Mathematics in Adult Education: The Nigerian Experience

Isaac Olorunfemi Osafehinti

Adekunle Ajasin University,
Akungba-Akoko, Ondo State, Nigeria
prof_osafehinti@yahoo.co.uk

The importance accorded mathematics as a compulsory subject in Nigeria from Primary to Secondary school levels, reflects the vital role it plays in the contemporary society. Apart from the fact that success in mathematics enhances the quality of student’s certificates in the General Certificate Examination (GCE), trends have shown that to secure admission for most courses in the universities, a credit pass in the subject is an advantage. Thus, the study of mathematics in schools represents a basic preparation for adult life and a gateway into vast array of career choices. From the societal perspective, mathematics competence is essential for the preparation of an informed citizenry and for the production of highly skilled personnel required by industry, science and technology. However, only a small percentage of learners ever study mathematics beyond the secondary school level. The growing awareness of the need to study mathematics for self improvement, promotion and job security, has led some adults to seek admission into universities to study the subject. The yearnings of these adults are being met through Adult Education programs in some Nigerian universities. This paper reports an evaluation of the efforts made so far in this regard in the Adult Education programs of Adekunle Ajasin University.

Introduction

“Mathematics is the science that draws necessary conclusions” (Pierce, 1881).

Summary of Views about Mathematics

Mathematics is the body of knowledge centered on such concepts as quantity, structure, space and change, and also the academic discipline that studies them. Other practitioners of mathematics maintain that mathematics is the science of pattern and that mathematicians seek out patterns whether found in numbers, space, science, computers, imaginary abstractions or elsewhere (Steen, 1988; Devlin, 1996). Mathematicians explore such concepts, aiming to formulate new conjectures and establish their truth by vigorous deduction from appropriate chosen axioms and definitions (Jourdan, 2003). Mathematics, can therefore, be described as an organized active thinking, which involves the search for patterns and relationships that may be expressed in symbols. It is an expression of the human mind that reflects the active will, the contemplative reason and the desire for aesthetic perfection. Thus, mathematics is a structure of relationships and the formal symbolism is a way of communicating parts of the structure from one person to another. Hence, a mathematical statement basically deals with relationship within the structure expressed through the use of symbols—a kind of language designed purely for the purpose. The nature of mathematics has always tended towards abstraction. This is because its basic elements, which are numbers are very abstract. Through the use of abstraction and logical reasoning, mathematics evolved from counting, calculation, measurement and the systematic study of the shapes and motions of physical objects. Thus, mathematics attempts to present actual
relationship between concepts connected with numbers, together with their applications to problems arising in real world. Therefore, learning mathematics involves the apprehension of such relationships together with their symbolism and the acquisition of the ability to apply the resulting concepts to real situations occurring in everyday life. It is this aspect of mathematics namely, its application, that has made the subject the essential aids by which individuals and the society have benefited immensely. Knowledge and basic use of mathematics have always been an inherent and integral part of individual and group life.

Mathematics and Human Activities

In all the entire history of education, mathematics has held its leading position among other school subjects. It is generally considered as an indispensable tool in the formation of the educated man. According to Griffiths and Howson (1974), the educated man is that knowledgeable man, trained to approach the affairs of the daily life with some sense of detachment and objectivity and to reason about them soberly and correctly. For over 30 years, the position of mathematics in relation to the personality of man has not really changed, rather it has expanded. Mathematics is the means of sharpening the individual’s mind, shaping his reasoning ability and developing his personality. Personality, according to the principles of psychology, involves through a process of integration of the whole man. An integrated person is that one who is able to take a wider as opposed to a personal or sectional view in most questions. Such a person would be constructive rather than just critical in a difficult situation. These qualities made the integrated person an individual who is always trying to unite things rather than separate them. For sure, he would seek connections rather than differences and perhaps most importantly, he would be able to make a good adjustment to his environment by establishing a fundamental identity of interest between himself and his fellow men. Mathematics provides the forum in which this process of integration could be held, developed and internalized. The fate in mathematics to produce integrative effect on human personality dated as far back as the days of Pythagora. Mathematics was to the people of that age, a discipline of the mind *disciplina mentis* and so, it was dear to all who believe in education. In the ancient Egyptian society, mathematics was taught in order to achieve the desirable state of been a priest. The priest were highly honored and considered as men of high esteem and personality, who acquired their exceptional status through the discipline of mathematics.

