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Research Paper

The Impact of Business Mathematics Study on the Preparation of National Diploma (ND) Students For Applicable Skills In Nigeria's Polytechnic Institutions

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Abstract
This article explores the role and application of Business Mathematics study which has great impact in preparing students studying for the award of a National Diploma (ND) from a Nigerian Polytechnic Institution's School of Business Management for the development of relevant skills and knowledge specifically in Business.
Key words: Business Mathematics, Polytechnic, Role, skill, Impact, Business Management

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I. INTRODUCTION

It is very striking and interesting at the velocity of broad growth in polytechnic education in emerging nations such as Nigeria. This can be observed in the rapid growth and standardization of Polytechnics and Monotechnics in Nigeria, Aderoba (2010) as stated in Umar, M.T, Ishiyaku, A. S, and Ishaku, H. M (2021). Polytechnic and other specialized institutions in Nigeria offer a two-tier program of studies, namely National Diploma (ND) and Higher National Diploma (HND) with one year of industrial experience serving as one of the pre- requisite for entry into the degree program (Nation Policy on Education, 2014). Polytechnic education in Nigeria was established aiming at the training of middle manpower or middle-skilled workers such as technologists, technicians and acquisition of management skills that are very relevant to the needs, aspirations and the technological development of the nation's economy and industries. It is hoped that such acquired training and knowledge from Polytechnics will be beneficial and would lead to the transformation of the country's economy and industrial development (Ukpai, 2012).

Technical Education as a Polytechnic Education

Technical Education has been defined as the academic and occupational preparation of students for jobs or careers in applied science and modern technology. Technical education has as its objectives; the preparation of graduates for occupations that are classed above the skilled crafts but below the scientific or engineering professions. (www. Britannica.com, 2021)

It is defined by UNESCO and International Labour Organization (ILO) (2020) as those aspect of educational process that include, in addition to general education, the study of technologies and related sciences, as well as the acquisition of practical skills, attitudes, understanding, and knowledge relating to occupations in various sectors of economic and social life.

Polytechnic education which is technical is a veritable means of creating many levels and types of workforce or manpower required for the industrial, economic, and political sectors of a country's social developments.

Engineers, architects, planners, teachers, business managers, scientists, and other high, middle, and lower cadre professionals are essential to the success of any economy or nation.

Fundamental Notions of Mathematics

Mathematics is the abstract study of topics encompassing quantity, structure, space, change and other properties.

The study of mathematics as a science in its own right began in the 6th century BC with Pythagoras who coined the term 'mathematics' from the ancient Greek (Mathema) meaning "subject of instruction". In modern age, mathematics and its application are extremely significant (Okeke and Anakpua,2010).

Mathematics is the foundation of all scientific and environmental processes, and there is scarcelyany discipline i n which it is not useful (Ezurike, 2008). As Ezurike, (2021) pointed in Ukeje (2006) mathematics is at the heart of all important scientific, business, or technological innovation and it is the master key to realizing national potentials

Mathematics is a science subject developed as a result of man's effort to solve problems. However, once developed, mathematics creates an attempt to solve the problems of the day as well as self- generated problems (Ezurike, 2018).

It is an essential requirement by every field of intellectual endeavor and human development to cope with challenges of life. It is a core subject in both primary and post- primary schools in Nigeria.

Mathematics and its application occupy very important position in this science and technological age (Ezurike, 2021). The prosperity of any country depends on the volume and quality of mathematics offered in its school system (Ezurike, 2008). A sound background in mathematics is necessary for the study of sciences, business related subjects for scientific and sustainable technological and economic development.

Ezurike, (2021) reported that Umaru (1995) conceptualized mathematics as a language which provides indispensable means of investigating the nature of things particularly those which are dealt with in the field of science, technology, engineering, business and industry. He further pointed out that every field of science and technology has substantial mathematical content through different degrees.

Mathematics is used throughout the whole world as an essential tool in many fields; including business and applied mathematics which is applying mathematical knowledge to other fields inspires and makes use of new mathematical discoveries which has led to the development of entirely new mathematical disciplines such as statistics (Ezurike, 2021).

Mathematics is a part of our human heritage, and we have a responsibility to develop that heritage as it provides fundamental knowledge and skills for other courses and economy.

