Mathematics for Daily Living: Implication for the Society

Richard U. Utubaku
Aniah-Betiang, Elizabeth I.

Department of Mathematics,
Federal College of Education, Obudu, Cross River State, Nigeria

Abstract *With the use of Mathematics and especially now with the support of the mathematical processing and control machine called the computer, significant advancement are realized in science, technology and arts. This paper therefore, identifies seven educational values of mathematics, paying particular attention to its aesthetic value in man's physical environment. In x-raying the usefulness of mathematics in the different areas of life, the paper holds that mathematics is universal not only to science and science related areas, engineering and technology, but also in a way it makes itself relevant to the development of the social science and the liberal arts. Hence, one could almost say that without mathematics, the world could not have been what it is today.*

Introduction

The word "Mathematics comes from the Greek **uua** (Mathema) meaning 'science, knowledge, or learning' and **ua Uat** (Mathematiko's) meaning 'fond of learning' (Simonson and Gouvea, 2007). Explained this Agwagah (2008) noted that mathematics is often defined as the study of topics such as quantity, structure, space and change. These topics provide the major subdivisions of mathematics into: Arithmetic, Algebra, Geometry, and Analysis. These major disciplines within mathematics arose out of the need to do calculations in commerce among others. According to Thomaskutty and George (2007), mathematics cannot be considered as a classroom discipline only. Reflecting on this, James (2005) stated that not only an Academician, a Scientist, an Engineer, but a shopkeeper, a grocer, a housewife, a sportsman, an employee need mathematics, and who does not need it? A common man can get on sometimes very well without learning how to count an calculate (Agwuagah, 2008). She further highlighted that apart from an Engineer, a Businessman, an Industrialist, A banker, even a labourer has to calculate his wages make purchases from the market, and adjust the expenditure to his income. But is mathematics all about calculations?

People believe mathematics is a divine discipline. For instance, Galileo, in Obodo (2004), stated that mathematics is the language with which God wrote the universe. Some people love mathematics while some fear it; some are attracted to and study mathematics, while some worship it. For instance, ancient Indian mathematicians like Aryabatta and bhaskara worshipped Mathematics, and lived for it. Also, the legend Srinivasa Ramanujsan of India adored mathematics. These could be material and non-material reasons why people adore, worship and are attracted to mathematics. For some like Aryabatta and Bhaskara, it was not for any material benefit, but out of their devotion or adoration (Thomaskutty and George, 2007). What are other reasons for people adoring, worshipping, and being attracted to mathematics? Why should everybody learn mathematics? How does mathematics contribute to overall development of the members of the society? What is the significance of mathematics in the society? What should be the advantages of devoting so much effort, time and money of the society to learn mathematics? According to Kulshrestha (2005), these questions indicate the way to explore the values of mathematics.

Thomaskutty and George in Agwagah (2008) identified seven educational values of mathematics to include, Practical or Utilitarian values, Disciplinary values, Cultural values, Social values, Moral values, Aesthetic values and Recreational values. The practical or utilitarian values of mathematics seem to have been given greater emphasis in our society and the school mathematics curriculum than other value.

This work therefore will be presented in the following ways:

- Aesthetic values of mathematics
- Usefulness of mathematics in human daily activities
- The role of mathematics in Science and Medicine
- The role of mathematics in Law and Social Sciences
- The language of mathematics
- The role of mathematics in Engineering and Technology

Aesthetic Values of Mathematics Education

Aesthetic is concerned with beauty and art, and the understanding of beautiful things, (Hornsby, 2001). God as well as man appreciates beauty. Hence, after creation, God saw that everything he created was beautiful, man being created in the image and likeness of God saw himself existing in the world full of beautiful things, either as a result of creation or through some fundamental processes of man's innovative nature. Birkhoff in Agwagah (2008) defines aesthetic as the qualities that make a painting, sculpture, musical composition, or poem pleasing to the eye, ear or mind. He noted a mathematical measure of aesthetic value using the formula: M = O/c, where M is aesthetic measure or value, O is aesthetic order and C is complexity. This implies that a high aesthetic value is placed on orderliness and a low one on complexity. In order words, beauty increases as complexity decreases. This definition indicates that aesthetic relates with appreciation of beauty and beautiful things, using the senses of eye, ear and mind.

