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Editor-in-Chief
Ray O'small Nwokike
Department of Mathematics/Statistics
Federal Polytechnic, Oko.

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Ray O'small Nwokike

Department of Mathematics/Statistics

Federal Polytechnic Oko

Mobile: 08062630952

E-mail: rayokike2003@yahoo.com

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Instruction to Contributors

Papers are invited from researchers

- In science (pure and applied) and technology
- The length of the articles should be between 6 and 10 typewritten pages excluding tables and appendices.
- Only papers not previously, published in journals should be sent in for publication.
- Footnotes/references follow the APA format.

GENERAL:

a) Manuscripts should follow the outline stated above.

b) Three copies of such manuscripts and correspondence should be addressed to the Editor-in-Chief, Department of Maths/Statistics, Federal Polytechnic Oko Anambra State, Nigeria.

Please send along a diskette of dimension 3.5" (8.75cm)/CD ROM containing the manuscript preferably in Ms Word, Ms Excel, Corel Chart, Page Maker and Corel Draw.

c) The text should be written in English; subscription rate per volume is N6000.00 postage (excluded).

Note: a free copy of the journal will be sent to the author(s) while additional copies will be purchased from the Editor-in-Chief.

FOREWORD/ EDITORIAL COMMENTS

The vital role played by Science, Technology, Engineering and Mathematics (STEM), in the development of nations have for long been recognised and effectively utilised by the developed nations of the world.

Conversely, those nations that have failed to recognise or gave undue attention to the catalytic role of STEM in their national development agenda, are referred to as under- developed. Obviously, our country, Nigeria falls within this latter category. To this end serious effort is needed from all stakeholders in nation building including the Science Teachers Association of Nigeria (STAN), in redressing this ugly trend thereby paving the way for Nigeria to take its rightful position among the developed nations of the world, the so much canvassed vision 20/2020 agenda.

The Science Teachers Association of Nigeria (STAN), a non-profit making professional Association, has its cardinal goal as promoting Science, Technology, Engineering and Mathematics teacher effectiveness in Nigeria. This goal is anchored on the realisation that no meaningful national development initiative can be fully achieved if the role of the teacher is neglected. This goal is achieved through a number of avenues including workshops, seminars, conferences, excursions, quiz/ project competitions and a number of academic publications. Through these avenues, ideas are cross-bred among STEM teachers and researchers at primary, secondary and tertiary levels thereby engendering the professional development of the members.

The STEM JOURNAL OF STAN 2010, is a product of Anambra State Branch of the Association and this Maiden Edition is meant to encourage members to publish and make progress as well as facilitate the interchange of ideas among STEM teachers at the state, national and international levels on issues of relevance to national development particularly, those bordering on STEM.

Articles are invited from contributors on regular basis. The views and opinions expressed by the authors are not necessarily those of STAN but that of the individual contributors.

It may be pertinent at this juncture, to give credit to the Immediate past Executive of STAN, Anambra State under the able leadership of Dr. C. V. Nnaka (Mrs.) for initiating this journal project and the Editorial Board for bringing the job to a logical conclusion.

God Bless.

Dr. Mars C. Anaekwe
Chairman
STAN Anambra State.

TABLE OF CONTENTS

USE OF PROCESS SKILLS APPROACH TO TEACH SOME MATHEMATICAL CONCEPTS

BY

DR. F.U. CHINWEOKE
AGULU GRAMMAR SCHOOL,
P.O. BOX 4, AGULU
ANAMBRA STATE

&

C.E. OKIGBO
SCIENCE EDUCATION DEPARTMENT
NNAMDI AZIKWE UNIVERSITY, AWKA
ANAMBRA STATE

ABSTRACT

The inculcation of process skills in our students is very vital for their development and acquisition of mathematical skills towards problem solving. This paper thus addresses the use of process skills approach to teach some mathematical concepts. In this paper, model lesson plan presenting use of process skills approach to teach concepts of pie and percentage error was x-rayed. The importance of these process skills in teaching and learning of science/mathematics makes it worthwhile that science/mathematics teachers should imbibe them in their classroom's teaching and learning activities for their students' scientific/mathematical skills acquisition towards becoming our future scientists and mathematicians. In effect teachers should be encouraged, by empowering them to attend conferences, seminars and workshops, to help equip them with competencies/skills needed for effective use of these process skills.

