

MATHEMATICS AS THE BASIC LANGUAGE FOR CHILDREN IN SCIENCE AND TECHNOLOGY

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Abstract

Mathematics has its relevance in many areas of life and in various school subjects like science and technology. It is described as the language of science and technology because it serves as a means of transferring, imparting and communicating technological language. This paper therefore discusses some of the roles of mathematics as the language of children in science and technology. The challenges facing the primary mathematics teacher are also considered because it is the teacher who in the final analysis, translates all policies into practices.

Introduction

Science and technology are basically interrelated but contrasting activities. Science serves the role of seeking out knowledge, finding out and exploring the world in which we live. It involves observing, posing questions, predicting, finding patterns and relationships, as well as manipulating materials and equipment effectively (Haggis 1991:34). These are activities which the children find very interesting to carry out. This is because children by their very nature are very inquisitive and possess some imaginative powers at a very early age. Ajuar and Okandeji (2002:173), also agree that right from a very early age, as soon as a child can grasp things with their hands, they start experimenting with everything they encounter. They want to touch, feel, smell and observe things around them. These activities are basically reported by the children using simple mathematical terms.

On the other hand, technology serves the purpose of using and applying the knowledge acquired through the scientific processes in the service of humanity and in fulfilling individual, community or national need. Technology is a product of creativity which is a higher order of thinking. Resnick in Sawa (2000:24), stated that higher order of thinking involves a cluster of elaborate mental activities requiring advanced judgment and analysis of complex situations using multiple criteria. Despite the importance ascribed to scientific and technological developments, a greater percentage of Nigerians lack access to the knowledge skills and technologies that can improve the quality of their lives and help them contribute to national development. Thus, the need to start early from the home and primary school level to emphasize scientific and technological skills which depends greatly on the use of mathematical language.

Mathematics as the language

Onoh and Obodo (2001), defined mathematics as a language which deals with quantitative facts and relationships as well as with problems involving space and form. It is seen as a language of size and precise order which expresses quantitative expressions in special symbolic forms. Similarly Odogwu (2001) described mathematics as a labeling system for the reality, used for describing and communicating models of various aspects to concrete reality.

Mathematical language possesses several characteristics. It is precise, accurate, and objective. It maintains sound judgment, logical conclusion as well as critical, analytical and postulative thinking. It also relies greatly on the use of symbols and numbers for the purpose of conveying its meaning. Mathematical language plays vital role in science and technology. This is because it serves as a means of transferring, imparting and writing technological language. It serves the purpose of communication and this is an essential vehicle for any technology.

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It has been observed that children are very inquisitive and possess some imaginative powers at a very early age. They ask hundreds of inquisitive questions and we use scientific and mathematical processes to provide the necessary answers. For instance children can be exposed to the physical world and encouraged to observe and record the number of cars passing along their street at a particular time of the day. This ability to observe and record results carefully is a vital step resulting to

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scientific exploration. Scientists equally show interest in finding patterns and classifying natural occurrences. Scientists at times, encourage the child to think about objects according to their sizes. In doing this, they rely on mathematical concepts, skills and operations such as measurement set, counting basic arithmetic operations etc.'

Primary school children can be introduced to some scientific concepts which provide the necessary framework upon which scientific facts rest. These scientific concepts include; organization, change and diversity etc. The child is easily exposed to the fact that the natural world changes continually. While some objects change at a rapid rate, some do so at a relatively slow rate. To observe and classify these changes and diversities, the child consciously or unconsciously adopts the use of some mathematical facts and terminologies. Consider what happens when a child is asking to observe and record what happens when an ice cube is allowed to melt and vice versa. Such terms as shape, liquid, volume, time etc may be unavoidably used by the child.

Furthermore, the role of mathematics as the language of children in science and technology could be categorized as follows:

(a) Acquiring Functional Numeracy And Computational Skills

The knowledge of single digit number facts, ability in using basic arithmetic operations, mental arithmetic and recognition, use and estimate with percents are valuable to a Childs development in science and technology. According to Haggis (1991), numeracy is a complementary element to scientific and technological literacy. In different parts of the country, numeracy adopts different shades of meaning. It is not just a matter of being able to add and subtract but particularly that of being able to use such skills to solve problems encountered in everyday life. Mathematics inculcates in the child the ability to sound using both whole and fractional numbers and the ability to apply such in solving practical problems. It develops in the child a kind of competence in the basic skills and knowledge for dealing with numbers.