Aesthetic qualities include: variety, integrity, diversity and harmony. According to Brady (2005), harmony and integrity are key to definitions of beauty in classical and medieval philosophy. They are connected to qualities such as order, symmetry etc. Variety and diversity are commonly contrasted with monotony, dullness and lack of interest. Aesthetic value in mathematics refers to the beauty of mathematics or beauty in mathematics. One may ask, is mathematics beautiful? What mathematics is beautiful? What problems are associates with the study of the beauty of mathematics? Can the beautiful image of mathematics be integrated in the context of pedagogy?

According to Hardy (1992), there is no permanent place in the world for ugly mathematics. Hardy is simply saying that mathematics is beautiful. Russell in Agwagah (2008) expressed his sense of mathematics beauty in these words.

Mathematics rightly viewed possesses not only truth, but supreme beauty – a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, without the gorgeous trapping of paintings or music, yet sublimely pure and capable of a stem perfection such as only the greatest art can show. The true spirit of delight, the exaltation, the sense of being more than man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as poetry.

This implies that mathematics do not study pure mathematics because it is useful, but because he delights in it and because it is beautiful. This points to the fact that mathematics is beautiful.

According to Thomaskutty and George in Agwagah (2008), when we go through the biographies of great mathematicians, we see that almost all of them were attracted to this 'divine' discipline, by realizing its beauty. The fineness, the harmony, the symmetry, all adds to the beauty of mathematics. Mathematics system and structure that if inconsistencies were found in axiomatic foundations of mathematics, most mathematicians would probably prefer to change the axiomatic foundations than to give up the beauty of the body of mathematics. Mathematics is beautiful in terms of its simplicity, power, utility, multi-connections and other adjectives often used to describe a painting, poem or song (Bett, 2007). Simplicity is one of the highest values in mathematics. Mathematics try to identify the smallest set of rules from which many other

propositions can be logically derived. The simplicity of mathematics is expressed in a mathematics article, the beauty is in the elegant efficient way it concisely describes ideas of great complexity. Mathematics ideas are by nature, precise and well defined, so that a precise description is possible in a very short space. Modern notation, for instance makes mathematics much easier. It is extremely compressed; a few symbols contain a great deal of information.

There are topics in mathematics, which can be used to illustrate its aesthetic element of power. Example is the number notational system (Bett, 2007). Using 10 symbols – 1,2,3,4,5,6,7,8,9,0, it is possible to create an infinite number of distinct numbers. The reason is because of the amazing power of place value notation. The practical utility of mathematics can be shown in many ways. For instance, the universe is made of galaxies, mountains, creatures, vehicles, and all manner of other things each seemingly unique. The way in which those things intrude on one another is a chaotic affair, often violently, but sometimes with great subtlety. But thanks to mathematics, people are able to think about the world of objects and happenings and to communicate those thoughts in ways that reveal unity and order. The numbers, lines, angles, shapes, dimensions, averages, probabilities, ratios operations, cycle, correlations, regressions, etc that make up the world of mathematics enable people to make sense of a universe that otherwise might seem to be hopelessly complicated. (Agwagah, 2008). Circles, squares, triangles and other shapes can be found in things in nature and in things that people build. Numbers and shapes can describe many things in the world. Just as letters and words make up a language in reading and writing, numbers and shapes make up a language in mathematics. Numbers and shapes and operations on them, help to describe and predict things about the world around us.