Numeracy, the ability to understand and work with numbers is a necessary tool for the daily living of the people of any society. In many situations of life, an individual is faced with the task of taking some decisions. Many of such decisions can be taken more rationally if approached quantitatively.

Mathematics as a Universal Language

Mathematics is a universal language that cuts across all cultures and serves as a means of expressing thoughts in a neat and precise form. It is a means of communication and description used by economists, geographers, scientists, businessmen and women—people of all walks of life. No matter in what native tongue, mathematics precision remains the same. You may wish to consider the following mathematical instruction:

*Make thee an ark of gopher wood, rooms shalt thou make in the ark, and shalt pitch it within and without with pitch. And this is the fashion which thou shalt make it of: The LENGTH of the ark shall be THREE HUNDRED CUBITS, the BREADTH of it FIFTY CUBITS and the HEIGHT of it THIRTY CUBITS. A window shalt thou make to the ark ..............with LOWER, SECOND and THIRD stories shalt thou make it* – (Genesis 6: 14-16).
The above is a record of God’s instruction to Noah about the dimension of the Ark he was to build. This precise instruction was purely in mathematical language for the purpose of precision, neatness and fewness of words.

Today, more and more mathematics vocabularies are used in human interactions; at home, in the office and in sending messages in order to achieve precision in communication.

**Mathematics in the Nigerian Educational System**

In the Nigerian educational system, mathematics is accorded a prime place. The subject is made compulsory from Primary to Secondary school levels. This national position reflects the importance attached to mathematics in the educational system and the vital role it plays in the contemporary society. At the most basic level, the knowledge of mathematics is essential in the conduct of everyday living. In commerce, engineering, and the natural and social sciences, advanced mathematical concepts and techniques are indispensable tools.

Apart from the fact that success in Mathematics enhances the quality of students’ General Certificate of Education (GCE) certificates, the trend has shown that in order to secure admission into most courses at university level, a credit pass in the subject is an advantage. Thus the study of mathematics in schools represents a basic preparation for adult life and a gateway to a vast array of career choices. From the societal perspectives, mathematics competence is essential for the preparation of an informed citizenry and for the production of highly skilled personnel required by industry, science and technology.

**Mathematics in Adult Education**

Mathematics in adult education is an instrument for moving forward (Omolewa, 2006). With the use of mathematics, adult education makes provision and enables access for those who, for a variety of reasons have been kept out of the education system. The provision may simply be that of fundamental level of literacy. It however goes beyond this primary level of education to include remedial classes and continuing education programs in mathematics. Thus, mathematics in adult education offers people a second chance. Its focus is on lifelong learning and it provides everyone with the hope to live and change unacceptable circumstances and situations of life. It provides an alternative means of access to living through further learning. Perhaps, the greater value of mathematics in adult education is that it opens an avenue for bringing about change in individuals, communities, societies and nations. Its role is to assist whoever is ready to move from failure to success, from unknown to the known, from the obscure to the recognized and from the ignored to the celebrated (Egunyomi, 2008). Therefore the importance of mathematics in adult lives cannot be undermined.

**Categories of Adults Learning Mathematics**

In Nigeria there are three categories of adults who learn mathematics:
- Learners of mathematics in Adult Literacy Program
- Learners of mathematics for access to higher education
- Adult workers studying mathematics to earn university certificate for self-improvement, promotion or job security.
Mathematics in Adult Literacy Program

This is the level of literacy acquisition. The learning of mathematics by this group of people is part of the literacy program for adults in the society. The mathematics component of the program is essentially numeracy. Numeracy is a proficiency which involves confidence and competence with numbers and measures. It requires an understanding of the number system, a repertoire of computational skills and an inclination and ability to solve number problems in a variety of context. Numeracy also demands practical understanding of ways in which information is gathered by counting and measuring and is presented in graphs, diagrams, charts and tables.

Adult learners have different needs when it comes to numeracy. Some will want to improve their numeracy skills in everyday living situation such as shopping, banking and other situations of human interactions. Still others will need specific instruction on how they could read electricity bills, appreciate purchases and even assist their children or grandchildren in home works.

