

METHODS OF TEACHING SCIENCE, BASIC TECHNOLOGY AND COMPUTER STUDIES



EDITED BY

**Professors: I. O. Abimbola, A. S. Olorundare,
M. O. Fajemidagba, Esther O. Omosowo, S. A. Onasanya,
Dr. M. A. Fakomogbon & Dr. N. A. Adedokun-Shittu**

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CHAPTER 6

PROBLEMS AND PROSPECTS OF TEACHING MATHEMATICS

M. A. Akanmu *Ph.D* & M.O. Fajemidagba *Ph.D*

Objectives

Reading through this chapter, students should be able to:

- (i) Identify and explain the two principal ideas of Skinner relevant to the teaching and learning of mathematics;
- (ii) Describe aspects to be considered for an effective mathematics teachers;
- (iii) Explain challenges of effective integration of new technologies in the teaching and learning of mathematics; and,
- (iv) List and explain things that could enhance the prospects of mathematics teaching.

Introduction

The usefulness, power and beauty of mathematics permeate the world around us. Its understanding aimed at developing mathematical curiosity and use of inductive and deductive reasoning for problem solving can therefore not be underestimated. As a science of numbers and shapes, mathematics has been described as the most potent instrument upon which modern scientific and technological development rely. In spite of this and in the recent years, there have been critical issues on effective teaching and learning of mathematics. The picture and impressions created from available literature is clear and disturbing. The elements of this picture are the students, the teachers, the technology and the mathematics curriculum. Each of these has its problems and prospects, which are discussed in this chapter.

The Learners

Learning of mathematics is a process, which consists of series of mental connections or bonds. Forming and strengthening an immense number of bonds and connections between the sequence of numbers in counting, use of the language, symbols and notation, the items in addition and multiplications, algebra rules, trigonometry and geometry, and so forth, could be complex tasks. Thus, understanding the approach of Piaget as a child psychologist whose set of empirical data formed the foundation of his theories on development, learning and education will be necessary in mathematics classes and probably, explain, in part, the lack of desired mental capability of many youngsters to pursue abstract thinking required in mathematics. Part of the problem seems to lie in the fact that we are yet to have a good grasp of the psychological principles that govern the learning of mathematics, whereas much is known about the psychology of language. As opined by Skinner (1954), the two principal ideas of immediate *reinforcement* of right responses and careful *programming* of the learning tasks must be emphasised for building appreciable learner's firm control over mathematical phenomena. Under optimum conditions, every time a student gives a right answer to a given task, there must be some way of whispering approval to his ear within the time frame of the response

made. Also, with respect to careful programming of the learning tasks, the trick is to arrange them in such a way that when a student hits on the response to one task, the chances will be that he/she strikes the right response to the next. For instance, having worked up the easy task of $2 + 2 = ?$, he might not find it difficult to solve $5 + 2 - 3 = ?$. Until one day, on his frame of mind, find it easy to dispatch task on calculus and trigonometry.

Unfortunately, the current teaching fashion as applied to mathematics is against this programming approach. The argument is clear by the field theorists that the approach is arbitrary and mechanical with the claim that the learner may perform the task given without necessarily getting the understanding of the reasons for his actions. The chances are also that the field theorists are not far from controversies as it is clear that in the strengthening of all the various kinds of learning connected to mathematics, both theories, that is, reinforcement and programming have important roles to play. The definition of their roles, is not limited to the theorizing approach of mathematics teaching today, which constitute a major setback, but from a long series of closely controlled, monitored and well-coordinated experiments with learners as they progress from year to year. With the present-day teaching approach and criteria for evaluating students' progress, there could be misleading notions about students' intelligence. The crammers (rote learning) excels whereas the intelligent ones (conceptual/factual learning) may suffer. The prospect therefore is to profit more about the relationship that exists with such factors as home background, parental attitudes, cognitive variables, non-intellective variables and mathematical learning to get a reasonably full understanding of what it takes to develop learners' competence in mathematics.

The Teachers

Mathematics teachers are undoubtedly pivotal to the effective teaching and learning of mathematics. Their duties transcend the four corners of the classroom. Like any other true profession, critical aspects, such as understanding/mastery of the subject matter, use of effective teaching technique, attitudes and characteristics are non-negotiable variables for a mathematics teacher. By understanding /mastery of subject matter, we mean thoroughness in subject being taught and prerequisite qualifications. Parallel to this is the use of effective teaching technique, which has to do with ability to organize thoughts/ideas, sequence events and transmit knowledge in the most innovative ways that could improve students' assimilation and accommodation of new materials. Then, attitudes and characteristics which are largely characterized by experienced or inexperienced teacher, effectiveness of a teacher and empathy (show of concern for social and emotional development of the students). All of these are important as neglect of any may pose serious danger to effective teaching of mathematics in our schools.