Business Mathematics

Business Mathematics is a type of mathematics course that is meant to teach students studying for the award of National Diploma about money and provide them the tools they need to make informed financial decisions (www.educba.com). Business mathematics not only teaches about the specifics of finances recited to owning and operating a business but also offers helpful advice and information related to personal finance. This course prepares students and any consumer to manage their finances responsibly and profitably by explaining everything they need to know about accounting, economics, marketing, financial analysis, and more. Business mathematics will help to make inflows and outflows of money and commerce make sense, even to the most mathematics-averse individuals, using relevant and authentic applications.

Business mathematics is not just for business owners, contrary to what its name might suggest. A number of different professionals utilize business mathematics- related skills every day; bankers, accountants, and tax consultants, all need to become well-acquainted with every aspect of corporate and personal finances in order to deliver appropriate advice and problem solve with customers. Real estate and property professional also employ business mathematics often when calculating their commission, navigating the mortgage process, and managing taxes and fees upon closing a deal.

When it comes to professionals that deal more with capital allocation such as investment consulting and stockbroking, understanding investment growth and loss and making long term financial prediction is a fundamental part of the daily job. Without business mathematics, none of the jobs could function.

For those that do own a business, business mathematics is even more important. Business mathematics can help these individuals to be successful by providing them with solid understanding of how to manage goods and services to juggle discounts, markups, overhead, profits, inventory management, payroll revenue, and all of the other complexities of running a business so that career and finance can flourish.

Challenges of Teaching and Learning of Business Mathematics

Education has been generally acknowledged as the key that unlocks the gate to the social, economic, political and technological development of any society. However, much depends on its quality and contents (Obasi, 2020). Education maximizes the creative potentials and skills of the individual for self-fulfillment and general development of the society (National policy on Education 6th edition, 2014).

Moreover, Business Mathematics education plays a very important role in the day to day activities.

It quickens human awareness and trains the mind, the habit of accurate reasoning.

Mathematics is one of the core subjects recommended in the National Policy on Education (NPE) at both the primary, Post- Primary schools and a compulsory credit pass requirement for admission in tertiary institutions in Nigeria (NPE, 2014). Also general mathematics course is offered in the first year in many faculties and schools in the Universities, Polytechnics and colleges of education. These suggest the importance attached to mathematics whose knowledge is required by every member of the society in view of its usefulness in day to day activities business transactions, science and technology (Ezurike, 2021).

Mathematics is therefore an important subject in the nation's aspiration for scientific, business and technological development. The relevance of mathematics cannot be overemphasized and the usefulness can be observed in areas like applications (Odili, 1990 as reported by Ezurike, 2021).

Ezurike, (2021) observed that mathematics is a science subject in which pupils usually perform poorly in the First School Leaving Certificate Examinations and Senior Schools Certificate Examinations. And this situation has a trickled effect on students in the tertiary Institutions.

However, from research and experience, this having been studied and recorded that there is a wrong notion of some people about the abstractness of mathematics or the perception that mathematics is a difficult subject/ course (Ezurike, 2021).

This erroneous belief definitely has its terrible effect in teaching and learning of Business Mathematics in the tertiary institutions such as Polytechnics. It is very obvious. And these, in recent times, led to the declining interest on mathematics which has become a great source of concern to mathematics Lecturers and other well-meaning Nigerian academicians at all levels and, ipso facto, a regular focus on the effective strategies on teaching and learning of mathematics to boost the student's interest on mathematics courses.

It is against the backdrop of this dismal notion that this paper seeks to specifically discuss the great role and use of business mathematics studies which is aimed at equipping students with relevant skills and knowledge in the Schools of Business Management of Polytechnics in Nigeria, in other to manage personal or public finances and businesses upon graduation.

The Concept of Polytechnic Education

English Dictionary defines Polytechnic as "an educational institute that teaches applied arts, sciences, technology and engineering rather than only academic subjects" (Wiktionary, CC by S.A 3.0 license).

Polytechnic education, which is part of technical education programme in tertiary education level leads to acquisition of practical and applied skills as well as fundamental scientific knowledge. Polytechnic educate future leaders and develop the middle-level technical capacities that underpin economic growth and development (Ekundayo & Ajayi, 2009) and also made emphases that, the main purpose and relevance of polytechnic education in Nigeria is the provision of much needed manpower to accelerate the social- economic development.