The programs for adult numeracy are usually organized by Departments of Adult Education in universities. They are usually delivered to the learners at community levels using Primary School buildings in the localities. The contact periods are evenings and weekends. This type of arrangement reduces the cost of education on the part of the learners. The numeracy aspect of adult education is holistic in nature, combining real life application of mathematics and the integration of mathematics into the whole program of adult learning. The real life application aspect described as active and authentic (Herod, 2000) is premised on the assumption that teaching and learning numeracy is most effective when it is tied to “real life” situations that are meaningful and relevant to the learners. When adult learners apply mathematics knowledge in their own lives or to their needs, they are motivated. Relating mathematics to the culture and lives of the people makes the learning of the subject very stimulating. It makes them see mathematics in everyday life. The process encourages critical thinking—solving life problems using variety of strategies.

The integration of mathematics into the whole program of adult literacy follows the pattern for numeracy for Adult Literacy Learners of Manitoba Adult Literacy and Continuing Education. Numeracy is taught along with Reading, Writing and Spelling. This approach ensures a blending of knowledge from the four areas of learning. It paves the way to learners’ understanding of verbal mathematics.

Evaluation of performance at this level is essentially informal. The measure of success is the learners’ ability to apply the knowledge they have gained to various aspects of their lives. Tutors
have noticed several instances where adults joyfully report their experiences of how they had been able to use their knowledge of numeracy to gain enlightenment in daily life interactions.

**Mathematics for Access to Higher Education: The Extra-Mural Programs**

Extra-mural studies are programs organized by Faculties of Education or Institutes of Education in Nigerian Universities to provide remedial education for people who had prematurely dropped out of the formal school system or either failed or obtained poor grades in the West African School Certificate Examination or General Certificate of Education.

The programs are located outside the main stream of the university academic system, in public or private school premises that can accommodate the number of candidates that seek such educational improvement assistance. The aims of the extramural studies include:

- To provide a functional and remedial education for those who had prematurely dropped out of school.
- To provide an opportunity for university aspirants to obtain qualifying grades in mathematics.
- To provide remedial courses including mathematics for candidates who either failed or obtained poor grades in various certificate/qualifying examinations.

The mathematics curriculum for this category of adults is a replica of the curriculum for Secondary School Certificate or the General Certificate of Education. The success of the program is measured by the percentage of candidates that succeeded in obtaining the required grades to gain admission into higher institutions. The mathematics programs of extra-mural studies have not attracted any serious empirical studies or investigation.

**Mathematics for Self-Improvement, Promotion or Job Security**

Adult learning mathematics of this category are found in the Sandwich Degree Programs in Nigerian Universities. What follows is an evaluation of learners’ performance in mathematics in the Sandwich Degree Programs of Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria.

**The Objective**

The Sandwich Degree Program is designed to meet the yearnings of many adults who had missed the opportunity of university education at their early stage of life. Apparently these adults cannot leave their jobs for full-time studies without government sponsorship. There is also the growing awareness of the need to study mathematics for self improvement, promotion or for job security. This is very true of many secondary school teachers who have reached a certain level in their career and could not earn promotion or elevation to a higher status because they do not have university degrees. These and other reasons have led some adults to seek admission into the university to read mathematics. The needs of this category of adults are met through the Sandwich Degree Courses.

**Structure of Courses**

The academic contents as well as the practical skills that students are expected to acquire are arranged in modules described as courses. The courses are graded according to the levels of the academic maturity of students. In addition, they are stratified into four or five hierarchical order depending on the entry requirements. Each hierarchy of courses denotes the year the courses are offered.
The following are the mathematics courses for the four year program:

**Year One**
MAT 101 Algebra and Trigonometry  
MAT 102 Vector, Geometry and Mechanics  
MAT 103 Introductory Calculus  
MAT 104 Statistics for Physical Sciences

**Year Two**
MAT 201 Mathematical Methods I  
MAT 202 Elementary Differential Equations I  
MAT 203 Linear Algebra  
MAT 205 Sets, Logic and Algebra  
MAT 206 Introduction to Numerical Analysis  
MAT 207 Real Analysis I  
MAT 208 Continuity and Differentiability  
MAT 209 Probability Distribution

**Year Three**
MAT 301 Abstract Algebra I  
MAT 302 Abstract Algebra II  
MAT 303 Introduction to Topology  
MAT 305 Vector and Tensor Analysis  
MAT 306 Elementary Differential Equation I  
MAT 307 Complex Analysis I  
MAT 308 Complex Analysis II  
MAT 309 Real Analysis II  
MAT 310 Numerical Analysis

**Year Four**
MAT 401 Ordinary Differential Equation  
MAT 402 Partial Differential Equation  
MAT 403 Functions Analysis  
MAT 404 Lebesque Measure and Integral  
MAT 405 General Topology

These courses are offered along side with two sets of General Courses, which each student must take and pass to graduate. They are; General University Courses (GST) and General Education Courses (EDU).