BACKGROUND

Process skill is derived from the concept of science. Science according to Ibe and Nwosu (2003) is seen as a dynamic and an objective process of seeking knowledge and an enterprise that involves people searching, investigating and seeking verification of national phenomena. Science may be seen as a product and a process. As a product, it consists of body of knowledge in form of ideas, facts, principles, theories etc; and as a process, is seen as methods or ways of learning science.

These methods or ways of learning science is termed 'Process Skills'. According to Nwosu and Okeke (1995) process skills are the abilities, potentials, and technical know how which can be developed by experience and used in carrying out mental operations and physical actions. Ibe and Nwosu (2003) pointed out that possession of these process skills is basic to scientific inquiry and the development of intellectual skills and attitudes needed to learn concepts. Learning process skills is a preparation to becoming a scientist. Process skills are identified as: observing, measuring, hypothesizing, identifying, predicting, collecting, organizing, selecting etc. On the other hand the work of a scientist involves carrying out all those acts that is observation, measurement, experimentation, selection, organization, identification, prediction etc.

When these process skills are applied to science, they are called science process skills. Science process skills are means of learning science and are essential for the conduct of science and perhaps the best way to teach science. Chukwuemeka and Aneale (2008) termed science process skills as the generalization and transferable intellectual and physical capabilities, needed to learn the concepts and broad principles used in making valid inductive inferences and which are reflective of the behaviours of scientists. These skills are listed as follows: observing, measuring, classifying, communicating, predicting, inferring, questioning (inquiry), controlling variables, hypothesizing, deferring operationally, formulating models, designing experiments, experimenting, organizing, grouping, selecting, interpreting data and making deductions/conclusions.

These are the best ways of teaching science that will enable the children (students) carry out activities that involve use of their five sense organs (feeling, touching, smelling, seeing and hearing). Knowledge is highly retained by the act of doing rather than by memorization.

Learning science process skills is a preparation to becoming a scientist. Teaching students science/mathematics using science process skills will help to inculcate in them the habit of learning science by 'doing' instead of 'memorizing' facts and principles of science which they can easily forget with time.

Since the major aim of teaching science to our children is to let them know what science is as well as producing graduates who are capable of working like scientists; science teacher therefore should use methods whereby all students should actually carryout the kinds of activities/skills which scientists conduct in doing their work. This will help them develop and acquire a series of skills towards problem solving which are in turn related to the aim of teaching science.

Recognizing the importance of process skills in solving scientific problems, the Federal Republic of Nigeria (2004) emphasized that the quality of instruction at all levels of education (primary, secondary and tertiary) has to be oriented towards inculcating among others, the acquisition of competencies/skills necessary for self-reliance. But regrettably the teaching and learning of science/mathematics in our classrooms fall below this expectation. Njelita (2005) discovered that what the chemistry teachers perceived as their instructional practices were different from what they were seen practicing in the classroom. Oragwam (2006) lamented that the knowledge of what goes on in our classrooms these days reveal that the teaching procedure in use makes mathematics instruction barren and uninspiring. All these support the claim that science teachers do not make use of right methods (science process skills) recommended for teaching science/mathematics in our classrooms.

The consequence of use of this wrong teaching methods in teaching is evident in poor performance of students in both internal and external examinations. The case at hand is the recently released November/December 2009 WAEC/NECO examination results in which the candidates results were abysmally poor and pages of newspapers carried that. Orintunsin and Belo-Osagie (2010) in Nation Newspaper of April 15, page B!, reported that hues and cries that greeted the 25.99 percent credit pass for WAEC and 10 percent credit pass for NECO in five subjects including English, and Mathematics, cut across the country, have left no one in doubt of the abysmal performance of candidates as unacceptable. This poor performance of our candidates has compelled the Federal Government to summon the chief executives of the two examination bodies to explain the mass failure and proffer solution. This case is not different from what has been going on over the years in the internal examinations.

The proffered solution to this is nothing but effective use of good teaching methods (e.g. process skills approach) which will allow long retention of knowledge passed on to students by their teachers.

To this end a leg out strategy as an example for the use of process skills approach to teaching mathematical concepts is considered imperative.

Model Lesson Plan on use of Process Skills Approach to Teach Mathematical Concepts.

Subject: Mathematics
Class: S S II
Time: 40 mins
Topic: Concepts of Pie and Percentage Error.

