

APPLICATION OF MATHEMATICS SKILLS IN ENTREPRENEURSHIP EDUCATION FOR SUSTAINABLE DEVELOPMENT.

Angel Otse Ogbu ¹, Uko Benjamin Joseph ², Obotu Akogwu Timothy ³

¹ Department of Mathematics Education

³ Department of Computer Education

Federal College of Education Technical Bichi, Kano, Nigeria.

² Department of Mathematics Education

Federal University of Education, Kano, Nigeria.

E-mail:¹ angel6tus@gmail.com, uojoseph63@gmail.com, timothyakogwu@gmail.com

Abstract

Mathematics skills serve as a critical foundation in entrepreneurship education, equipping learners with analytical, problem-solving and decision-making abilities essential for sustainable development. Many entrepreneurship students lack adequate mathematics skills like financial literacy, statistics, optimization necessary for sustainable business management and limited integration of mathematics into entrepreneurship curricula, making students unprepared for real-world challenges. Overemphasis on theoretical mathematics without practical application in business scenarios. Students who acquire mathematical skills through entrepreneurship education are better equipped to make informed decisions, manage resources efficiently and sustain their enterprises. The paper discussed mathematics skills in entrepreneurship education and the qualities required for entrepreneurial skills to be successful. It was recommended among others that Government and non-governmental organizations should create an enabling environment for business development programs 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.

Keywords: Mathematics application, Entrepreneurship Education, Sustainable Development.

Introduction

Mathematics has been an integral part of human civilization, dating back to early human history, where it was used to track events and count. Its applications continue to play a crucial role in today's market systems. The advancement of a nation's social and economic development is deeply tied to science and technology, both of which have their roots in mathematics. As mathematics forms the foundation of science and technology, the pace of a nation's development is closely connected to its mathematical capabilities (Okafor, et al., 2022).

Entrepreneurship education is a branch of learning designed to equip individuals with the mindset and skills needed to take risks and embark on new ventures. It helps students develop essential qualities such as creativity, focus, resilience, problem-solving, goal-setting, and resource management, all of which contribute to self-reliance. One of the major obstacles to youth and national development is the existing skills gap. To address this issue, fostering entrepreneurial skills in students can be an effective solution. In the light of Nigeria's call for greater self-reliance, it becomes even more important to nurture a generation of self-sufficient individuals. Entrepreneurship education as a new course in the curriculum of the Nigerian tertiary institution prepares students for economic challenges after school, making them to become job creator rather than job seeker. It provides students with the required knowledge, skill, and motivation for entrepreneurial success in a variety of settings which are offered with strategies.

Mathematics Skills in Entrepreneur

Mathematics serves as a vital tool in the development of entrepreneurial skills, as it is essential in virtually all aspects of life (Nwoeke, et al.,2023).

Uka (2015) also highlights the positive relationship between problem-solving and entrepreneurship education. Since problem-solving is at the heart of mathematics, it naturally aligns with entrepreneurship, where creativity and problem-solving are crucial. Therefore, there is a clear connection between the two fields. Odiri, (2020) state that there are two main components to mathematics:

(a) Mathematical Knowledge: This category includes knowledge of what works well and how to create advances.

(b) Mathematical Techniques/Skills: These entail using that knowledge in real-world situations with useful tools and techniques.

According to Omokaro (2019), Mathematics has always been a fundamental component of all scientific fields as well as the development of entrepreneurial skills. In today's world, it will continue to be essential for the development of science, technology, and entrepreneurship. According to Idu (2018), mathematics is essential to all knowledge and any entrepreneurship education that does not include it may be fundamentally flawed. Entrepreneurs need specific skills to succeed in business, many of which are grounded in mathematical knowledge. Mathematics plays a key role in various aspects of everyday life, including business, which revolves around buying and selling goods for profit. It is used in businesses to record, organize, summarize, and analyze transactions. Entrepreneurs rely on mathematics to effectively manage and run their businesses. Basic arithmetic, including fractions, decimals, percentages, algebra, statistics, and probability, are essential tools. Practical applications of these skills include managing checking accounts, forecasting sales, calculating price discounts, mark-ups, and mark-downs, handling payroll, computing simple and compound interest, and minimizing resource wastage (Wikipedia contributions,2024)