**Evaluation of Sandwich Mathematics Program**
The remaining part of this paper focuses on the evaluation of the efforts to provide Mathematics to adult learners in the university.

**Sample**
The sample consists of 32 (29 males and 3 females) students of the Four-year program, who had successfully completed their degree course in Mathematics Education. The students were selected on a whole class basis from the three centres where the program was mounted—Ikare, Ibadan and Agege in Lagos. The average age of the student is 48.32 with a standard deviation of 1.76.
Procedure
The results of the performances of the students from the point of entry to the point of graduation were collected and analyzed.

Results
The university regulations require that students’ scores in various examinations be graded and assigned points as outlined below.

<table>
<thead>
<tr>
<th>Scores</th>
<th>Grade</th>
<th>Credit Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>70% +</td>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>60-69%</td>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>50-59%</td>
<td>C</td>
<td>3</td>
</tr>
<tr>
<td>45-49%</td>
<td>D</td>
<td>2</td>
</tr>
<tr>
<td>40-44%</td>
<td>E</td>
<td>1</td>
</tr>
<tr>
<td>Below 40%</td>
<td>F</td>
<td>0</td>
</tr>
</tbody>
</table>

(i) The Total Credit Point (TCP) of all courses taken by a student is computed by multiplying the number of units for each course by the grade point equivalent of the marks scored in that course and summing over all the courses.

(ii) The Grade Point Average (GPA) is obtained by dividing the Total Credit Point (TCP) by the Total Number of Units (TNU) of the courses taken.

Thus: $\text{GPA} = \frac{\text{TCP}}{\text{TNU}}$

(iii) The Cumulative Grade Point Average is determined by summing up the TCPs for the years spent in the program and divided by the total Number of Units aggregated over the years.

The class of degree at the point of graduation is determined by the Overall Grade Point Average as follows

- First class: 4.50 – 5.00 Symbolized as 1st
- Second class upper: 3.50 – 4.40 “ 2¹
- Second class lower: 2.40 – 3.49 “ 2²
- Third class: 1.50 – 2.39 “ 3rd
- Pass degree: 1.00 – 1.49 “ P

The tables below show the final results of graduated students at the three centers:

Table 1. 2007 Graduating Students List: Education Mathematics (Ikare Centre).

<table>
<thead>
<tr>
<th>STUDENT</th>
<th>CTCP</th>
<th>CTNU</th>
<th>CGPA</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>430</td>
<td>121</td>
<td>3.55</td>
<td>2¹</td>
</tr>
<tr>
<td>2.</td>
<td>427</td>
<td>121</td>
<td>3.53</td>
<td>2¹</td>
</tr>
<tr>
<td>3.</td>
<td>414</td>
<td>121</td>
<td>3.42</td>
<td>2²</td>
</tr>
<tr>
<td>4.</td>
<td>393</td>
<td>121</td>
<td>3.25</td>
<td>2²</td>
</tr>
<tr>
<td>5.</td>
<td>392</td>
<td>121</td>
<td>3.24</td>
<td>2²</td>
</tr>
<tr>
<td>6.</td>
<td>391</td>
<td>121</td>
<td>3.23</td>
<td>2²</td>
</tr>
<tr>
<td>7.</td>
<td>389</td>
<td>121</td>
<td>3.21</td>
<td>2²</td>
</tr>
</tbody>
</table>
Table 2. 2007 Graduating Students List Education Mathematics (Agege-Lagos Centre).

<table>
<thead>
<tr>
<th>STUDENT</th>
<th>CTCP</th>
<th>CTNU</th>
<th>CGPA</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>449</td>
<td>127</td>
<td>3.54</td>
<td>2^</td>
</tr>
<tr>
<td>2.</td>
<td>424</td>
<td>127</td>
<td>3.34</td>
<td>2^</td>
</tr>
<tr>
<td>3.*</td>
<td>415</td>
<td>129</td>
<td>3.22</td>
<td>2^</td>
</tr>
<tr>
<td>4.</td>
<td>394</td>
<td>127</td>
<td>3.10</td>
<td>2^</td>
</tr>
<tr>
<td>5.</td>
<td>348</td>
<td>127</td>
<td>2.74</td>
<td>2^</td>
</tr>
<tr>
<td>6.*</td>
<td>316</td>
<td>135</td>
<td>2.34</td>
<td>3^rd</td>
</tr>
</tbody>
</table>

*Students who repeated some courses in the program. It is also to be noted that not all the students that started the courses together graduated at the same time.

