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Mathematics Education as a Tool for Entrepreneurship Development among Youths in Nigeria

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Abstract
This study looked into how mathematics education improves entrepreneurship development among Nigerian youths for national economic growth. Although the current economic situation in Nigeria has caused numerous challenges to the government and Nigerians, it is the responsibility of mathematics educators to provide adequate mathematics knowledge to students that play an important role in providing the necessary numerical assistance to entrepreneurs who are unable to handle matters of mathematical relevance in their day-to-day entrepreneurial activities. The catalysts that enhance entrepreneurship in Nigeria were also discussed in this study. The role of mathematics education in entrepreneurship development and national growth was also examined. This study places a major emphasis on the importance of a strong knowledge of mathematics education to train young people (youths) in a variety of skills, such as entrepreneurial ability, managerial experience, record-keeping, creativity, and innovation for the revitalization of Nigerian economics through the knowledge of mathematics acquired by youths at various levels of education. It is suggested that mathematics education should be encouraged and strengthened at all levels of the Nigerian educational system, and full mathematics laboratories should be sited in schools across the country so that youths can make use of such laboratories to acquire various mathematical skills that will help them in the start-up of their businesses even after they have graduated, and the government should create an enabling environment for business development by providing capital and other resources.

Keywords: Catalysts, Entrepreneurship Development, Mathematics Education, National Growth.

Introduction
Mathematics is inherently a subject of great utility. It is so basic to many things that it forms part of the very language we speak today. Mathematics activities, according to Idu (2013), are part of the heritage of the human race. Man has used it to calculate the distance to the stars, predict eclipses, navigate the seas and space, map the earth, construct cathedrals and bridges, split atoms, and design machines ranging from simple levers to the most complex space satellites and

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electronic computers. All the elaborate business transactions between men and women in the market and between nations are founded on knowledge of mathematics (Abubakar 2020). The subject is growing and will not relent until full knowledge of entrepreneurship is achieved. Mathematics as a subject has contributed more to the growth of modern civilization than any other known subject. The uniqueness of mathematics emanates from the fact that it assumes the culture of all people and tribes. Mathematics has truly been a guiding light for all sciences and the development of entrepreneurial skills (Omokaro & Nwanunu, 2019). It will continue to help science, technology, and entrepreneurs reach the position they must occupy in our current civilization. Mathematics is essential to all knowledge, and any entrepreneurship education that does not include mathematics may have a fundamentally flawed groundwork (Idu, 2018).

However, mathematics education has been recognized by many stakeholders for its inevitable contribution towards improving the national economy of any nation by providing necessary skills to the youth and having them use those skills in their day-to-day businesses. Idu (2013), in his work, summarized the objectives of teaching mathematics at all levels of education as follows: fostering originality, creativity, and curiosity in the learners; acquiring relevant manipulative skills; emphasizing the wide applicability of mathematics in various fields; leading the learners to discover and appreciate the beauty and elegance of mathematics; and bringing out positive mental attitudes toward mathematics in the learners.

Essentially, there are skills required for an entrepreneur to succeed in their businesses; such skills are simply acquired through the incorporation of mathematical knowledge. However, mathematics is a fundamental subject that is applied in every aspect of daily life, including business, which involves buying and selling goods for profit. It employs mathematics to record, categorize, summarize, and analyse business transactions. Thus, commercial enterprises use mathematics to keep track of and operate their businesses, such as basic arithmetic involving fractions, decimals, percentages, basic algebra, statistics, and probability. Linear programming, calculus, and matrix algebra are all used in business management today. Practical applications include checking accounts, forecasting sales, price discounts, mark-ups and mark-downs, payroll calculations, simple and compound interest, and reducing the wastage of resources (Veer & Shukla, 2009).

Mathematics Education is at the Heart of Entrepreneurship

Enhancing entrepreneurial knowledge and skills among youth in Nigeria has become a must if there is a need for national growth in terms of the economy. According to Oviawe (2010), Nigeria, like most developing countries around the world, is confronted with vast problems and harsh realities such as poverty, unemployment, conflict or insecurity, high costs of living, and the spread of unnamed diseases. These situations pose significant challenges to the very existence of individuals in most developing countries, necessitating the education of educated men and women capable of functioning effectively in the society in which they live. The massive unemployment of Nigerian graduates from various institutions of higher learning can be attributed to a mismatch between labour market requirements and the graduates' lack of essential employable skills (Oni & Adekola, 2000).