Ezejeghu, (2021) noted that graduate unemployment has significantly contributed to various social issues, such as robbery, kidnapping, prostitution, political violence, and the recent insurgency in the northeastern and northwestern regions of Nigeria. Thousands of young people, particularly those of school age, have lost their lives, and the Nigerian government is still struggling to find a solution to this ongoing crisis. One contributing factor to the unemployment issue is the widespread belief that many recent Nigerian graduates lack the necessary skills for employment. Idu (2018) highlighted that each year, many young people enter the job market with certificates and skills but with little understanding of the actual demands of the labor market. A lack of proper mathematics education has exacerbated this issue, and entrepreneurship, which could have alleviated the problem, has been discouraged. Abubakar (2020) pointed out that entrepreneurship is a key solution for providing employment, generating income, reducing poverty, and addressing the country's alarming unemployment rate.

Omolayo (2016) defines entrepreneurship as the process of starting a business, managing business operations, and taking risks to generate profit by utilizing skills acquired through mathematics education. In Nigeria, the role of mathematics education in fostering entrepreneurship for societal development is crucial and should not be underestimated. It is essential to integrate entrepreneurship into mathematics education, as doing so will better prepare students to meet the socio-economic demands of the workforce. Bashir & Umar, (2020) stated that entrepreneurship can be categorized into

four types: business entrepreneurs, academic entrepreneurs, government entrepreneurs, and social entrepreneurs

A Business Entrepreneur: is someone who creates and owns a business.

An Academic Entrepreneur: refers to individuals who become educators, researchers, or managers within educational institutions, adopting entrepreneurial methods while maintaining educational objectives.

A Government Entrepreneur: leads and manages public or government institutions with an entrepreneurial mindset. Meanwhile,

A Social Entrepreneur: operates social or non-profit organizations, raising funds from the public for societal causes.

Entrepreneurship can be influenced by three factors: Nature, Nurture, and Training.

"Nature" refers to being born into an entrepreneurial family, where a person is more likely to follow in their parents' footsteps, potentially taking over the family business. "Nurture" pertains to individuals who, despite not being born into an entrepreneurial family, grow up in an entrepreneurial environment, which increases their chances of becoming entrepreneurs. However, even without such background, a person can still become an entrepreneur through the right training and education. A person with the proper system, curriculum, and instructors, anyone can be educated to become an entrepreneur.

As Goddy noted in Umaru (2017), graduate unemployment is primarily due to graduates' overwhelming desire to pursue tertiary education without considering the relevance of their chosen courses or their content. This results to the acquired skills from the tertiary institution been dysfunctional and irrelevant. The question now is should these graduates and those who have acquired the desired skills allowed to roam the street? Frankly speaking, the nation can overcome those menaces by creating in the individuals the awareness that they can develop their acquired skills through the power of innovating ideas and investments provided by the individuals themselves undermining the fear and risk involve. Mathematical skills such as logical arguments, abstract thinking, formulation and solving of problems, computational skills, analytical skills, creativity skills, innovative skills, communication, conceptual ability, interpretation, decision making skills, research skills are useful managerial skills that can be transferred into developing scientific innovative and risk taking approaches which can result to profitable venture or job creation.

The importance of Mathematics education cannot be overemphasized. It is worthy of note that the door through which any nation can pass in developing her citizens to become self-reliant, useful to themselves and the nation, is Mathematics Education which offers skills, ideas, concepts, gateways, etc. to national development. Therefore, Nigeria, like other growing nations must employ the unique services of Mathematics for a successful entrepreneurship. This of course will be reinventing Nigeria entrepreneurship for global competitiveness.