Aim of Establishing Polytechnics in Nigeria

The aim of establishing polytechnics in Nigeria is to train Technologists, Technicians and acquisition of management skills in courses leading to award of certificate National Diploma (ND), Higher National Diploma (HND), and Advanced Professional Diploma which are relevant to the needs, aspirations and the development of the Nigerian's diverse economy and industries.

Federal Republic of Nigeria (FRN) (2004, p.36) stipulated that higher education is expected to;

1) Contribute to national development through high level relevant manpower training;
2) Develop and inculcate proper values for the survival of the individual and society;
3) Develop the intellectual capabilities of individuals to understand and appreciate their local and external environments;
4) Acquire both physical and intellectual skills which will enable individuals to be self-reliant and useful member of the society;
5) Promote and encourage scholarship and community service; and
6) Forge and cement national unity; and promote national and international understanding and interaction.

Objectives of Technical/ Polytechnic Education in Nigeria

The aims and objectives of technical education have been articulated by the National Policy on Education (1998 revised) as follows;

1) To provide trained manpower in applied science, technology and commerce particularly at sub-professional grade.
2) To provide technical knowledge and vocational skills necessary for agricultural, industrial and economic development.
3) To provide people who can apply scientific knowledge to the improvement and solution of environmental problems for the use and convenience of man.
4) To give an introduction to professional studies in engineering and other technologies.
5) To give training and impact the necessary skills to the production of craftsmen, technicians, and other enterprising and self- reliant, and
6) To enable young men and women have an intelligent understanding of the increasing complexity of technology.

Mathematics in Polytechnic Education

Mathematics is a science of number and space, and the language of science, business and technology. According to the objectives of establishing Technical/ Polytechnic Education captured in Federal Policy of Education (1998 revised) in Nigeria, one of the most important objectives is; To provide trained manpower in applied science, technology and commerce particularly at sub- professional grade. Therefore, in line with the stipulated curriculum of Polytechnic Education, School of Business Management in Polytechnic Institutions; case study, Auchi Polytechnic Auchi, Edo State, Nigeria offers Business Mathematics, a 3-unit compulsory course in year one.

Departments That Offers Business Mathematics in Polytechnic Institutions

The polytechnic Institutions are divided into academic Schools and non- academic department. School of Business Management is one of the major academic Schools of the Polytechnic and is made up of five (5) departments, namely;

(i) Department of Business Administration;
(ii) Department of Public Administration;
(iii) Department of Banking and Finance;
(iv) Department of Marketing;
(v) Department of Accountancy

Role of Business Mathematics in Business

Business is always surrounded with challenges which need to be dealt with in a proper fashion so that they do not arise in future. These problems that occur on a daily basis can be effectively solved with the help of mathematical models. Hence mathematics not only helps to calculate but also analyze business problems and work upon them. Mathematics is an important part of managing business. Hence the introduction of a branch of mathematics called Business Mathematics. Learning and using business mathematics enables a person to think out of the box, sharpens one's thinking and helps in precisely formulating and structuring relationships.

Use of Business Mathematics in Business

In order to know a business, it requires skill more than developing a product or providing a service. If a business has to survive and succeed it needs to look after the finances and make necessary arrangements for it to prosper as well. Understanding business mathematics is very important to maintain profitable operations and accurate keeping of records. It is required right from the start for pricing products/services till the end when we need to check if the Budget was met.

Let's look at situations where business mathematics is required.

Production Costs Calculation

For a person to start of production and establishes his business, it is very important to estimate the costs that would be incurred in relation to the manufacturing such as the cost of raw materials, machineries, rent, administration expenses etc. In addition to these basic expenses there are other associated costs such as marketing, warehousing, interest and payment of loans etc. Once all the expenses relating to production have been included, it would be easy to estimate the profit from it to sustain and remain competitive in the market. Accurately determining the cost associated with each item will make the base for the business strong.

Price Determination

When you have successfully determine the costs, the next task is to price the products correctly so that it generates right amount of cash flows for future requirements of the business. Changing the correct selling price would ensure that the product remains profitable.

Profit Measurement

These require determining the net profit by subtracting the operating costs from the total amount of sales / revenue during a period of time. What also needs to be deducted are the tax, depreciation, discount expenses. This helps to find out if the products are being charged enough to contain the business operation and expand.

