EFFECTIVE TEACHING OF MATHEMATICS

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Abstract

Papers have been presented Tor over years on the role of mathematics in nation building. All emphasis lay on the need for the nation to grow technologically which has basis on the level of scientific development a country has. Mathematics here becomes, very essential as it is the language of science. Unfortunately, instead of an improvement in the pursuit of the study of mathematics in our society, the reverse has always been the case. The writer in this paper dwelt on the effective teaching of mathematics as a way of raising interest in the study of the subject. Problems militating against and ways of enhancing the effective teaching of mathematics are discussed.

Introduction

Mathematics was described by Polya (1973), as the science that yields the best opportunity to observe the working of the mind, and has the advantage that by "cultivating it we may acquire the habit of a method of reasoning which can be applied afterwards to the study of any subject and can guide us in the pursuit of life's object.

The level of mathematics required varies from primary to secondary and from secondary to post secondary schools. In the same vein, the level of teaching and the calibre of teachers required also varies from one level to the other. At primary level, mathematics is one of the branches of learning that teachers must be capable of fostering, whether they like the subject or not. Sullivan (2003), emphasized that teachers at this level are not expected to be familiar with the full range of the aspects of scientific knowledge that are required for their teaching. Rather, it is important that they know how to learn the science they need and more especially, mathematics. We expect that primary school teachers will be familiar with mathematical concepts required for teaching in the early years, and even if they are uncertain about topics in the higher classes, we hope that they will learn those concepts as required.

The secondary school teacher, in contrast to the teacher in primary school, should be a mathematician capable of creating and organizing mathematical ideas as well as disseminating them. His mathematics courses during training should reflect the changes in the subject as a contemporary body of knowledge as well as developing deductive processes and the creative aspects of-mathematical discovery. At secondary level, we anticipate that prospective teachers would not have studied all of the mathematical domains that might be required in their teaching, hence, learning" continues.

At the post secondary level, much of the teachings are done by means of lecturing. At this level, teaching is highly specialized and as such, the teacher should be well trained. What matters most at this level is teaching and application. The way a teacher teaches mathematics to students studying business courses differs from the way he does the same to students in engineering. For instance, the teacher applies differentiation to the rate of change of the variables Cost (C), Profit (P), Revenue (R) with respect to the variable output (X) which is marginal cost, marginal profit and marginal revenue respectively to business students while in application to those in engineering, relates it to the rate of change of distance with respect to time which is velocity and so on.

Werry (1989), was plain in this respect when emphasizing that the more sound the foundation of mathematics, the more likely it is that the teacher has deep commitment to the subject, can see where topics lead, can make links between topics, can respond to students' questions with confidence, and can draw on interesting and relevant applications. The teacher with very little background might be expected to concentrate on narrow skills of limited applicability, to rely too heavily on textbooks, and not to convey a sense of enthusiasm for the subject.

Easy Going With Mathematics

The fear by students, of mathematics being a hard subject is supposed to be an uppermost agenda in the mind of any mathematics teacher. The ability to conquer this fear remains the challenge of any mathematics teacher. Planning how to subdue this fear in the students starts from lesson preparation to presentation.

In the opinion of Wcrry (1989), the teacher plays a central role by attempting to provide I conditions under which learning will occur most successfully for the group of students in a particular class ;it a particular time. The teacher translates or interprets (he intended curriculum for the students. That curriculum, ;is perceived and experienced by (he students, is thus dependent lo a very Ian extent on the teacher's interpretation. Teachers have an important influence on the ways in which students learrn mathematics ,and on their achievement in the subject. Bringing lo the classroom belie and altitudes towards mathematics by teachers have a bearing on those formed by students.

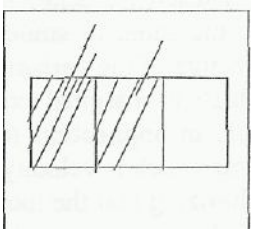
Simmons (1993), recommends three approaches to be employed by mathematics teacher These are exposition, discussion and analogues. We shall examine these approaches to see how the influence the attainment of maximum objective in his lesson presentation.

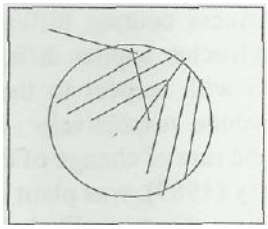
(exposition: The teacher should be able to express himself perfectly in terms of communication *am* presentation of lesson. Tin's approach to classroom teaching, particularly if the whole class is being addressed, puts the teacher in the spotlight, usually center stage, and demands are not dissimilar I those of an actor with an expectant audience. Effectiveness in this requires skills and attributes.

Discussion: Mathematics is learnt through interaction. Good discussion will not just happen, it has I*[1] be planned for, worked at and practiced. It essentially requires a shift in established roles of many teachers and their students. The teacher exploits questioning techniques and discussion which expose the students' demands and skills.

Analogies: Some areas of mathematics syllabus may appear too unfamiliar in nature but an approac . with applicable analogue makes it very famili;ir. in general, using models or symbolic reprcsentalior ol some unfamiliar topics appeals lo the students' informal knowledge about those topics knowledge which is based upon their own experience of real life situations. We consider here some . examples:

1. ' Thai a line perpendicular to a plane is perpendicular to every line drawn on the plane to its contact with the plane could be likened to a pencil held perpendicular on a table. In this ease, the pencil represents the perpendicular line while the table, the plane. The students can sec practically that \ lines drawn on the table to that point of contact is always perpendicular to the pencil.
2. As earlier mentioned, on the disappointing performance of students in mathematics, mam ".
   students cannot bring to (heir minds, the real meaning of fractions. According to Simmons (1993). : the. lack of'understanding of a fraction in any way other than as "part of a whole[11] has caused a In: - of errors. Models of fractions certainly provide an impressive picture of a whole being divided into eqim! parts. ('onsider the fraction 2/3. If the students are presented with a familiar activity which involves 'sharing', in a natural way, for example, 2 loafs of bread shared equally by three students, mosl students could see the connection. Examples of models of 2/3 arc shown below.