Entrepreneurship Skills

Entrepreneurship skills are skills for the development of scientific innovative ideas and risk-taking approaches for profitable venture. It is the act of becoming an entrepreneur. Entrepreneur is a person who creates new ideas, new activities and coordinates the factors of production, and taking decision on how the business should be run. This has to do with the entrepreneurial competency of the entrepreneur. According to Bloomberg (2010), entrepreneurship is defined as the activity of an entrepreneur who involves three main parts which are generating business ideas that has to do with formation and

formulation of goals, organization of cases which includes effective ways of enforcing such goals and enforcement of such cases which should involve, generating the choice of activities of course. Bloomberg (2010) state that no one can succeed in life endeavors in general and in entrepreneurship in particular through mere luck, except through creative ideas, extensive research work, plenty of trials, doggedness, innovative ideas precise decision making, accurate problem solving good managerial abilities and consistent persistence of efforts. All these and more that make entrepreneurship activities a success can be provided through the knowledge of Mathematics education. (Tsafé 2013) in (Akissani et al, 2016). Mathematics education in modern world enables learners get acquainted with learning concepts in the development of entrepreneurship skills in solving the problem of unemployment and the evil vices associated with it. According to Akissani *et al.*, (2016), learners are able to understand and acquire commercial skills, bargaining power; exchange rates and so on through Mathematics education, failure of their ability to carry out these enterprises may be delusional. To function optimally in entrepreneurship, that individual must be knowledgeable in Mathematics. Mathematics education as the key to entrepreneurship makes the individuals become acquainted with the skills and thus acquire certain enterprise in the society and capable of making him/her self-employed. Mathematics education is a pivot through which many policies could be translated into real life situations and whose profound impact could be noticed if carefully utilized for proper policy formulation and implementation (Tsafé 2013).

Some research studies such as that of Uka (2015), has shown that there is a positive relationship that exists between problem solving and entrepreneurship education. Problem solving itself in Mathematics has to do with creativity which invariably has bearing with entrepreneurship.

The importance of Mathematics to entrepreneurship is very vital and crucial at this time when the economy of Nigeria is dwelling, so many graduates from our institutions of learning are roaming the streets and seeking for white collar jobs and some of them desire to be wealthy at all cost. This has made many of them internet fraudsters and kidnappers. Mathematics has become indispensable because it involves our daily activities. According Akissani (2018), said that Mathematics equips learners with the skills they need to interpret and analyze information, simplify and solve problems, assess risks and make informed decision. If a learner is exposed enough to Mathematical activities requiring manipulative skills, then the learner could grow to become a useful practical and industrious member of his community and hence create jobs for him and others (Chado and Bala 2014) in (Akissani *et al* 2018). The implication of this is that, with the knowledge of Mathematics education, the individuals can be engaged in small scale businesses such as carpentry, weaving of cloths, farming, fishing, rearing of snails or grass cutters, potting and ceramics, piggery and animal husbandry, poultry farm, metal work, reetailed trading, dress making, transportation, frying of beans cake and flour products, and many others. These, when well organized and managed, can lead to large scale businesses where the individuals become employers of labour.

(Akissani *et al* 2016). According to them, for an individual to become an entrepreneur, he/she must be knowledgeable in Mathematics so that in the process of his/her entrepreneurship, all transactions he/she may come across and filling of documents like voucher, ledger, invoice that may require the knowledge of Mathematics would be done with ease. Hence, combating unemployment, poverty alleviation, curbing the menace of kidnapping, vandalism, militancy, insurgency, etc can be achieved through the effective teaching and learning of Mathematics applications and the importance of Mathematics modeling in solving real life problems.

Essential Entrepreneurial Qualities

Successful entrepreneurs often embody several key traits—enhanced by mathematical and cognitive skills—that help them thrive: The ability to adjust swiftly to new situations and devise inventive solutions when circumstances shift. This quality supports resilience and flexible decision-making in uncertain environments. Research on entrepreneurial learning shows that adaptability, often referred to as adversity quotient or strategic agility, is vital for navigating challenges effectively (Sutopo, Hakim, & Yulianto, 2025).