Specific Objective: At the end of the lesson, the students should be able to:

1. Identify the materials used in measurement
2. Measure the circumferences of any circular objects and their diameters.

3. Calculate the ratio of the circumference to the diameter of a circle, which is pie
4. Deduce that Pie is given by circumference divided by the

diameter of the same circle. I.e. Pie = $\frac{\text{Circumference}}{\text{Diameter}}$

5. Calculate the percentage error of their measurement.

Entry Behaviour: Students have learnt the terms – circumference and diameter of a circle.

Set Induction: What do we mean by the circumference of a circle? How can you define the diameter of a circle? Let them explain with the aid of diagram on the chalkboard.

Instructional Materials: Any measurable circular objects or cut-out circular-shaped objects, ruler, or tape, thread, chalk and chalkboard etc.

Instructional Techniques: Demonstration, illustration, giving examples, questioning etc.

Instructional Procedure:

Step 1: Introduce the topics: Pie and Percentage Error. Start by asking students what is Pie? This question will lead you to activity 1:

Activity 1: Demonstration: Demonstrate to the students using thread, ruler or tape and cut-out circular shaped object, how to measure the circumference of a circle and its diameter.

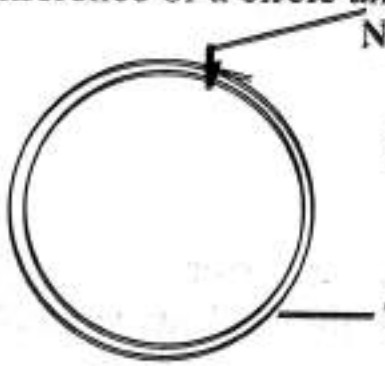

Fig 1.

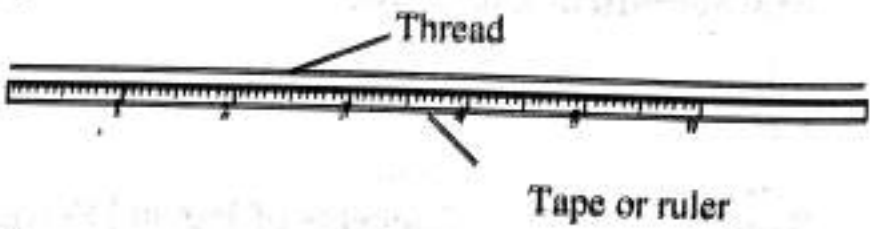

Fig 2.

Measure the circumference of the circle with a thread first, then stretch out the thread and measure the length with a tape or ruler, that gives you the distance round the circle or the circumference (see in figures 1 & 2 above.)

Then, for the diameter, fold the object to overlap itself along the symmetrical line to x-ray the diameter in unfolding the object. Then ruler is used to measure the diameter (see figures 3 & 4 below).

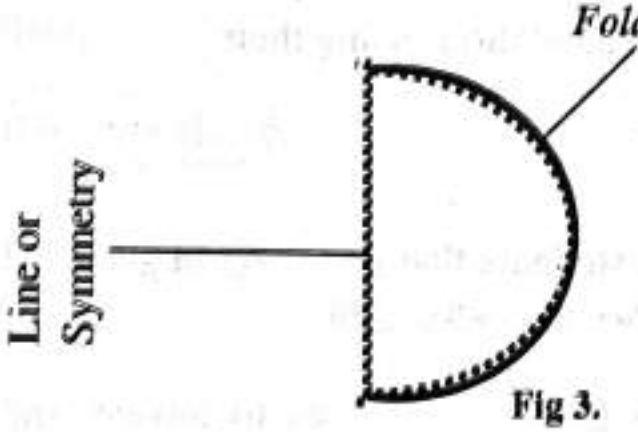

Fig 3.

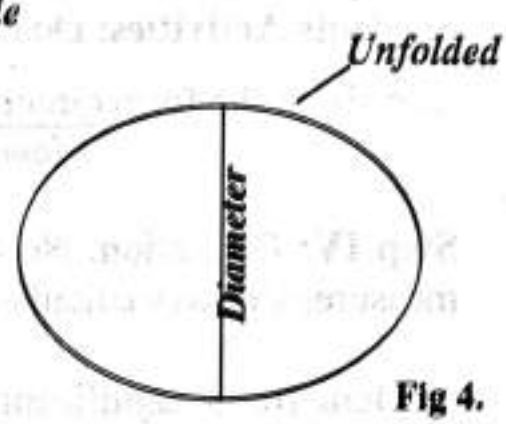

Fig 4.

