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.

Article Information

DOI: 10.9734/JSRR/2016/19079

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Complete Peer review History: http://sciedomain.org/review-history/11752

Received 24th May 2015
Accepted 10th September 2015
Published 8th October 2015

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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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 (l), width (w) and height (h).
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.

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.

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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 artefacts.
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