(b) Developing Problem Solving Abilities In The Child

Learning to solve problems is the fundamental reason for studying mathematics and it is equally a strong base for children's development in science and technology. It is the process of applying previously acquired knowledge to new and unfamiliar situations. Akinsola (2001), stated that the society needs to solve problems that confront humanity and mathematics methods are veritable vehicle of problem-solving. Problem-solving according to Obodo (1997), comprises of identifying, defining and delimiting the problems, proposing hypothesis, collection of data, trying out the hypothesis and verification. It therefore follows the steps of scientific method as well as those of reflective thinking. It also inculcates in the child, the habit of finding adequate patterns and seeking logical answers.

(c) Developing Abilities In Measurement And Estimation,

A child cannot be exposed to scientific experiments and technological advancements without a minimum ability in measurement, approximation and estimation of numbers and quantities. Mathematics enables the child to acquire simple techniques for estimating such things like time, distances, weights etc knowingly or unknowingly, estimation is one of the mathematical ideas that span the spectrum of society. Mathematics enables the child to equally develop fundamental concepts of measurement through concrete experiences. They are able to measure distances, mass, time, capacity, temperature, perimeters, areas etc. These abilities are quite inevitable in science and technology,

(d) Developing Geometrical Concepts

Children are exposed to spatial concepts through mathematics. The knowledge of such geometrical concepts like three dimensional and two dimensional shapes, parallel lines, symmetry, congruency, perpendicularity etc in a practical and descriptive manner plays vital role in children's development in science and technology. It enables them to function effectively in the three- dimensional world.

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(e) Developing Statistical Abilities

Basic knowledge of statistics and techniques of representation and interpretation of data acquired through mathematics are very essential for children to develop adequately in science and technology. Elementary statistics exposes the child to gain ability in collecting and organizing data to answer questions in everyday life. It also enables the child to know how to construct, read and arrive at conclusions from simple tables, maps and graphs.

Consider this science activity planned for children to illustrate capillary action and discover how its description and analysis depends largely on the use of mathematics concepts, symbols and operations: "Lay 4 pieces of celery in a row on a cutting board or counter so that the place where the stalks and the leaves meet matches up. Cut all 4 stalks of celery about 10 centimeters below where the stalks and leaves meet. Put the 4 stalks in 4 separate cups of purple water (use 10 drops of red and 10 drops of blue food color for each half cup of water). Label 4 paper towels in the following ways: "2 hours," "4hours," "6hours," and "8hours." Every 2hours from the time you put the celery into the cups, removes 1 of the stalks and put onto the correct towel. (Notice how long it takes for the leaves to start to change). Each time you remove a stalk from the water, carefully peel the rounded part with a vegetable peeler to see how far up the stalk the purple water has traveled. What do you observe? Notice how fast the water climbs the celery. Does this change as time goes by?. Measure the distance it has traveled and record this amount (Bruno, 1991).

Notice that for the child to carry out this activity successfully he or she needs good knowledge of numbers and numerals, measurement of length in metric system, measurement of time, estimation, basic arithmetic operations etc.

In general, mathematical language is a central and essential ingredient in any scientific and technological endeavour. This is because the originators and inventors of modern technology would have lived and died along with their ideas if there were no appropriate mathematical language in which they wrote their designs, formulae, theories and principles (Onoh and Obodo 2001). It is therefore necessary that its speaking and usage starts fluently and confidently from the childhood stage most especially in the primary school so as to lay a good foundation and introduce them early enough to science and technology.

Implications For The Primary Mathematics Teacher

The primary mathematics teacher plays strategic roles in influencing the achievement of the learners. Teachers effectiveness as measured through his ability to acquire and use good instructional skills and methods is a prominent factor that influence the achievement of learners in school mathematic. It is the teacher in the final analysis who translates policies into practices and programs into actions (Benard 2001). This implies that for mathematics to succeed as the language of children in science and technology, the teacher should adopt the use of inspiring methods, which would reduce the abstract nature of the subject. Such methods should enable the child to gain functional numeracy, develop problem solving abilities, form a habit of effective critical thinking which is the basis for developing a scientific attitude and develop computational skills in solving everyday life problems.

The development of mathematical language in children does not take place spontaneously. Thus Odogwu (2000), is of the opinion that the primary concern of the mathematics teacher at the primary level is to encourage and improve the communication of mathematical meanings. This communication could be achieved through verbal, pictorial or in mathematics symbols. The primary school pupils must be guided to understand these symbols and use them confidently. These symbols should be explained to the child both in the mother tongue and English language so that he can relate the mathematical idea between his mother tongue, English language and mathematical language. Teaching at this level must place emphasis on mathematical activities, which are focused on mathematical meanings. This could be achieved through making effective use of instructional materials. Instructional materials according to Obodo (1997), helps to reduce the level of abstraction involved in teaching and learning a concept and provides for active participation of the students.