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Ajufo (2013) observed that graduate unemployment has contributed in no small measure to social vices such as robbery, kidnapping, prostitution, political violence, and the recent insurgency in the north-eastern and north-western parts of Nigeria. Thousands of young people, especially those of school-going age, have lost their lives, and up to this very moment, the Nigerian government is still battling with how to resolve this problem. This problem of unemployment might be due to the general belief among the Nigerian public that many recent Nigerian graduates are unemployable. Idu, (2018) observed that a large number of young people enter the labour market every year armed with certificates and skills but with minimal links to the needs of the labour market.

However, in the words of Omokaro and Nwanunu (2019) observed that existing skill gaps impede youth development, and, as a result, national growth and development have been paralyzed. Lack of proper mathematics education makes students faced with this situation, entrepreneurship, which could have saved the situation, was discouraged. Tertiary education has not adequately included the philosophy of autonomy, such as creating a new cultural and productive environment that will promote self-discipline and productivity for the general welfare of individuals and society at large. It is imperative to understand that mathematics education can be viewed as a means to an end. According to Abubakar (2020), entrepreneurship has been identified as a means of providing employment and income generation in the country, as well as a panacea to poverty reduction and the country's appalling unemployment rate. In the same vein, Abiodun-Oyebanji (2015) defines unemployment as the proportion of the labour force that is not employed at any given time, expressed as a percentage. In our country, Nigeria, today, the rate of unemployment has reached dangerous and alarming proportions, and as such, even professionals like lawyers, doctors, engineers, and accountants, to name a few, are not immune.

The concept of the term entrepreneurship is nebulous in its form, and many academic disciplines, including physiologists and economists, have contributed their perspectives on it. An economist considers entrepreneurship to be the combination of resources such as labour, materials, and other assets such that their value as a group exceeds their value. Omolayo (2016) defines entrepreneurship as the act of establishing a business, arranging business transactions, and taking risks to profit from the skills gained through mathematics education in Nigeria. Operationally, entrepreneurship is the willingness and ability of a person or persons to acquire educational skills to explore and exploit investment opportunities, as well as establish and manage a successful business enterprise.

Mathematics and Enhancement of Entrepreneurship Development in Nigeria

The systems thinking method is used in mathematics. System thinking refers to the process of understanding how things interact with one another in a larger context. People, structures, and processes in business organizations work together to determine whether an organization is healthy or unhealthy (Ackoff et al., 2020). Systems thinking is defined as a problem-solving approach in which problems or challenges are viewed as parts of a larger system rather than reacting to specific parts, outcomes, or events and potentially contributing to the development of "unintended consequences" (Ackoff et al., 2020). As a math teacher, you must have a vision that is ahead of everyone else's. Remember that sight is what you see with your eyes; vision is what you see with

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your mind. The entrepreneurial process for creating value out of nothing, according to Gogte (2021, p. 224), is illustrated in the flowchart below:

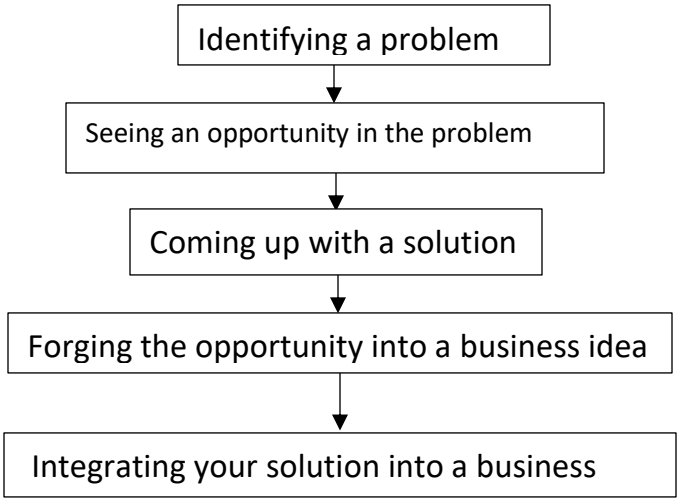


Figure 1: Entrepreneurship process

Mathematics usually compares the scientific processes and the entrepreneurial processes to integrate them for maximum benefits. The scientific method invariably starts with the identification of a problem. Mathematics tends to build a wide range of interdisciplinary skills that can adequately prepare students and entrepreneurs for the future. Theoretical approaches to mathematics teaching must be jettisoned and replaced with practical activities. Knowledge of entrepreneurship with a mathematical bias is recommended for teaching as a good background for young and upcoming entrepreneurs. Knowledge of entrepreneurship in mathematics stresses the abilities of both the mathematics teacher and the students to recognize or exploit an opportunity in society through innovative activities.

The Role of Mathematics Education in Entrepreneurship Development

Mathematics is important in the development of entrepreneurship because it is about creativity and innovation. Starting a new business necessitates a careful evaluation to determine its viability. However, such evaluation necessitates the use of mathematical techniques to become a reality (Idu, 2018). Mathematics skills are required to put in place the projected cash flow, budget, projected statement of income and expenditure, and so on while undergoing feasibility and viability appraisals. The planning process, which involves deciding today what will be done in the future, necessitates a good deal of mathematics because, for example, if it is a production venture, knowing the required quantity of products to be produced necessitates mathematics. As a result, the role of mathematics education in shaping entrepreneurship for societal development should not be taken lightly. The need to teach entrepreneurship in mathematics is imperative as to which entrepreneurship in mathematics education will help equip the students in order to meet the socio-economic requirement in the world of work (Bashir and Umar (2020).

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According to Pal Kaur (2017), mathematical principles are needed to study accounting. It incorporates successful exploration of numerical, geometrical, and logical relationships. Mathematics benefits accountants in comparison. Mathematical formulas help businesses and commerce compare income, costs, expenses, and profits. The various formulas are derived using various percentages, ratios, and equations. The various ratios are derived, such as inventory turnover ratios, profitability ratios, debtor turnover ratios, debt-equity ratios, etc. Mathematics helps derive accounting equations. The basic concept in accounting is that a company's total wealth is referred to as its assets. There are two possible claims on assets (A): liabilities (L) and capital (C). By using mathematical relations, $A = L + C$ it is implied that accountants use mathematics to arrive at the total cost and take a decision regarding manufacturing or buying the product. The total cost formula for business is $T = a + bx$ where T is the total cost, a is fixed cost, b is the cost per unit produced, and x is the number of units produced. Also, profits are determined by subtracting total cost from total revenue, which helps in analysing the financial health of a business, and prices are determined by adding some make-up to cost. So, accountants used addition and percentages to determine the prices of products.

Statistics is very indispensable for the businessman, which initially emanated from mathematics. It formulates various plans and policies and forecasts future trends, such as changes in demand and market fluctuations, using statistical techniques. On the other hand, Mahmud et al. (2022) observed that future events are uncertain, and to predict these uncertainties, probability is an effective tool to forecast sales, scenarios, future returns, and risk evaluation in the business world. Before introducing the product, a team of market researchers' analyses data relating to the population, the income of the consumer, tastes, preferences, habits, and pricing policies of competitors by using various statistical techniques. We can collect and analyse the data in the field of the economy using statistical methods. The probability theory serves as a useful tool for decision-making, estimating the number of defective units and sales expected, and also in business policies. Pal Kaur (2017)

At an advanced level, the contribution of mathematics to enhancing entrepreneurship has been tremendous and uncountable. Some aspects of mathematics, such as matrices, play a prominent role in developing a solution required for commercial organizations (Udonsa, 2015). It has the knowledge to deal with the unique needs of various sectors of industry. It gives opportunities to finance and logistics management and customer relationship management by providing them with a variety of solutions. Also, product price matrices are helpful to set bulk purchase discounts. Determinants and the Cramer rule help solve problems related to business and the economy. It enables one to obtain an optimal solution to maximize profit or minimize cost problems. Linear algebra serves as a powerful tool for its applications in business (Orga & Ogbo, 2012).