Usefulness of Mathematics in Human Daily Activities

According to Odili (2006), the utilitarian aspect of mathematics in preparing students for useful living include counting, notations, addition, subtraction, multiplication, division, weighing, measuring, selling and buying. Every student on finishing secondary education, should have clear idea of numbers and a comprehension of both the very large and the very small numbers. Students should understand the way number is applied to measure lengths, volume, weight, area, density, temperature, speed, acceleration and pressure. Estimation and approximation helps them to check economic waste in every day life. Odili further highlighted that economy of modern living and the technology of modern selling requires a housewife to be able to estimate quickly which of two different prices offers, sizes or measures is the better buy and to be able to see through many of the tricks of the trade. This presentation shows daily usage of mathematics.

The study of mathematics will form in the students the habit of clarity, brevity, accuracy, precision and certainty in expression and this will go a long way in giving us much-needed unity in this nation. In homes, offices, market places and playgrounds get involved in one argument or the other. The success in any argument depends on persuading and there is nothing more persuasive than a logical argument. The idea of logical, where the validity of conclusions rests upon the validity and consistency of the assumptions and definitions upon which the conclusion are base, will help to eliminate frequency conflicts in our society.

According to Osofechinti in Odili (2006), the importance of mathematics to individuals in their daily undertaking is so enormous that the knowledge of mathematics is an indispensable tool for a successful and balanced human existence on earth. Mathematics helps man to sharpen his understanding and definition of religious concepts. Such concepts as eternity, heaven, spirit life, power, salvation, wisdom, strength, light, hope, faith, righteousness, glory, blessing, truth, grace, peace, neighbour, sun and death can each be defined with mathematical rigor and precision (Osah-Ogulu and Odili, 2000).

In mathematics, Fakuade in Odili (2006) asserts:

In government offices, a modest amount of mathematical knowledge is required for executing business, policies and decisions. In commercial sector, the daily running of businesses, modern development and advances in commercial matters and business connections depends very heavily on experts use of

mathematical knowledge and processes.
That is, in preparing individuals for life, we may consider the power of mathematics in character building through active involvement, personal success work with and opportunities for stimulating curiosity, self-expression and self-criticism.

Role of Mathematics in Science and Medicine

Mathematics apart from being an intellectually stimulating discipline, is continuously being developed to meet the changing requirement of Physics, Chemistry, Biology, Social Sciences, Psychology, Engineering and even law to mention a few. Odili maintained that achievement in sciences is often contingent upon mathematics knowledge and the ability to perform mathematical operations. Although, physics and mathematics form different disciplines in institutions, the separation is not any more clear-cut than that between certain fields of mathematics (Ihejieto in Odili, 2006). At the early school stage, physics students are involved in measurement of length, area, volume and masses. To do these with dexterity, calculations, for which a good knowledge of mathematics is essential, are needed.

The physical phenomena in mechanics require a good knowledge of elementary differential equations and vector analysis. Complex numbers are used in treating oscillating quantities and on the principle of super position. Fourier series constitute an essential tool. To describe the motions in a plane or space, the physicist must have a good knowledge of vector algebra. Linear transformation in vector space is needed in the study of the general theory of coupled oscillations. The fundamental concepts and mathematical methods used in treading the mechanics of continuous media are applied in the study of vibrating strings and of the motion of fluids. Lagrange's equations and the fundamentals of advanced dynamics. Hamilton's equations is prerequisite to courses in quantum mechanics. In all sections of physics, mathematics form the basis of understanding it and also of its application. Ingle and Turner in Odili (2006) in their study on mathematics and chemistry at the o'level argued that the pattern of thought used in expressing some scientific concepts is identical to that used in some particular mathematical concepts. They added that students' difficulties with ration and proportion and computational skills in mathematics might affect their ability in learning some chemistry concepts and further suggest the following:

a. In chemistry computation, mathematics activities involved are addition, subtraction, multiplication, division, fraction, and decimals, positive and negative numbers, reciprocals, index notations and standard forms, use of logarithms, slide rule calculations.
b. Rate and proportion: Direct and inverse proportion, ration and percentages.

