covariance (ANCOVA) was used to test the null hypothesis. The results of the study revealed among others, that the Ethnomathematics-based instructional approach was superior to the conventional method in enhancing pupils' achievement in geometry.

1. INTRODUCTION

Ethnoscience has been perceived from an array of perspectives. It has been perceived in relation to the folk systems, cultural classificatory system, culturally related perception of the physical world and folk medical systems [1]. It is perceived as the science which focuses on the discovery and description of the folk systems [1,2]. A more embracing view of ethnoscience was presented by Ogunbunmi and Olaitan. They believe that the best definition of ethnoscience is that study which approximates or reflects the natives' own thinking about how their physical world is to be classified, consciously or unconsciously, explicitly or implicitly, and within the framework they accordingly act [3]. They believe that classification into types is a discovery of combinations of attributes favoured by the makers of the artefacts, not an arbitrary procedure of the classifier. This classification system is believed to be non-artificial but corresponds to mental templates and folk classifications of the people [4,1]. The views of Ogunbunmi and his colleagues are more embracing because they incorporate the totality of people's ideas and belief systems which are part and parcel of the individuals in that particular society.

Abonyi identified Ethnomathematics as a major branch of ethnoscience. Ethnomathematics is the science of numbers and its manipulations that are embedded in the peoples culture [4,2,5]. These manifest in cultural artefacts such as mats, clay pots, clay bed, houses (round and rectangular), decorations, baskets, local drums and fish traps. Geometric concepts like square, rectangle, circle, straight line, angle, parallel and perpendicular lines and lines of symmetry are embedded in these artefacts [6]. Though there are local terms within the Boki tribe of Nigeria for these geometric concepts, they are used in the topological rather than in the Euclidean sense. For example, the Efik and Ibibio tribes of Nigeria have terms like ekara for circle, ekari-ekari for round and itung for angle; the Tivs have the term ahwa for circle, the Igbos have *gburugburu* for circle, the Bokis have *dandang* for straight line, *dyimonge* for angle, *monge* for curve and *kekere* for circle, amongst others.

To incorporate these ethnomathematical ideas and concepts in teaching primary school mathematics, Bockarie indicated that teachers of mathematics need to know the mathematics embedded in the learner's culture [7]. It was advocated that the mathematical heritage of the people of Africa be valued and reflected in the mathematics curriculum [8]. In support, Gilmer argued that a mathematics curriculum aligned to the culture of the learner would respond to the classroom instructional needs of pupils who ordinarily could have thought mathematics is too difficult to learn [3].

Practical and descriptive geometry is one of the five components of the Primary School Mathematics Curriculum in Nigeria. Geometry has for many centuries been regarded as one of the best ways of training the mind in logical thinking and imagination. Spatial ability, which is the child's ability to judge the positions, sizes and shapes of objects in space can be developed through the knowledge of geometry. Children's first geometrical experiences come from real life through interactions with the culture and the physical environment. According to Kuruma every child is in contact with quantitative impulses from the beginnings of life [9]. The child lives and moves in space with important geometrical qualities such as the basic properties of metrics (symmetry of metrics). Again, the space of the child's world is divided into some parts (the cot, the little room, the house, compound and the garden) and it is possible to move from one of these parts to another.

Mathematics developed gradually from the study of natural phenomena such as geometry, trigonometry and mensuration [10]. Mathematical practices thus developed as a result of every single culture, tribe, community and individuals trying to cope with daily needs, problems and challenges [11,12]. These mathematical practices of different cultural groups manifest themselves in arts and artefacts [13].

At one time, mathematicians and mathematics educators began to discuss mathematics and culture. This concern opened a new research dimension on cultural-based mathematics in

many parts of the world [14]. Ethnomathematics, viewed from the perspective of D'Ambrosio is the mathematics practised among identified cultural groups. It is the knowledge that is indigenous to a particular culture as people within any cultural group use ideas of mathematics in their daily life [15,9].

Geometry continues to be regarded by pupils as their area of greatest difficulty to learn and difficult to teach by teachers [8]. The methods teachers use to teach geometry are implicated as one of the factors responsible for poor learning and low achievement in geometry. This is the reason it was advocated the integration of an Ethnomathematics teaching approach into the school mathematics classroom [16]. The present study derives its significance from the observed difficulty in pupils' learning of geometry and the seeming inadequacy in methods of teaching geometry in primary schools in Nigeria. Thus, the use of an Ethnomathematics-based instructional approach, which integrates significant cultural mathematics artefacts into school geometry, would provide learners the opportunities to make sense of the geometric concepts using personal experiences.