Apart from the matrices that played a great role in enhancing entrepreneurship, calculus is another branch of mathematics made up of two fields: differential calculus and integral calculus. Differential calculus plays a valuable role in management and business for decision-making in production (e.g., supply of raw materials, wage rates, and taxes) (Mahmud et al., 2022). In calculus, the case when y is a function of x or we can say one variable (y) is dependent on another variable

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(x), and the derivative of y w.r.t. x i.e. $\frac{dy}{dx}$ measures the change of variable y w.r.t. change in variables x. Derivatives enable a firm to make important production decisions. It is also called marginal function. Demand can be assumed to be a function of price. This operator is also helpful in calculating minimum cost and maximum profit. However, to total cost of production and marketing depends on the number of units in mathematical relations, which can be described as $C(x) = F + v(x)$ where the cost function $v(x)$ is a variable cost and F is a fixed cost. The revenue function $R(x)$ can be represented as $R(x) = xp(x)$, where x is the number of units and p is the rate per unit.

Hence, with all these in mind, knowledge of derivatives is essential for understanding economic relations. Another integral operator is used to calculate the total revenue in the case of marginal revenue. So, calculus plays a vital role in tax, profit, and revenue calculations, which are very important for any business. Mathematics is important in the development of entrepreneurship because it is about creativity and innovation (Mahmud et al., 2022). Starting a new business necessitates a careful evaluation to determine its viability. Such evaluation necessitates the use of mathematical techniques to become a reality. Mathematics skills are required to put in place the projected cash flow, budget, projected statement of income and expenditure, and so on while undergoing feasibility and viability appraisals. The planning process, which involves deciding today what will be done in the future, necessitates a good deal of mathematics because, for instance, when it is a production venture, knowing the required quantity of products to be produced necessitates mathematics. As a result, the importance of mathematical knowledge in shaping entrepreneurship for societal development cannot be overstated.

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Mathematics Education as a Method of Entrepreneurship Development

The most important subject for creative thinking is mathematics. Often, the entrepreneur does not create a new product or service. Rather, he or she sees how that idea and result can be made a reality to the benefit of all (Omogiate-Iwelu, 2016). An entrepreneur can use mathematics to better understand and improve his or her marketing strategies. Entrepreneurs who are well-versed in mathematics frequently outperform their counterparts who are not. Mathematical entrepreneurs are capable of analysing data, computing probabilities and statistics, comprehending investment systems, assessing target consumers, and comprehending taxes (Omogiate-Iwelu, 2016). The key component is getting off the couch and doing something. Many people have ideas, but only a few decide to act on them today, not tomorrow or next week. A true entrepreneur is a doer rather than a dreamer (Bushnell, 2012). The ability to be self-employed, create jobs for others, innovate or create new ideas, and add value to existing goods and services are among the credits for entrepreneurs, ultimately lifting the economy to higher levels.

According to Udonsa (2015, p. 4), there are certain methodologies that mathematics educators should use to get the attention of students who have the requisite knowledge of mathematics that can provide them with the skills needed for indulging in entrepreneurship activities that can enhance businesses during and after their school programmes. Such methods are identified as follows:

1. Problem-Solving: The development of mathematical creativity, heuristic thinking, and ingenuity in students through the assignment of open-ended, unusual, and sometimes unsolved problems Simple word problems and problems from international mathematics competitions such as the International Mathematical Olympiad are examples of problems. Problem-solving is used to develop new mathematical knowledge, typically by building on students' prior knowledge.