Also, Fakuade and Kalejaiye in Odili (2006) writing on mathematics topics related to chemistry suggest that fractions and decimals, axes and scales, line graph, addition and subtraction, logarithm numbers – use of four figure tables, indices, ratio and proportions, direct and inverse variation, substitution of values in an algebraic expression, and change of subject in a formula should be studied by chemistry students in the SSS level.

Adetula (2002) maintained that in medicine, problem that can be tackled using mathematics include: the conduction of electronic signals by nerves, flow of blood, calculations of radiation, treatment of patients and diffusion of radio active tracer and other chemicals in the body. In the health care delivery system, both the doctor and the patient will be in problem without mathematics. For example in the words of Akesode (2000) from diagnosis of diabetes through paternity testing using DNA to test HIV status, the language is mathematics. From a minor surgery of suturing an ulcer to a major brain surgery or organ transplant, mathematics has a place especially with regard to precision of measurement.

Role of Mathematics in Law and Social Sciences

Odili (2006) affirms that Mathematics is universal not only in the way it influences the basic sciences, the

applied sciences, engineering and technology, but also in the way it makes itself relevant to the development of courses in the social sciences and the liberal arts. That is, the dependence of courses in the social sciences such as mathematics is such that a basic knowledge of mathematics beyond further mathematics is required. He further emphasized that successes of mathematics in the study of inanimate nature have inspired the mathematical study of human nature in recent times. Such mathematical topics involved are:

- In finance – constraints in linear programming techniques and probability.
- In insurance business – constructing life tables premium rates, equity linked contracts, ruin theory, discounted cash flow and time series
- In geography – measurement of distance, areas on maps using amp projectors, the study of the solar system, the determination of the shape and the size of the earth, the distance of the horizon, the indivisibility of objects, the relationship between longitude and time, nautical miles, the use of national grid in ordinance survey maps and the interpretation of contour maps, have all been made possible through expert application and knowledge of geometry and trigonometry.
- In education, mathematics is used in educational planning and evaluation, test and measurement, information system, design and implementation.

Mathematical trend analysis, financial/cost analysis, school mapping, operation research, parameter estimation, time series analysis, cohort analysis, descriptive/financial statistical analysis.

The application of mathematics in law is not used in direct forms as in other disciplines. The principles of mathematics reasoning forms the basis for its understanding. Prospective law students with mathematics background perform better. Such areas as ownership right, power, justice, crime, guilt, trial, conviction, evidence, suspect, constitution, charge, offence count, liability, civility etc are now defined with mathematical precision (Gemignani, 1979). Therefore, the impact of mathematics in law shows up in the high performance and great repute enjoyed by the mathematically literate law firm.

Language of Mathematics

The universal language of mathematical acts across cultures and uses carefully defined terms and concise symbolic representation to add precision to communication. Hence, the mathematical statement 5 + 3 = 8 means the same to a Tiv, an Igala, an Igbo, a Yoruba or a Hausa, no matter what native tongue is used. The grammar of the language, its proper usage is determined by the rule of logic. The study of mathematics form in students the habit of clarity, brevity, accuracy, precision and certainty in expression and this go a long way to unite us in this country. The success in any argument depends on one persuading his opponent and there is more persuasive than logical argument. Therefore, the idea of logic rest valid conclusion upon the validity and consistency of assumptions and definitions to eliminate frequent conflicts in homes.

The vocabulary of mathematics language consists of symbols such as + - addition, - subtraction, ÷- division, $\sum$ - summation, $\sqrt{}$ - Square root, $\int$ - integration etc.