The difficulty primary school pupils continue to experience in learning geometry is worrisome to mathematics educators in Nigeria, and in other countries [8]. Plane and solid shapes, polygons, and geometrical transformations are topics generally identified by learners and teachers to be difficult to learn and teach in primary schools [17]. It was indicated that the difficulty in learning and teaching geometry has led to mass failure in geometry examinations and low achievement in geometry.

Blanco and Ademulegun attributed pupils' low achievement in geometry to inappropriate methods of teaching [7,18]. An examination of this state of affairs showed that most mathematics teachers still emphasise the Euclidean methods of teaching geometry, which is abstract in the presentation of geometric concepts. The problem faced by pupils here is that, for example, Euclidean definitions of plane geometrical figures on paper or chalkboard, are not seen by pupils in class instruction as real objects. Hence, understanding of geometry becomes a problem. This is why one still finds pupils defining a rectangle as just a plane shape with four faces, and having difficulty in comparing the properties of pairs of rectangle and of square as well as of square and rhombus.

Current studies on methods of science instruction in Africa have revealed that the existing instructional approaches are highly particularistic, hopelessly biased, not only of perpetuating a lack of understanding regarding indigenous fields of knowledge and cognition, but also causing outright harm on them [3,19]. The current instructional approaches seem to have contributed to poor concept formation and attitude among beginners to science. This trend in concept formation and attitude is carried along as students progress in science, technology and mathematics [20]. Adesoji and Akpan already noted that science taught in Nigeria and Africa generally makes us academic foreigners in our own country [12:70]. They made reference to the handbook of Science Education Programme for Africa (SEPA) as saying that a tragedy of science education in Africa which children and adults have shared is that it has not always paid attention to the culture of the Africans both in methods and materials.

Fafunwa understood the dilemma quite well when he stated that "the African Society today is in an ambivalent position and so is the child from this environment" [20]. He explained that between the ages of 0 and 5, the African children are wholly brought up in a traditional African environment. He further observed that as those children reach the primary school age they enter another educational system quite different and strange to their initial environment. That is, they grew up with a certain cognitive (learning) style and suddenly found themselves in another environment with an entirely different approach". On the implications of such estrangement, Fafunwa wrote:

> *The fact of the matter, however, is that the child's cognitive equilibrium has been disturbed and this abnormal situation (the deep gulf between traditional non-formal African system of education and the formal, Western oriented system of education) tends to retard the cognitive process in terms of the anticipated outcomes of the Western form of education.[19:20]*

Any assumption that an African child could be easily adjusted to such a dramatic change without creating a suitable link is bound to fail. For the child to accept and adapt to a new field of knowledge, the gap between their culture and the new field of knowledge has to be bridged [21,22].

Science starts with preconception, with the culture and with the common sense. The

conceptualist view of science treats science as a quality in its own right. Kneller, while addressing the conceptualist view of science, stressed that a child should construct the pictures of his environment in the light of his own experience provided that he finally reaches the objective picture of the universe [23]. Kneller further emphasized that human nature and the general perception of the environment is relative to time and place. The prime virtues of any educational system, especially of those that must meet the unprecedented rate of change in modern industrial society, are flexibility and willingness to experiment. In his conception of reality, Spinder noted that even modern adults owe less to their direct experience and more to the experience of their culture [23].

The state of teaching and learning geometry does not seem to improve because conventional methods have failed to utilise the geometrical experiences of the child acquired at home in teaching geometry. Although researchers have articulated a number of likely benefits from Ethnomathematics-based instruction, enough empirical evidence has not been provided to justify the adoption of the technique. As such, researchers in mathematics pedagogy are still confronted with the task of providing quantitative evidence for the adoption of Ethnomathematics-based instructions in our primary schools. This study is a response to this challenge and is designed to explore empirically the effects of an Ethnomathematics-based instructional approach on primary school pupils' achievement in geometry.

1.1 Research Question

What is the effect of Ethnomathematics-based instructional approach on pupils' mean achievement scores in geometry?