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2. Classical Education: The teaching of mathematics within the quadrivium (a medieval course involving the "mathematical arts" of arithmetic, geometry, astronomy, and music) was a component of the Middle Ages' classical education curriculum, which was typically based on Euclid's Elements taught as a paradigm of deductive reasoning.
3. Conventional Approach: The gradual and systematic progression through the hierarchy of mathematical notations, ideas, and techniques begins with arithmetic and is followed by concurrent instruction in Euclidean geometry and elementary algebra. Because didactic and curriculum decisions are frequently dictated by the logic of the subject rather than pedagogical considerations, the instructor must be well-versed in elementary mathematics. By emphasizing some aspects of this approach, other methods emerge.
4. Rote learning is the repetition and memorization of mathematical results, definitions, and concepts, usually without meaning or supported by mathematical reasoning. "Drill and kill" is a derogatory term. Rote learning is used in traditional education to teach multiplication tables, definitions, formulas, and other aspects of mathematics.
5. Exercise: Reinforcement of mathematical skills through the completion of a large number of similar exercises, such as adding vulgar fractions or solving quadratic equations,
6. Relational Approach: Uses class topics to solve everyday problems and connects them to current events. This approach focuses on the many applications of math and assists students in understanding why they need to know it as well as in applying math to real-world situations outside of the classroom.
7. Recreational Mathematics: Fun mathematical problems, according to Singmaster (nd), can motivate students to learn mathematics and increase their enjoyment (appreciation) of mathematics.
8. Standards-Based Mathematics: The Standards and Principles of Mathematics for Schools were established by the NCTM to formalize a vision for pre-college mathematics education in the United States and Canada that focuses on deepening students' understanding of mathematical ideas and procedures.

The Role of Entrepreneurship Education in National Development

The significance of mathematics education in any nation's development effort cannot be overstated. The expansion of education sector facilities can spur growth in all other sectors. According to Sule (2004), education is a pure path to mental liberation and the improvement of people's socioeconomic status. Entrepreneurial programmes, if properly planned and implemented, will increase the opportunities for self-employment and job creation. It has several multiplier effects on the economy, encourages innovation, and encourages investment in people by establishing new businesses, commercial activities, and economic sectors that create jobs and contribute to the progress of society (Amarjeet & Malik, 2016). Entrepreneurs introduced new technology for the nation's advancement.

According to Kolawale and Omolayo in Arogundade (2011), many people have difficulty transforming their business ideas into realities and starting new businesses due to a lack of necessary information and skills. To that end, Nigerian curricula in the past were geared toward preparing graduates for white-collar jobs. This explains why millions of our young people and

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graduates roam the streets of major cities and towns looking for white-collar jobs. Nigeria, on the other hand, is repositioning its curriculum to stimulate economic growth through a deliberate agenda of producing entrepreneurial graduates.

Mathematics Education and Entrepreneurial Skills in Schools

The shift from general education to entrepreneurship education, like mathematics education, that most scholars are advocating for might be necessary for light of current realities and the need to develop and empower society's youth in particular. However, there appears to be agreement on the importance of entrepreneurship in alleviating some socioeconomic problems, particularly poverty, unemployment, and various social vices in society (Oviawe, 2010). Akpomi (2009) and Oviawe (2010) researched the mode of using entrepreneurial education as a strategy or instrument for channelling the necessary energies of Nigerian universities, faculties, and students away from paid employment and toward self-employment, which is therefore unavoidable to build capacities. Entrepreneurship education must be prioritized for students to learn the fundamentals of entrepreneurship and how to create a good business plan.

Educational Policy Framework on Entrepreneurship in Nigeria

The Nigerian education system can be traced back to colonial times. The education policy at the time was aimed at producing Nigerians who could read and write to work in positions such as clerks, interpreters, inspectors, and so on, but who lacked the entrepreneurial or professional skills to stand on their own or even establish and manage their businesses (Aladekomo, cited in Abubakar, 2020). Nigerian Industrial Banks (NIB), the Nigerian Bank for Commerce and Industries (NBCI), the Nigerian Agricultural and Cooperative Bank (NACB), and other financial institutions were established in Nigeria. Thirteen such institutions have been established in the country. The policy was deficient in that it did not address issues of self-employment at the tertiary level, instead focusing solely on primary and secondary schools (Oviawe, 2010). Many governments see entrepreneurship as a solution to the country's poor economic performance and lack of job creation. The challenge remains that a better understanding of the factors that influence entrepreneurship and the environment is required to motivate and support entrepreneurs' growth. However, Amarjeet and Malik, (2016) proposed that in understanding the micro-economy foundation that will lead to growth in emerging economies requires knowledge of the primary catalyst for entrepreneurship. While the relationship between individual savings and growth can be difficult to decipher, there is enough evidence to suggest that access to capital plays a significant role in driving productivity. More importantly, these policy instruments must consider the various resource constraints and availability, the nature of existing networks, and market capabilities.