The drive to challenge oneself, benchmark against others, and apply one's skills—such as mathematical reasoning or analytical thinking—to gain an edge. In studies of creative industry entrepreneurs in Nigeria, traits like the “need for achievement” (akin to competitiveness) were found to fuel innovation, risk-taking, high performance, and continuous improvement (Aulia & Ananda, 2023).

A belief in one's capabilities, often grounded in prior problem-solving and knowledge, crucial for making bold entrepreneurial moves. Investigations into self-efficacy—commonly aligned with confidence—among Nigerian students' entrepreneurs highlight its importance in opportunity recognition, overcoming setbacks, and sustaining motivation (Adewale & Salami, 2024).

Persistent motivation and determination to pursue goals relentlessly. Whether framed as perseverance, resilience, or self-efficacy, this inner force underpins the ability to stay committed, bounce back from adversity, and sustain effort over the long haul (Adewale & Salami, 2024; Sutopo et al., 2025).

Mathematics Education and Entrepreneurial Skills in Schools

The shift from general education to entrepreneurship education—similar to the emphasis given to mathematics education—has been widely advocated by scholars as a necessary response to present realities and the urgent need to empower society's youth. There is broad consensus that entrepreneurship plays a vital role in addressing socioeconomic challenges such as poverty, unemployment, and various social vices (Akissani et al, 2016). Research by Uka, (2015) highlights entrepreneurship education as a strategic tool for redirecting the focus of Nigerian universities, faculties, and students from reliance on paid employment to the pursuit of self-employment, thereby fostering capacity building. For this reason, entrepreneurship education must be given priority to ensure that students gain a solid understanding of entrepreneurial fundamentals, including the development of effective business plans. Integrating mathematical problem-solving into entrepreneurial scenarios, engaging students in project-based learning, promoting teamwork, providing real-world experiences, and encouraging innovative thinking are effective ways of merging mathematics education with entrepreneurial skill development. Furthermore, adopting interdisciplinary approaches—such as combining mathematics with business simulations and real-life challenges—strengthens entrepreneurial reasoning. Hands-on activities also enhance students' grasp and application of mathematical concepts within entrepreneurial contexts, particularly in areas like business planning, budgeting, product design, fashion design like shaping everything from garment creation to business operations. In pattern making, designers use geometry, algebra, and trigonometry to establish dimensions, proportions, and fit. Statistical methods support size chart development and ensure designs suit diverse body types. Arithmetic plays a role in fabric estimation, seam allowances, and hemming, helping reduce waste and maintain precision. Technology also relies heavily on math: CAD software uses algorithms for pattern customization, while algebra and geometry inspire fabric prints and motifs. On the business side, mathematics enables accurate cost estimation, profit analysis, and pricing strategies. In addition, it supports inventory control, sales forecasting, and product distribution. Finally,

innovations like wearable technology and smart textiles demonstrate how mathematics drives advancement in fashion technology thereby enhancing entrepreneurial skill development.

Conclusion

Nigeria required a rapid change to "catch up" with the global economic trend as many students shy away from mathematics and the numbers of students admitted across continue to dwindle. Emphasis is laid on 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 translate the mathematics education curriculum to be more practicable and turn schools mathematics lab to centers for entrepreneur development 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 create an enabling environment for business development programs 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.
4. Mathematics practical should be conducted always as to equip the student with skills that will sustain them after school.

Reference

- Abubakar, S. (2020). Refocusing Education Towards Entrepreneurship Development in Nigeria: A Tool for Poverty Eradication. *European Journal of Social Science*, 5. 14.
- Adewale, A. A., & Salami, O. P. (2024). Entrepreneurial Self-efficacy, Resilience and women Entrepreneurial Performance in Nigeria: Moderating role of Innovativeness. *Journal of Entrepreneurship and Innovation in Emerging Economies*. Retrieved from <https://www.researchgate.net/publication/380971952>
- Akissani, I. & Muntari, I. (2016). Mathematics Education; A Veritable Tool for Poverty Alleviation in Nigeria. *Proceeding of Annual National conference of Mathematical Association of Nigeria* (M.A.N);261-271