1.2 Research Hypothesis

There is no significant difference in the mean achievement scores of pupils taught geometry using Ethnomathematics-based instructional approach and those taught geometry using the conventional method.

1.3 Research Method

The study adopted quasi-experimental design. This was because the study used intact classes in order not to disrupt the classroom arrangement in the schools. Specifically, a pre-test, post-test, non-equivalent control group design was used. Intact classes were randomly assigned to the experimental and control groups. Both the experimental and control groups were given the same pre-test on geometry before the commencement of the experiment. The treatment group was taught geometric concepts (properties of solid shapes, plane shapes, angles, parallel and perpendicular lines and lines of symmetry) using an Ethnomathematics-based instructional approach whereas the control group was taught the same topics using the conventional method. The two groups were given a post-test after the experiment.

The study was carried out in Boki Local Government Area of Cross River State, Nigeria. The area covers a land area of 3,500 kilometre square [24].

A sample of 402 primary 6 pupils with 202 pupils for the experimental group, and 200 pupils for the control group was used. Simple random sampling method was adopted to select ten schools from 32 schools identified to have large pupil enrolments. The treatment group had five schools with seven intact classes while the control group had five schools with nine intact classes. The treatment group was exposed to Ethnomathematics-based instructional approach whereas the control group was exposed to the conventional method of teaching.

The instrument for data collection was the Achievement Test in Geometry (ATG), constructed by the researchers. It was used to measure pupils' achievement in geometry. It contained 25 multiple choice items with four options. These items were selected from the 9-year Universal Basic Education Mathematics Curriculum content (1 – 3 and 4 – 6) for primary 6 [25], which included properties of solid shapes, plane shapes, angles, parallel and perpendicular lines and lines of symmetry.

The researchers prepared a test blue-print to guide the development of the test items. The preparation of the test blue-print was based on the school scheme of work for primary 6 and used in constructing the instrument (ATG). The test blue-print contained units in geometric concepts taught in the course of the study and cognitive learning objectives (Knowledge, Comprehension and Application) of the test items. The internal consistency reliability coefficient of the instrument was 0.78 using the Kuder-Richardson 20 estimate.

1.4 Experimental Procedure

The researchers organised a training programme for the regular class teachers who were used as research assistants for the study. Two sets of instructional packages (lesson plans) for teaching the units of geometric concepts were prepared by the researchers. The instructional package for the treatment group focused on using an Ethnomathematics-based instructional approach; while the other for the control group focused on the conventional method in teaching geometry. Both the treatment and control groups were administered ATG as pre-test before the commencement of teaching by the regular teachers and the post-test at the end of four weeks of teaching. The teachers were closely supervised to ensure that they used the instructional packages as provided by the researchers.

1.5 Method of Data Analysis

The research question was answered using mean and standard deviation while the null hypothesis was tested using analysis of covariance (ANCOVA) at 0.05 level of significance.

2. RESULTS

2.1 Research Question

This research question was answered by computing the mean and standard deviation of achievement scores of subjects in the treatment and control groups. Summary of the results is shown in Table 1.

Summary of results presented in Table 1 shows that the treatment group yielded an adjusted mean score of 54.56 with a standard deviation of 11.99 while the control group had an adjusted mean score of 43.22 with a standard deviation of 9.78. This indicates that the Ethnomathematics-based instructional approach is superior to the conventional method in fostering pupils' achievement in geometry.

2.2 Hypothesis

There is no significant difference in the mean achievement scores of pupils taught geometry using an Ethnomathematics-based instructional approach and those taught geometry using the conventional method.

This hypothesis was tested using Analysis of Covariance (ANCOVA), at 0.05 level of significance. Summary of the results is shown in Table 2.

From the Hypothesis, the Analysis of Covariance (ANCOVA) table shows that the calculated F-value of 134.763 is greater than the critical value of 3.86 at an alpha level of 0.05. Since the calculated F-value exceeds the critical value, the null hypothesis was rejected. The researchers therefore conclude that there is a significant difference in the mean achievement scores of pupils taught geometry using the Ethnomathematics-based instructional approach and those taught geometry using the conventional method. This implies that the pupils taught geometry using an Ethnomathematics-based instructional approach had mean achievement scores that differed significantly from those taught geometry using conventional methods. The researchers concluded that pupils taught geometry using an Ethnomathematics-based instructional approach achieved significantly better than their counterparts taught geometry using conventional methods.