Constraints of Entrepreneurship Education in Nigeria

According to Oviawe (2010 p. 115), the following factors are impeding entrepreneurship education in Nigeria:

1. Poor knowledge-based economy and low spirit of competition
2. Poor enterprising culture
3. Lack of entrepreneurship teachers, materials, and equipment.

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4. Unavailability of funds
5. Non-inclusion of entrepreneurship in the school curricular
6. Poor societal attitude to technical and vocational education development
7. Inadequate facilities and equipment for teaching and learning
8. Insensitivity of government to enterprise creation and expansion strategy.
9. Poor plan and execution of processes of action.
10. An isolated packet of ineffective programmes and management in competencies

Strategies that could be adopted to enhance entrepreneurship education

Some strategies that could enhance entrepreneurship education are proposed by Eze (2020, p. 23) as follows:

1. Adopting effective teaching methods: Effective teaching methods should be used in the teaching of entrepreneurship education. Most often, hands-on learning (experiential) should be employed (Nwaukwa, 2018). Also, the adequate practice should be ensured to enhance mastery of skills.
2. Instituting Entrepreneurship Trust Fund: Here, the government, non-governmental organizations, business entities, and parents should be implored to support entrepreneurship education by contributing to the entrepreneurship trust fund, which would be solely used for promoting entrepreneurship education and its programs.
3. Annual lecture and exhibition of entrepreneurial products: Successful entrepreneurs should be invited annually to talk about their journey so far. This would encourage the young ones. An annual exhibition of entrepreneurial products should also be organized by the administrators of entrepreneurship programs. This will also help to create awareness of the programs' products.
4. Instituting entrepreneurship agencies: Entrepreneurship agencies should be established to identify the strengths and weaknesses of entrepreneurs and prospective entrepreneurs, and to provide data for proper planning, implementation, and monitoring of entrepreneurial activities.
5. Providing a conducive environment for entrepreneurial activities to thrive: A conducive environment for entrepreneurial activities should be provided with adequate and improved equipment and facilities (constant power, water, and a good road network) for growth. Power and alternative sources of power should be made available to entrepreneurs, and they should be supported with adequate finance. Newly established entrepreneurs should not be allowed to pay taxes for two years or more, depending on their adequacy and level of establishment, to ensure a firm foundation for successful entrepreneurial ventures.
6. The adequate market for entrepreneurial products: production without an adequate market leads to waste. Entrepreneurs should be encouraged by adequate patronage. Their products should have an effective channel of distribution, and the entrepreneurial agencies should be the last channel to absorb the remains that consumers could not buy. Very expensive entrepreneurship products could be subsidized by the government to enable consumers to buy those products.

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Conclusion

Previously, Nigeria required a rapid change to "catch up" with the global economic trend. This work has emphasized the importance of strong mathematics education to train young people in a variety of skills, such as entrepreneurial ability, managerial experience, record-keeping, creativity, and innovation. Nigerian youth will be productive and committed employees or employers of labour if entrepreneurship education is well-planned and executed. As a result, this work challenges policymakers to refocus their policies on problem-solving rather than maintaining the status quo. As a result, it is concluded that the role of mathematical education in fostering entrepreneurship for national development should not be taken lightly. Despite the government's efforts to make youth self-sufficient through anchor borrower programs such as market moni, trader moni, N-ship, and others, such efforts are not enough. There is a need to improve the mathematics education curriculum and integrate it into schools so that vibrant youths can develop vast entrepreneurship skills that will allow them to settle themselves in various start-up businesses.

Recommendations

The following recommendations were made:

1. Government and non-governmental organizations should be asked to create an enabling environment for business development programmes in schools by providing capital and other resources to enable schools to organize seminars, conferences, and also training and retraining of mathematics teachers and students on various innovative skills concerning entrepreneurial activities.
2. Mathematics education, as an inherent quality of entrepreneurship, should be encouraged and strengthened at all levels through direct school funding to maintain its status quo in all Nigerian educational systems.
3. School mathematics curricula should be reviewed to accommodate entrepreneurship skills at all levels of education, and more emphasis should be placed on practical aspects and demonstrations right from the school mathematics laboratories' practice.

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