- Aulia, R., & Ananda, R. (2023). The Impact of Entrepreneurial Characteristics and Competencies on Business Performance in the Creative Industry in Indonesia. *Asia Pacific Journal of Innovation and Entrepreneurship*, 17(3), 348–364. <https://doi.org/10.1108/APJIE-09-2023-0172>
- Bloomberg, I.P (2010). Effect of Mathematics Learning on Entrepreneurship. Retrieved from <http://www.America.com>, <https://infonomics-society.org>
- Ezejughu, M. C. (2021). High Rate of Unemployment and Crime increase in Nigeria. *Sapientia Foundation Journal of Education, Sciences and Gender Studies*, 3(1). <https://www.sfjesgs.com/index.php/SFJESGS/article/view/131>
- Idu, U. E. (2018). The Role of Mathematics in Enhancing Entrepreneurship Development in Nigeria. *International Journal of Science and Research (IJSR)*, 7(1), 1736–1739. <https://doi.org/10.21275/24011802>
- Mahmud, M. S., Maat, S. M., Rosli, R., Sulaiman, N. A., & Mohamed, S. B. (2022). The Application of Entrepreneurial Elements in Mathematics Teaching: Challenges for Primary School Mathematics Teachers. *Frontiers in Psychology*, 13(1), 1–9. <https://doi.org/10.3389/fpsyg.2022.753561>
- Nwoke, B. I., Nwaneri, M. O., & Okorie, S. (2023). Developing Secondary Students' Mathematics Problem-Solving Abilities Through Collaborative Learning In Owerri West Local Government Area Of Imo State. *Faculty of Natural and Applied Sciences Journal of Mathematics and Science Education*, 5(1), 30–36. <https://fnasjournals.com/index.php/FNAS-JMSE/article/view/237>
- Odiri, O. E. (2020). Methods To Build, Develop Mathematical Concepts And Skills in the Early Childhood Mathematics in Nigeria. *Journal Plus Education*, 27(2), 211 – 225. <https://doi.org/10.24250/JPE/2/2020/OO>
- Okafor, I. E., & Nwabuoku, J. (2022). Mathematical Creativity: A Means of Attaining Technological Advancement For Employability And Global Competitiveness In Nigeria. *Chukwuemeka Odumegwu Ojukwu University Journal of Educational Research*, 2(1), 89–98.
- Omokaro, B., & Nwanunu, P. (2019). The Role of Mathematics Education in the Development of Entrepreneurial Skills among Secondary School Students. *Abacus (Mathematics Education Series)*, 44(1), 560–567.
- Omolayo B. (2016). Entrepreneurship in theory and practice. in F. Omotosho, T.K.O Aluko, O.I.Wale Awe and G. Adaramola (eds). *Introduction to entrepreneurship development in Nigeria*. AdoEkiti: Unad Press.
- Sutopo, W., Hakim, L., & Yulianto, A. (2025). Strengthening Entrepreneurship Learning and Entrepreneurial Orientation towards Adversity Quotient through Strategy Agility. *Journal of Innovation and Entrepreneurship*, 14(1), 1–18. <https://doi.org/10.1007/s44217-025-00746-6>
- Tsafe, A.K. (2013). Mathematics Literacy: An Agent of poverty Alleviation and National Development. *Journal of education and Practice*. 4(25)
- Uka, N.K. (2015). Developing Entrepreneurship Skills in Secondary School Students through Effective Mathematics Education in Aba, Nigeria *International Journal of Education, Learning and Development* 3(7); 1-11
- Umaru S, and Momozoku. (2017). Mathematics: A Panacea for Employment Generation. *Proceeding (M.A.N.)* 520-524

Wikipedia contributors. (2024). *Business mathematics*. In *Wikipedia*. Retrieved July 8, 2025, from https://en.wikipedia.org/wiki/Business_mathematics