2.3 Summary of Findings

Based on the results of the analysis of data, the following main findings were made:

1. The Ethnomathematics-based instructional approach was superior to the conventional approach in fostering pupils' achievement in geometry.
2. There was a significance difference between the mean achievement scores of pupils taught geometry using the Ethnomathematics-based instructional approach and those taught geometry using the conventional approach.

3. DISCUSSION

The finding of this study revealed in Table 1 indicates that the Ethnomathematics-based instructional approach is superior to the conventional method in fostering pupils' achievement in geometry. This implies that the Ethnomathematics-based instructional approach was more effective in enhancing pupils' learning of geometry than the conventional method. The finding strengthens the relevance of teaching geometry from a cultural perspective, as it is consistent with the views of Laridon, Mosimege and Mogari, Katsap & Silverman, and Rosa and Orey who supported the teaching of geometry

Table 1. Mean geometry achievement scores of pupils taught geometry using the Ethnomathematics-based instructional approach and those taught with the conventional method

Group	N	Adjusted mean	Std Dev
Treatment group (Group taught with Ethnomathematics-based instructional approach)	202	54.56	11.99
Control group (Group taught with conventional method)	202	43.22	9.78

Table 2. Analysis of co-variance for pupils' overall geometry achievement scores by teaching methods

Source of variation	Sum of squares	Df	Mean square	F	Fcv
Covariates	9089.470	1	9089.470	93.866	
Main effects	13232.199	2	6616.099	68.324	
Method	13049.697	1	13049.697	134.763	3.86
Explained	22468.174	4	5617.044	58.007	
Residual	38443.279	397	96.834		
Total	60911.453	401	151.899		

concepts to pupils using a method that is adapted to their culture, and background experience [13,26,27]. As they noted, this approach allows learners to develop a personal role in active learning and therefore they could participate more effectively in the instructional process. Table 2 shows significant (p<0.05) difference in the mean achievement scores of pupils taught geometry using the Ethnomathematics-based instructional approach and those taught geometry using the conventional method. The higher achievement by pupils in the experimental group may not be surprising, as the pupils had developed effective communication in learning geometry and self-confidence in solving problems using Ethnomathematics materials (cultural artefacts) in their immediate environment. The finding corroborated the findings of Kurumeh, Achor, Imoko and Uloko, and Odili and Okpobiri [9,6,28, 17]. According to them, pupils learn geometry concepts by sharing in the construction of geometry concepts actively using cultural artefacts in their immediate environment. This type of learning environment is practical and brings to the fore the applicability of geometry in real life situations, makes for meaningful learning and hence better pupils' achievement in geometry.

Ethnomathematics, like ethnoscience in general, deals with local perception, practices, skills and ideas, and their underlying cosmologies in the context of processes of socioeconomic transaction development [1,29]. The terms ethnoscience and Ethnomathematics therefore become an articulation of a particular culture, describing the often unique systems of indigenous knowledge (IK) and Indigenous Technology (IT) characteristics of local populations or groups in the third world as well as of the similar groups in western nations (Warren et al., 1995).

4. RECOMMENDATIONS

The following recommendations were made by the researchers:

1. Ethnomathematics-based instructional approach should be adopted in the teaching of geometry.
2. In-service training for teachers on the importance and effective use of this teaching approach should be provided by the Government. Government should use all the necessary machineries (STAN, MAN, NUT, Faculties of Education, and Colleges of Education) to organise in-service training in the form of workshops and seminars where this innovative approach will be discussed.
3. The Nigeria Educational Research and Development Council (NERDC) should sponsor research on the Ethnomathematics approach among various cultural groups in the country and incorporate the results into the National Primary School Mathematics Curriculum.