Role of Mathematics in Engineering and Technology

Fakuade in Odili (2006) claims that the better mathematician an engineer is the better engineer he becomes and the more likely he is to make effective use of mathematics. In engineering field, the search for the problem, the study in physical situation and making of a mathematical model, the solution of the problem, generalization of the solution and interpretation of results, all have recourse to the use of mathematics. Mathematics have dominated scene in the aircraft technological development especially by way of research aeronautics and in the structure of aircraft itself. The branch of mathematics closely associated with aeronautics fluid dynamics. Fluid dynamics is the study of motion of gases and liquids, which involves the use of Eulerian equations of motion of fluids, together with the continuity equation, which expresses the conservation of mass, and the equation of state of the fluid. All the mathematical results obtained from the

solution of these equations lead to decisions on viscosity of the air, the steadiness of the motion of the aeroplane, external forces acting on the body of the aeroplane, the condition to the air traffic have largely relied on the use of electronic digital computer, which is a major branch of mathematics.

In the recent years, there have been major developments in Information and Communication Technology, the highly synergistic combination and collaboration of computer science or technology with communication technology in the service of humanity. Its effectiveness as an instrument of information dissemination is not inherent in its transmitted form, its power is derived from the mathematical machine that converts inputs into outputs. Excellence in modern warfare together with highly sophisticated contraction space vehicles is an essential determinant of the supremacy and superiority of a nation. All these ideas depends so much on the knowledge and application of mathematics that one could almost say that without mathematics, the world could not have been what it is today.

Conclusion

With the use of mathematics and especially now with the support of the mathematical processing and control machine called the computer, significant advancement are realized in science, technology and arts. The application of mathematics within the context of the socio-cultural environment of man produces harmony, order and peace. It provides serene beauty in man's physical environment (aesthetic values). It is difficult to imagine how such fields as accountancy, engineering, natural and applied sciences, land surveying, quantity surveying, modern corporate management, education, medicine, banking, finance, actual science, architecture, fine and industrial arts, etc could get along in their services to humanity without mathematics. It becomes necessary that school administrators, teachers, parents/guardians and students should now view mathematics as an all-important subject for making sustenance and development of our society in the 21st century and beyond. What is needed now is more mathematics and not less for our industrial growth, since mathematics as a science numbers, quantities and measurements will continue to provide us with empirical statistical data upon which we can base sound decisions in our developmental efforts. While teachers should expose students to various representations of a mathematical idea, he should provide opportunities in class for students' initiative, independence and creativity in the mathematics classroom.

References

Adetula, S.O (2002). Teaching to improve Problem-Solving abilities. African Mathematics 2 (1) 139 – 154

Agwagah, U. B.V (2008). Mathematics Beyond Calculation Aesthetic Values. ABACUS: The Journal of the Mathematical Association of Nigeria (MAN). 33 (1) 70 – 79

Betts, P (2007). Toward how to Add an Aesthetic Image to Mathematics Education P.betts@unwinnipeg.ea

Brady, E (2005). Aesthetic in Practice. Valuing the Natural World. New York: Brooklyn College Press

Germignani, M. (1992). Mathematics Apology. Cambridge; Canto

Hornsby, A.S (2001). In S. Wehmeier. S (ed) Oxford Advanced Learners Dictionary of Current English, Sixth Edition. Oxford University Press

James, A (20005). Teaching of Mathematics. Neslkamal Publications, Hydrabad.

Kulshrestham A.K (2005). Teaching of Mathematics. India. Surga publications, Mccrut

Obodo, G.C (2004). Principles and Practice of Mathematics Education in Nigeria. Enugu: Floxtone Press

Odili, G.A (2006). Mathematics in Nigeria Secondary Schools. A Teaching Perspective. Lagos: Anachuna Educational Books

Okolo, P. N (2008). Aesthetic Value of Mathematics: The Implication to Mathematics Education: ABACUS: The Journal of the Mathematics Association of Nigeria 33 (1) 119 – 125

Osah-Ogulu, D.J. & Odili, G.A (2000). A Mathematics Centred Schematic Model for Realizing the Prime Sectoral Values of the 21st century. Human Scoeity. Nigeria Journal of Professional Research in pedagogy and psychotherapy 1 (2) 78 – 87

Thomaskutthy, P.G & George, M (2007). Mathematics and Civil Society. http://www.en.wikipedia.org/wiki/civil