Knowledge is constructed through the senses (Ogunkunle, 2002). Thus by implication, the teacher should give the children opportunity to experiment with ideas and help guide their discovery of critical concepts. The children should be exposed to cooperative learning, where they easily discover and comprehend difficult concept in the process of discussing with each other. Instructions in mathematics should aim at providing experiences and information from which learners build or

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construct new knowledge, which is both valid and powerful. This is very vital if the children are to develop mathematics as the language of science and technology.

It has been observed (Ezeugo 2003), that the mathematics laboratory serves as a means of creating an appropriate learning environment for mathematics learning. It exposes the students to experience that stimulate their thinking, imagination and interest and provides avenue for student to study the relationship between cause and effect and as a result, have better understanding of mathematics. In essence, mathematics laboratory provides opportunity for practical illustration of mathematical principles, laws and theories, thus bridging the gap between formal education and real life so that the learning experiences gained in the classroom are adequately applied in meeting everyday needs. This is an essential complement to scientific and technological literacy. The teacher should therefore give much attention to laboratory work so as to assist the children in understanding well through experimental activities dealing with concrete situations. In adopting the use of the mathematics laboratory, the teacher should emphasize the relevance and application of mathematics in other fields, subjects and everyday life.

Since the primary level is the starting point of the nations, educational system, the challenge before the mathematics teacher is to help pupils develop a solid foundation in mathematics language for scientific and technological growth. The mathematics teacher at the primary level has to exercise some patience, endurance, tolerance and diligence. He has to devote a lot of time and attention to the child so as to enable him imbibe the mathematical language necessary for science and technology.

Hindrances To The Development Of Mathematics Language.

Several factors militate against the teacher's role in inculcating mathematics as the language of science and technology in children. These according to Obodo, (1997); Ogunkunle, (2002), Bernard, (2001); Odogwu, (2000) include; lack of specialization in primary school teaching; large number of pupils in the classroom, lack of adequate school infrastructure and teachers lack of motivation.

In the primary schools, the teachers are forced to teach all the subjects. As a result, those who teach mathematics are not trained mathematics teachers. They only possess a meager and unsatisfactory knowledge of mathematics. Many of the exhibit negative attitude towards the subject, yet they are compelled teach it. This affects the pupils adversely.

Primary school education is presently witnessing population explosion. There exists very large number of pupils in the primary school classrooms and this hinders the teachers ability to give individual attention to the children. As a result, the teacher may not identify the mathematical difficulties of the pupils quite early. When this happens, the pupils exhibit weak foundation in mathematical language.

Another problem facing the development of mathematical language is lack of adequate infrastructure and mathematics laboratory (Ezeugo, 2003). Most primary schools lack sufficient infrastructure to cater for the large number of pupils, in some schools, pupils sit on bare floors to take their lessons. The mathematics laboratory is equally lacking and even some basic instructional materials are rarely used. This affects the quality of mathematics instruction. Moreover, Obodo, (1997), Onoh and Obodo, (2000) stated that the teachers lack of competence, negative attitude, use of ineffective teaching method, too much work load, lack of motivation resulting from poor remuneration equally hinders the development of mathematics as the language of children in science and technology.

Recommendations

From the foregoing, it is recommended that:

1. Teacher trainee's should be exposed to enough courses in mathematics to provide the required confidence for the teaching of the subject. The application of mathematics to the solutions of human problems should also form a part of the training process.
7. Regular seminars / workshop / refresher courses should be organized for teachers to enable them upgrade their knowledge on current practices in the subject.
3. Government, school administrators and policy makers should consider allowing teachers in the primary schools to focus on their areas of specialization.

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4. School administrators should ensure that the number of pupils per class is greatly reduced to enable the teacher make meaningful impact on the children.
5. Government should provide the necessary infrastructure and teaching materials and ensure that each school has a viable mathematics laboratory.

Conclusion

From the above, it is observed that mathematical language is a central and essential ingredient in children's development in science and technology. It enables them to develop problem solving abilities and form a habit of effective critical thinking which is the basic for developing a scientific attitude. It is therefore necessary that its usage should start gradually, fluently and systematically from the primary school which is the foundation of any educational system. This has several implications for the primary mathematics teacher whose duty it is to acquire and use good instructional skills and methods for the purpose of influencing the achievement of the learners. However the actualization of mathematics as the language of children in science and technology is hindered by some factors which include lack of specialization in primary school teaching, existence of cry large classes, lack of adequate infrastructure and poor motivation of teachers.

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