5. CONCLUSION

Ethnomathematics-based instructional approach uses cultural artefacts that are found in the

learners' locality in teaching geometry. The findings of the study have shown that their use in geometry instruction enhances pupils' learning and better achievement than the conventional method. This teaching approach is not only more effective and superior; it is one approach that could enhance classroom instructional delivery in primary school geometry. Therefore, this study has established that Ethnomathematics-based instructional approach is a plausible teaching option for use by mathematics teachers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX 1

Ethnomathematics-Based Instructional Approach: Lesson Notes for Treatment Group in Geometry

Topic: Properties of 3- Dimensional Shapes

Class: Primary 6
Time: 40 minutes

Instructional Objectives

At the end of the lesson, pupils should be able to:

(1). Identify some common 3-dimensional shapes, namely, cuboids, cubes, cylinder, cone, and sphere.
(2). Identify the faces, surfaces, vertices/corners, and edges of solid shapes.
(3). Draw their shapes using cultural artefacts

Instructional Materials

Cultural artifacts as may be mentioned by pupils in class.
Step 1 Entry behaviour: knowledge of cultural artifacts like clay bed, local basket, native drum etc.
Mode: Group work (Gender sensitive)

Teacher's Activities

He divides the pupils into groups. Asks each group to appoint a leader.

Pupil's Activities

Pupils cooperate with the teacher to form groups and appoint leaders.
Step 11 Content Development
Mode: Group work

(a)   Identification of Common 3-dimensional Shapes

Teacher's Activities

(i) The teacher introduces the lesson by explaining the things seen around, like liquids, gases and solids. All these things occupy space and have shape. A thing which occupies space and which can keep it shape without help is called a solid. Gases and liquids occupy space but must be kept in a container if their shape is to remain the same. So they are not solids.

 i.   Asks pupils to give examples of solids from their environment.
ii.   Through appropriate questioning, the teacher explores pupils' knowledge of solid shapes using various cultural artefacts like clay bed/sleeping bed (kiipimpong), long drum (kyiru), native drum (ekam), local basket (kakye), round house, gong (kemgbung), top of a basic of garri, calabash plates (Aban) (Chart1)
iii.   Provides opportunity for pupils to discuss the names of these cultural materials (artifacts)
iv.   Explains that these things that occupy space have their sizes, lengths and shapes (identify each cultural artefact with its related 3- dimensional shape)
v.   Asks each group to show the outside, inside, width, length and height of solid shapes.
vi.   Explains that every solid shape has three dimensions, namely, length (1), width (w) and height(h).
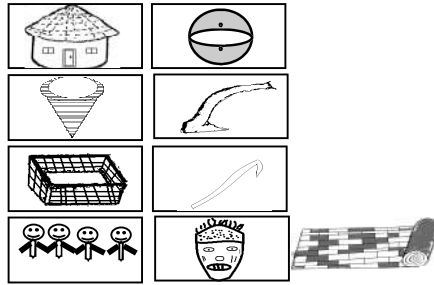
Chart 1: Cultural artefacts

Pupils' Activities

i) Pupils listen attentively to teacher's explanations.
ii) They give examples of solids from their environment
iii) Pupils mention cultural artefacts that are identifiable with 3-dimensional shapes
iv) They discuss the names of these cultural artefacts
v) They observe the sizes, length and shape of solids
vi) Pupils identify the outside, inside, width, length, and height of solid shapes
vii) Identification of Parts of the Outside of Solid Shapes

Teacher's Activities

i) Explains that the outside of any solid shape is called the surface. Edges divide the whole surface into faces.
ii) The teacher shows the pupils the surfaces, faces, vertices and edges on the various objects as indicated in charts 1 and 2.
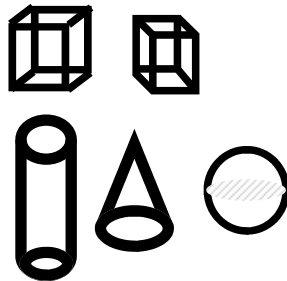
Chart 2: Diagrams of cuboids, cube, cylinder, cone, sphere

iii) Asks pupils to discuss in their groups the various parts of solid shapes.

Pupils' Activities

(i). Pupils observe and identify the surfaces, faces, vertices and edges of solid shapes.

Step III Discussions
Mode   Whole class

Teachers' Activities

Teacher leads the class discussions by asking pupils to:

i) Differentiate between solids and gases/liquids
ii) Give examples of three dimensional objects from their home.
iii) Mention cultural artefacts that have shapes like cuboids, cube, cone, cylinder and sphere.

iv) Identify the surfaces, faces, vertices, edges, height, width and length of solid shapes.
v) Teacher corrects misconceptions that may arise as regard these shapes using cultural artefacts.