Table 3. 2007 Graduating Students List: Education Mathematics (Ibadan Centre).

<table>
<thead>
<tr>
<th>STUDENT</th>
<th>CTCP</th>
<th>CTNU</th>
<th>CGPA</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>431</td>
<td>121</td>
<td>3.56</td>
<td>2^</td>
</tr>
<tr>
<td>2.</td>
<td>427</td>
<td>121</td>
<td>3.53</td>
<td>2^</td>
</tr>
<tr>
<td>3.</td>
<td>397</td>
<td>121</td>
<td>3.28</td>
<td>2^</td>
</tr>
<tr>
<td>4.</td>
<td>394</td>
<td>121</td>
<td>3.26</td>
<td>2^</td>
</tr>
<tr>
<td>5.</td>
<td>382</td>
<td>121</td>
<td>3.16</td>
<td>2^</td>
</tr>
<tr>
<td>6.</td>
<td>375</td>
<td>121</td>
<td>3.10</td>
<td>2^</td>
</tr>
<tr>
<td>7.</td>
<td>365</td>
<td>121</td>
<td>3.02</td>
<td>2^</td>
</tr>
<tr>
<td>8.</td>
<td>363</td>
<td>121</td>
<td>3.00</td>
<td>2^</td>
</tr>
<tr>
<td>9.</td>
<td>362</td>
<td>121</td>
<td>2.99</td>
<td>2^</td>
</tr>
<tr>
<td>10.</td>
<td>383</td>
<td>121</td>
<td>2.34</td>
<td>3^rd</td>
</tr>
<tr>
<td>11.</td>
<td>361</td>
<td>121</td>
<td>3.16</td>
<td>3^rd</td>
</tr>
</tbody>
</table>

The objective of the Sandwich Degree Program in Mathematics Education is to satisfy the aspirations of adults for a university degree.

A close study of the three tables above shows that the adults who studied mathematics in the Sandwich Degree Program of Adekunle Ajasin University, though few, performed creditably well. It should be noted that the data analyzed were for those adults of the set that graduated in 2007. There are earlier sets and a current one would be finishing up the program in December 2008.
Conclusion

It could then be concluded that the efforts of the university in meeting the needs of this special category of adult learners of mathematics are yielding a positive result. However, given the thrust of this conference, the university would pay greater attention to adults in category 1 whose mathematics need is purely numeracy.

It is this group of adults that need be empowered through mathematics education for the simple reason that these ones have not really had or enjoyed any appreciable formal education that would put them on any social standing in their communities.

Recommendation for Further Action

Mathematics in adult education is *sine qua non* to educational development and national progress. People are the subjects as well as the objects of development. People bring about development and development reflects on people. It has to do with enriching human resources and potentials. Therefore, using mathematics as a veritable tool in Adult Education is a course that must be pursued and achieved. The battle for adult education is a continuing one. As Egunyomi (2008) writes:

*The reason for continuity is that adult education often serves those who are not in a position to defend themselves: the weak, the poor, and sometimes the voiceless and the disabled. Adult Education is a struggle against ignorance, insecurity, neglect and abuse. It persistently encourages dogged determination and sternly discourages defeat or self-pity.*

Therefore a greater attention should be given to adults at the grass roots in the society to learn mathematics. This call to give mathematics its functional relevance to adults must yield to the following:

- Determination of the quality and quantity of mathematics needed for effective daily living by adults
- Identification of the instructional strategies and programs that will yield positive results
- The professional development and certification requirement for instructors of adult mathematics education
- Evaluation of learners’ outcomes in adult mathematics education

If the above could be settled, a roadmap towards effective adult mathematics education would have been defined. This in turn would lead to creating a society of men and women who can address issues around them quantitatively and reason about them soberly and objectively, paving the way to peaceful co-existence in our communities.

References


Herod, L. (2000). *Numeracy for adult literacy learners.* Winnipeg, Manitoba, Canada: Manitoba Education and Training, Adult Literacy and Continuing Education.