Recording the result in the form
Circumference =
Diameter =

Step II: Distribute materials to students and ask them to do the measurement by themselves while you go round acting as a facilitator.

Students Activities:

1. Measure the circumference of the circular shaped object as demonstrated by the teacher using the measuring instruments.
2. Fold and unfold the object and then take the measurement of the diameter.
3. Record their result in the way provided by the teacher.

Step III: Illustration: Now, go to calculation of pie when the students must have finished with their measurement and recordings. Illustrate to the students on how to calculate the ratio of circumference of a circle to its diameter which is done by dividing the circumference by the diameter of the same circle.

$$\frac{\text{Circumference}}{\text{Diameter}}$$

Example, if the circumference recorded above in my own measurement is 112cm and diameter is 34cm, the calculation will read; $\frac{112cm}{34cm} = 3.29$ (3s.f.)

Let the students do their own calculations from their own records.

Students Activities: Do their own calculations using their records, in the form $\frac{\text{circumference}}{\textit{Diameter}}$

Step IV: Deduction: Now tell the students that pie (π) in standard measurement was calculated and was given as $\frac{22}{7}$ or 3.14cm (to 3 significant figure - (3s.f.). That goes to answer the question what is pie? Which was asked earlier on. Thus pie is defined as the ratio of the circumference of a circle to its diameter, which is calculated as 22/7 or 3.14. Allow students time to compare their results with that of standard value of pie. Let them ask questions if any.

Students Activities: Comparing their results with the standard value of pie, asking question if need be.

Step V: Calculation of Percentage Error (P.E.) in measurement: First explain to the student what percentage error stands for. Thus: Percentage error stands for the percentage of the ratio of the difference between the standard or actual measurement and the wrong measurement of an item to its standard measurement. This is given by the relation.

$$P.E. = \frac{AM - WM}{AM} \times 100\%$$

Where,

P.E. is the percentage error

AM is the actual (standard) measurement and

WM is the wrong measurement. Now take example from your own measurement and do the calculation.

From my own measurement above $\overline{\wedge} = 3.29$ cm (3s.f.) while the actual or standard measurement is 3.14cm. Now P.E. is calculated thus;

$$P.E. = \frac{AM - WM}{Am} \times 100\% = \frac{3.14 - 3.29}{3.14} \times 100\%$$

$$= \frac{-0.15}{3.14} \times 100\%$$

$$= -4.77707$$

$$\simeq -4.77\% \text{ (3s.f.)}$$

or $\simeq -4.7\%$ (2s.f.)

Here, my own measurement is higher than the actual measurement and that is why it reads negative. Your own result might read positive if your value is below the standard value. Now do your own calculations of percentage error using your values.

Students' Activities: Calculate the percentage error of their own measurements.

Step VI: Summary: Deductions/conclusion.

1. Pie $(\overline{\wedge}) = \frac{\text{circumference}}{\text{Its diameter}} = \frac{22}{7}$ Or 3.14 by standard measurement

2. Percentage error (P.E.) $= \frac{AM - WM}{AM} \times 100\%$

Where,
P.E. = Percentage Error
AM =Actual Measurement
WM= Wrong measurement (channon, Smith, Head, Kalejaiye & Macrae (1999)

Step VII: Evaluation: Assignments.

1. What are the instruments used as measurement devices in this lesson?

2. Pick up any plastic object that has circular surface. Measure the circumference of the circular surface, try and locate its diameter and measure it as well. With your recordings, calculate pie ($\overline{\wedge}$). Write down your observation i.e whether your measurement is the same as the standard measurement of pie or not. If not, calculate the percentage error of your measurement.

Conclusion

From this model lesson plan, we see that process skills are systematic processes, which are derived from science as science utilizes systematic approach in solving its problems. Therefore, process skills approach is a teaching strategy that can enhance student's mathematical achievements, as it is a gateway to develop and acquire skills that help in solving mathematical problems effectively. Teachers are therefore advised to make use of process skills in teaching and learning. So, mathematics teachers should be encouraged as far as possible to make effective use of these process skills in teaching/learning of mathematics in order to produce quality human capital that will help to create wealth for our national development.

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