Pupils' Activities

Pupils participate actively by explaining the ideas learnt.
Step IV: Summary
Mode: Whole class

Teacher's Activities

i) Teacher summarizes the lesson
ii) Gives summary notes
iii) Gases, liquids and solids that we see occupy space and have shape.
iv) Solids can keep their shapes without help; but gases and liquids cannot, except they are kept in a container.
v) Solid shapes have sizes, lengths and shapes.
vi) A solid shape is called 3- dimensional because it has 3 dimensions – length (l), width (w) and height (h).
vii) They have surfaces, faces, vertices and edges.

Pupils' Activities

Pupils write Summary notes in their exercise books
Step V: Evaluation (oral)
Mode: whole class

Teacher's Activities

Mention:

1. The dimensions of a solid shape
2. Why is a solid different from gases/liquids?
3. The outside parts of a solid shape

Pupils' Activities

Provide responses to questions asked by the teacher.
Assignment
Draw the different cultural artefacts.

Topic: Properties of 3 – dimensional Shapes

Class: Primary 6
Time: 40 minutes

Instructional Objectives

At the end of the lesson, pupils should be able to:

i) Draw some common cultural artefacts and other solid shapes
ii) List the properties of 3- dimensional shape (solid shapes)

Instructional Materials

Cultural artefacts
Step I: Entry Behaviour: Pupils have seen clay bed, wooden gong, local drum, and traditional container made of cane rope.
Mode: Group Work

Teacher's Activities

Using some cultural artefacts, asks pupils to point out the surfaces, faces, vertices, edges, width, length and height.

Pupils' Activities

They supply answers to the teacher's questions
Step II: Content Development
Mode: Group Work
(a). Drawing of cultural artefacts and other solid shapes

Teacher's Activities

Asks pupils to draw cultural artefacts in their exercise books

Pupils' Activities

Pupils draw some cultural artefacts in their exercise books.
(a). Identification of properties of solid shapes.

Teacher's Activities

  i)   Teacher notes down the relevant concepts pupils have acquired culturally in relation to these cultural objects (solid shapes).
  ii) He connects to the pupils' initial ideas of these cultural artefacts with the new concept to be introduced in the lesson.
  iii) Teacher gradually introduces the properties of each solid shape based on the initial ideas pupils expressed as surfaces, faces, vertices and edges.

The Cuboids

Through questioning, pupils discuss the shape of a sleeping bed (kiipimpong) made of clay and the traditional container (Leche), made of cane rope.

Wall
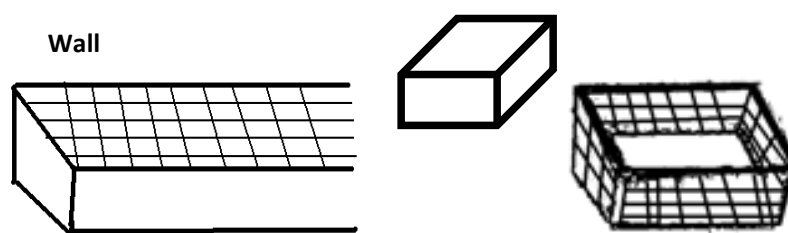
Each pupil participates in identifying and counting the number of the faces (6) edges (12) and vertices (8) and each flat face is a rectangle. The chalk box or match box is used to illustrate the properties. To explore their knowledge of a cuboid, each group is asked to write down six objects that have the shape of a cuboid in their home environment. Examples include, chalk box, maths set, match box, carton, etc. This brings out the cultural applications of cuboids.

The cube: teacher illustrates the shape of a cube employing a traditional musical drum (kakam). Pupils are asked to draw these cultural artefacts which have all sides equal. Together with the pupils, the properties of a cube are identified and counted thus: 6 equal faces, 12 edges, 8 vertices and each flat surface (face) is a square. The teacher then explores pupils' knowledge of common objects that have the shape of a cube in their home. Examples are magi, sugar and die.
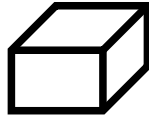
The cylinder:

The teacher uses appropriate questions to explore pupils' knowledge of objects (cultural artifacts) that have the shape of a cylinder. Pupils discuss the shape of native drum (ekam), long drum (kyiru), made of wood and a local basket (kakye). Pupils are asked to draw these cultural artefacts which are cylindrical in shape. Pupils participate to determine the properties of a cylinder (closed) 3 surfaces (two circular surfaces and one curved surface); 2 curved edges and no vertices. Pupils should discuss the uses of these cultural artifacts in their home setting. The teacher further asks group to list the local application of cylinder in their home environment. Examples include, the body of a round house, native drum, basket making with cane rope etc.