3. Appealing to the students* mind that even products of negative numbers give a positive number and the odd products of negative numbers give a negative number can be done through analogies. For instance, consider a soldier standing at attention facing eastward direction receiving order from another officer.

I st order - About Turn - reverse order (soldier faces west)
2nd order - About Turn - reverse order (soldier faces east)
3 rd order - About Turn - reverse order (soldier faces west)
4 th order - About Turn - reverse order (soldier laces east)
5 th order - About Turn - reverse order (soldier faces west)

and so on

Even reverse orders bring the soldier to his initial (positive) position while odd reverse orders bring him to the reverse (negative) of the initial (positive) position.

Teaching Aids Mathematics

Laboratories

Just as in physics and chemistry, there should be a befitting laboratory for mathematics teaching in every school. The advantages are numerous. The laboratory method provides many benefits in addition to an understanding of the mathematics involved. Students in the laboratory develop a method of enquiry; they are helped to learn to learn. Gathering, organizing, recording and representing data becomes essential skills. This method not only help to develop imagination and creativity, it provides for discovery, it motivates the students and helps develop interest in further enquiry but also provides for individualization, facilitating the use of language, and often provides the aesthetic appreciation.

Calculators

Calculators, whether scientific or non-scientific are found readily used in secondary schools this days. Much of the reluctance by mathematics teachers to allow the use of calculators according to Simmons (1993), developed from the fear that basic skills in arithmetic would suffer. If the use of calculators are to be effective, they must be seen to give the opportunity to do more enjoyable and productive mathematics. This will not necessarily happen by default, and part of the systematic use of calculators should be explicitly planned for by the teacher. Inappropriate use of calculators, for example where mental calculation would be possible and more desirable, can quickly lead to a more endemic situation where their only use is one which substitutes button pressing for thinking. For whatever part of the mathematics curriculum we plan to use calculators, we should always be aware of their role in suitably shifting the focus from actually calculating to thinking about the ideas behind the calculation.

Problems

If mathematics teaching showed any sign of continuing improvement and if students were learning mathematics well, the performance in mathematics at both secondary schools and tertiary institutions would have improved, Hiebert (2003). However, there are some problems militating against the effective teaching of mathematics in our schools. Robitaille (1992), observed that in every place where mathematics is taught, teachers' freedom of activity is constrained by environmental factors over which they are able to exercise little or no control. These include constraints within the school such as class size, determination of the content of the curriculum, lack of mathematical laboratories.

Class size

As Werry (1989), has it, class size is frequently regarded as an important variable in determining teaching behaviours in the classroom. Large classes are held to be difficult to manage, and to not allow the teacher to spend adequate time with individual students. On the other hand, small classes are said to permit teachers to monitor the achievement and progress of each pupil, be less stressful for the teacher, and allow the development of a more relaxed and productive classroom climate. In most schools, the class is always so large for proper assessment of the students.

Curriculum

In many mathematics curricula operational in our schools today, mathematics contents specified to be covered within a given period are found to be practically impossible. The time allotted to some mathematics courses in the curriculum are often very short that some topics are always left untreated at the end of the term or semester. Curriculum is an important guide in the teaching of mathematics. In the view of Philip (1973), the objectives of the curriculum determine the methods of teaching, and that therefore, 'psychology has been successful in suggesting ways of teaching only when objectives have been made operationally clear'

Lack of Laboratories

A well equipped mathematics laboratory should have do-it-yourself materials and tools. This problem of lack of mathematics laboratories is very endemic. At both secondary schools and higher institutions of learning, teachers teach students about solid figures, for instance, and appeal to their minds by drawing them on the board. Any solid figure could easily be demonstrated in the laboratory where students can observe it practically and bring the meaning closer to their minds,

Recommendations

Teaching takes place in a conducive environment and the interest in teaching is increased through positive motivation. The state and federal governments should make the. teaching of mathematics more attractive by giving some incentives such as scholarships which may include' oversea trips, and provision of some of the teaching aids mentioned earlier. This will boast the morals of mathematicians and mathematics educators which will in turn, increase the number of those who may choose mathematics as a career. In addition, private sector participation in the promotion of interest in mathematics is critical as government alone cannot bear this burden.

Conclusion

Teaching as a profession requires special skill which not every teacher has. There is the need for teachers especially, prospective mathematics teachers to undergo a preparatory program to achieve certain learning goals. Hiebert (2003), is of the view that it is possible to nurture, during a preparatory program, the knowledge, competencies, and dispositions that teachers will need to become expert mathematics teachers in the classroom. For teachers already working, in-service courses and workshops are to be organized for them periodically to acquaint them with the new teaching techniques. We cannot expect an initial course to give a complete training, but the intention should be to develop an attitude in the teacher which would be likely to produce continued growth in his professional insights and objectives.

Mathematics teachers are supposed to be motivated by given them some incentives. These will bring more commitment in the teaching of mathematics. This will no doubt bring about a turnaround in the declining number of mathematicians and mathematics educators which will in turn reduce the class size per teacher especially in higher institutions.

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