Financial Analysis

Financial analysis refers to an assessment of the viability, stability, and profitability of a business, sub-business or project. Therefore, to read the revenue and expenses of a business if we need to analyze the financial health of a business. We need to do sensitivity analysis of how an increase or decrease in sales figure or price could affect the business. It helps in determining how the business would affect. Using business mathematics helps in making these interpretations and takes the business to a higher level.

Topics Covered in Business Mathematics

Economics, accounting and consumer mathematics subjects to be taught in a business mathematics course include; Simple and Compound Interest, The Time value of money, Future and Present Value of Money, Annuity, Future and Present Value of Ordinary Annuity, Depreciation, Discounts, Profit and Loss, Rates, Taxes, Brokerage, Insurance, Bankruptcy, Foreign Currencies–Exchange, Cash Flow, Pay Back Period, Discounted Cash Flow Techniques, Discounted Pay Back period, Investment Appraisal Techniques, Net Present Value

Techniques, Internal Rate of Return, Investments and wealth Management – Loans, Markups and Markdowns, Mortgage Finance/ Amortization, Product Inventory, Statistics, Cost Function- Maxima and Minima, Applications of Differentiation and Integration to Business: Demand Function, Supply Function, Cost Function, Profit Function, Elasticity of Demand, Supply and Equilibrium Price etc.

Challenges in the teaching and learning of Business Mathematics

Polytechnics Institutions of today cannot be those of past years. The times are changing at a very high rate and the teaching and learning of Business Mathematics must follow the times and tides of the day.

Studies have shown that there are very notable challenges experienced in the teaching and learning of Business Mathematics in polytechnic institution. Such challenges are:

(a) The wrong notion of some students about the abstractness of mathematics or the perception that mathematics is a difficult subject (Ezurike, 2021).
(b) Deficiency of mathematical skills on the Business Management students
(c) Poor background of students on mathematics as a subject from Post Primary School.
(d) Get quick syndrome attitude on the part of the students resulting to non - attendance of classes.
(e) Examination Malpractice is a thief of hard work on the students.
(f) Cultism which makes the institution unsafe for academic work is a great challenge.
(g) Pandemic experienced in the whole world leading to shut of schools.

II. Recommendations

The polytechnics Institutions must brace up to the changes of the time

(a) Should make mathematics as a compulsory subject in Joint Matriculation board (Jamb) Examination for admission into the School of Business management.
(b) Government at all levels should monitor through their education ministries the compliance of the study of Mathematics as a core subject both in primary and post primary schools in Nigeria.
(c) Lecturers of Business Mathematics should endeavor to apply teaching strategies to improve the interest of the students.
(d) The Polytechnic Managements should as a matter of urgency put stringent rules to cub the menace of Students' life of "get rich quick", cultism and other forms of crime.
(e) Punish students strictly on examination malpractice

III. Conclusion

This paper presented the aims and objectives of Nigerian's National Policies on Education with respect to Polytechnic Education and its overall goals which is based on one of the beliefs that education is an instrument for national development and social change (NPE 6th edition, 2014). Also that Polytechnic and other specialized institutions in Nigeria maintains the two-tier program of studies, namely; National Diploma (ND) and Higher National Diploma (HND) which after graduation contribute to provide trained manpower in applied science, technology and commerce particularly at sub- professional grade.

However, Business mathematics goes hand in hand with commerce/ business and naturally, business deals with money and money encompasses everything in itself. Therefore, there is need for everyone to manage money as some point or the other to take decisions which requires everyone to know mathematics.

Business mathematics as a unique branch of mathematics is used by commercial enterprises to record and manage business operations. Commercial organizations use mathematics in accounting, inventory management, marketing, sales and forecasting, and financial analysis (www.educba.com). Hence, Business mathematics has great impact in preparing students studying for the award of a National Diploma (ND) from a Nigerian Polytechnic Institution's School of Business Management for the development of relevant skills and knowledge specifically in Business as stipulated in the aims and objectives of establishing Polytechnic Institutions in Nigeria.

It helps one know the financial formulae, fractions; measurements involved in interest calculation, hire rates, Cash flow management, salary calculations, pension calculation, production cost, industrial feasibility cost and calculation, tax calculation etc., which help complete business tasks efficiently. Business mathematics also includes statistics and provides solution to business problems which is a relevant skill for graduates from School of Business Managements in Polytechnic Institutions.

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