The Cone: The teacher explores the knowledge of pupils of traditional objects (cultural artefacts) with the shape of a cone. Pupils list such objects like roof of a round house, the gong (kemgbung), top of a basic of garri, etc.
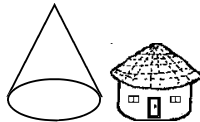
Pupils are asked to explain the cultural applications of this shape (conical) in making yam heap/mound, building the roof of a round house, top of the basin of garri. Teacher explains the properties of a cone: 2 faces (the circular and the curved surfaces), 1 edge and one vertex.

The Sphere: The teacher explores pupils' initial ideas of a shape that is spherical. They are asked to explain the shape of cultural artefacts like a pair of traditional eating plates (aban) (calabash) made from gourd.
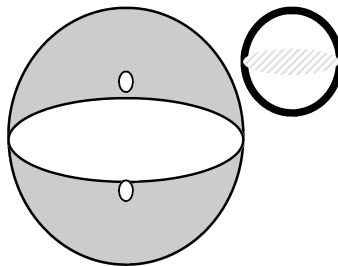
He determines the properties of a sphere: 1 face (round surface), no edge, and no vertex. Pupils are asked to explain the cultural applications of this shape (spherical) in making "Aban" (traditional plates). Examples in the home are: an orange, ball, body of a water pot

Pupils' Activities

Pupils participate actively with the teacher to develop the content and to mention cultural artifacts related to each solid shape.
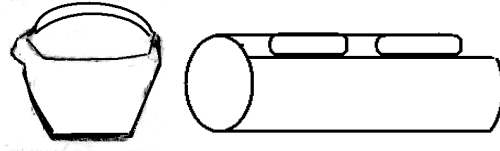
Step III Discussions.

Mode: Group Work

Teacher's Activities

   i)   Gives the groups two minutes to discuss properties of solid shapes with regards to cultural artifacts.
   ii) Asks each group leader to present the ideas, listing the properties of each shape.
   iii) Teacher reconciles any misconceptions pupils may express and links same to the lesson

Pupils' Activities

   i)   Pupils discuss the properties of solid shapes using cultural artefacts
   ii) Group leaders present the properties of solid shapes
   iii) Take note of any correction given by the teacher.
   iv) They mention the difference between a cuboid and a cube.

Step IV: Summary

Mode: Whole class

Teacher's Activities

   i)   The teacher summarizes the lesson and writes summary notes on the chalk board for pupils to write in their exercise books.
   ii) Goes round the class to supervise pupils' work.

Pupils' Activities

Pupils listen and then write down summary notes.
Step V: Evaluation
Mode: Individual Work

Teacher's Activities

Ask pupils the following questions:

   i)   List the properties of a cuboid, cone, cube, sphere, and cylinder.
   ii) Write down the names of solids shaped like (a) an orange (b) a brick (c) top of basic of garri (d) a die (e) a ball.
   iii) What is the difference between a cuboid and a cube?

Pupils' Activities

Pupils provide answers to questions.
Assignment
Indicate the number of (a) faces (b) edges (c) vertices of a cuboid, cube, sphere, cylinder and cone.
Topic: Angles
Class: Primary 6
Time: 40 minutes

Instructional Objectives

At the end of the lesson, pupils should be able to:

(i) Explain what an angle means
(ii) Classify angles

Instructional Materials

Traditional hoe, hook, made of stick and rope
Step I: Entry Behaviour: pupils have seen hoes and hooks.
Mode: Individual Work
 Meaning of an Angle

Teacher's Activities

Asks each pupil to draw intersecting lines and note the space between two lines.

Pupils' Activities

Pupils act according to teacher's instructions
Step II: Content Development
Mode: Group Work
Teacher's Activities

(i) Through appropriate questioning, the teacher explores pupils' initial ideas of an angle of cultural artefacts such as traditional hoe ("kygwap") and hook, (oyop).

(ii) Asks pupils to draw a traditional hoe (without the iron head) and a hook used for plucking fruits. They should note the space between the sticks.
(iii) Explains that the amount of space differs as the size of the cultural tool increases or decreases. Pupils are told that this space could explain the concept of an angle.

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