The recent development of recruiting teachers who lack interest in the profession, display of ignorance about the subject matter and carefree attitude on choice of appropriate means of delivery is scarily surprising. At least, 2 out of 10 mathematics teachers at senior secondary school level fall in this category. Their escape lies in memorization of answers to mathematics learning tasks without any clear understanding of concepts, basis for the applied rules, axioms or theorems

being taught to students. No doubt, this constitutes a major problem for the teaching of mathematics and development of mathematical skills needed for scientific and technological breakthrough. On the other hand, the remaining 8 out of 10 mathematics teachers who are committed and certified with experience and who have the right attitude are also faced with issues of motivation, lack of mathematics apparatus in the schools, availability of libraries and mathematical laboratories, discontented and half-hearted due to unpaid salary and overcrowded classrooms, among others.

The point is, with attendant benefits of mathematical knowledge and the role of teacher towards ensuring effective teaching and learning of the subject, there lies achievable prospects when teachers are:

- (i) recruited based on having the prerequisite qualification;
- (ii) provided opportunity for professional and academic development;
- (iii) motivated for effectiveness and demonstrable good relationship that, in turn, could enhanced students learning; and,
- (iv) provided with the necessary tools such as functional libraries and laboratories.

Technology

Integration of new technology in teaching is relatively new, but fast becoming a major challenge in the teaching and learning of mathematics in this part of the world. Substantial numbers of those teaching mathematics today learned mathematics without the use of technology. A few had the privilege of learning programming languages, such as BASIC as computers were being introduced into classrooms. In today's world of learning, mathematics textbooks now contain chapters on computer. Technology aided instructions or inclined devices for teaching, Hand-held computers with in-built mathematics software, are still lacking in our schools.

Technology (Communication and Information Technology) has the capacity to provide higher interactive potential for users to develop their individual, intellectual and creative-ability. The advantage of new technology over the traditional teaching approach includes: the development of human mental resources, which allows individual or group to both successfully apply the existing knowledge and produce new knowledge. Thus, the role of technology in this era is to primarily enhanced efficiency that is, helping the learner to learn mathematics more efficiently. If the technological tools are considered as providing access to new understandings of relations, processes, and purposes, then the role of technology relates to a conceptual construction kit. The assumption, the world over, is that the use of Information and Communication Technology (ICT) allows for increased individualization of learning with technologically-advanced workforce. With this in mind, the Nigeria nation cannot afford to downplay the need for investment and the timely integration of new technologies in the teaching of mathematics and other related subjects. The challenges, as identified by Emmanuel and Barau (2013), are to resolve issues of poor perception or ignorance about the potentials of ICTS among teachers, inadequate manpower for ICT training and utilization in the schools, high cost of accessing ICT facilities, provision of uninterrupted power supply with ICT driven policy.

Mathematics Curriculum

Between the students and the teacher is the mathematics curriculum. For mathematics as a subject, the mathematics curriculum bridges the gap between the teachers and the learners. The curriculum is the officially prescribed document that defines what pupils should learn and what teachers should teach in a subject within a school system. To be a useful prescription, the curriculum needs to be in vital contact with at least three areas of reality. These are:

- (i) the growing body of knowledge in the field itself;
- (ii) the specific mathematical needs of sciences, technology and profession; and,
- (iii) the minimal understanding of mathematics an ordinary person have to live comfortably in this technologically driven society.

The implication is that, the mathematics curriculum must be reviewed to meet the recent realities. The fact is that it has changed very little during the past century. The elementary school has offered arithmetic and some intuitive geometry; the higher education preparatory curriculum in senior secondary school has generally consisted of algebra in SS1; demonstrative geometry in SS2; trigonometry, solid geometry and, occasionally, advanced algebra in SS3.

The Nigerian system of education, which is largely being guided by the policy, since the success in the self-rule agitation from British colonial (which was said to be narrow in scope and did not meet the hope and aspirations of Nigerians) has changed (reformation) from 8-6-2-3; 6-5-2-3; 6-3-3-4 and, recently to 9-3-4 in search of a robust and all-encompassing system. This represents years for primary education, junior secondary education, senior secondary education and college/polytechnic/university education (higher education). The changing phases, according to scholars, could be attributed to personal idiosyncrasies of the actors, political instability, corruption, lack of political, will which constitute major challenges to effective teaching of mathematics as stakeholders are most times not involved in critical changes. Hence, with such growing wealth of materials and new delivery systems, teachers should be provided, individually or in groups, time and incentive for reviewing curriculum contents and resources. Also, provision of enabling environment that encourages teachers to investigate and document the effectiveness and implementation of the materials they adopt should be encouraged.

Revision Questions

1. What are the two principal ideas of Skinner considered relevant to the teaching and learning of mathematics?
2. Explain the field theorists argument against the two ideas of Skinner.
3. What are the critical aspects to be considered for a good mathematics teachers?
4. List and explain things that could enhance the prospects of mathematics teaching.
5. List and explain challenges of effective integration of new technologies in the teaching and learning of mathematics.
6. To be a use prescription, the curriculum needs to be in vital contact with at least three areas of reality. Write out the three areas and explain.

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