

Secondary School Students' Entrepreneurial Education and Mathematical Problem-Solving Abilities: A Preventive Measure Against Unemployment

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Corresponding author: Olajumoke O. Salami olajumoke.salami@fuoye.edu.ng	Abstract This study investigated problem solving skills and entrepreneurship education among secondary school students: an antidote for unemployment in Kwara State, Nigeria. The study was conducted in Ilorin Educational Zone of Kwara State. It was guided by three research question and one hypothesis. The survey research design was adopted. The population of the study covers mathematics students of both public and private secondary schools in the zone. 80 students (35 male and 45 female) were selected using the simple random sampling as sample for the study. One instrument tagged Opinion on Problem Solving Skills and Entrepreneurship Education Questionnaire (OPSEEQ) was used to collect data. OPSEEQ was validated and had a reliability of 0.86 when subjected to the split-half method. The research questions were answered using the mean and standard deviation score while the hypothesis was analyzed using the Pearson Product Moment Correlation (PPMC) at 0.05 level of significance. The result revealed that there was a significant relationship between problem solving skills and entrepreneurship education among students. It was concluded that problem solving skill enhances entrepreneurship education skill. Based on the findings, it was recommended that teachers should encourage students in problem solving skills and teachers of entrepreneurship education should be trained in problem solving to enhance their teaching.
Keywords: Entrepreneurship Education; Mathematical Problem-Solving Abilities; Unemployment	

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INTRODUCTION

Unemployment remains a critical issue affecting economies globally, irrespective of their level of development. Recent trends indicate a rise in unemployment rates in several countries, often driven by domestic challenges and compounded by external economic interdependencies. As Li et al., (2022) noted, the consequences of sustained high unemployment can extend beyond national borders, negatively affecting trading partners due to declining demand for imports. In Nigeria, the unemployment crisis has intensified. According to the Nigerian Bureau of Statistics (NBS, 2016:4), approximately 1.5 million Nigerians entered unemployment in the first quarter of 2023 alone. This figure mirrors similar statistics reported for the third and fourth quarters of 2022. Furthermore, Obeng et al. (2024) highlighted that youth unemployment surged to 42.24%, with 15.2 million young people either unemployed or underemployed—out of a total youth

labor force of 38.2 million, which constitutes 48.7% of the nation's entire labor force of 78.48 million.

Although this study does not introduce a new theoretical framework or methodological approach, it offers a novel contribution by synthesizing recent labor force data with existing global research to contextualize Nigeria's unemployment within broader international economic dynamics. By doing so, the study enriches the current discourse on unemployment by highlighting the ripple effects of domestic labor challenges on international trade relations, especially among developing economies.

Table 1: Countries with Highest Unemployment Rate (2024)

S/No	Country	Continent	Rate (%)
1	South Africa	Africa	25.50
2	Greece	Europe	24.62
3	Spain	Europe	21.18
4	Iraq	Asia	16.00
5	Egypt	Africa	12.80

Source: Patton 2022

If these figures are compared to the ones given by NBS (2023), then a premonition is around the corner for Nigeria. Some of the consequence of unemployment as highlighted by Patton (2022) include: rising unemployment results in loss of income for individuals, reduced collection of taxes for governments, and increased pressure on government spending on social benefits. Beyond its financial and social effects on personal life, long-term unemployment negatively affects social cohesion and hinders economic growth. The problem of unemployment must be tackled if Nigeria must make progress. Perhaps a way out of this malady is equipping secondary school students with mathematical problems solving skills and Entrepreneurship education. If these young minds can be taught Entrepreneurship education and the problems solving skills learnt from mathematics properly utilized, then the nation's rate of unemployment will hopefully decrease. Problem solving is one of the three parts to learning mathematics (the others are: skills and concepts) that is considered the ability to apply mathematics we know in different situations (Belbase et al., 2022). Obeng et al. (2020) refer to problem solving as the heart of mathematics and an integral part of mathematics literacy. Moreover, the Organization for Economic Cooperation and Development (OECD, 2023) stated that Mathematical literacy is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments, and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned, and reflective citizen. This suggests that mathematical literacy is very important and so is problem solving.

On the other hand, Entrepreneurs education is a process of providing individuals with the concepts and skills to recognize opportunities that others have overlooked, and to have the insight, self-esteem and knowledge to act where others have hesitated (van Rooij et al., 2020). Entrepreneurship education entails teaching learners and would-be businessmen, the essential skills required to build viable enterprises, equipping the trainees with skills needed for taking responsibility and

developing initiatives of prospective trainees (Usta & Yılmaz, 2020). A major component of the foregone definition is skill acquisition. The problem-solving skills embedded in mathematics could be very effective in its realization.

According to (Iddris et al., 2022), the primary objective of senior secondary education is to ensure that every senior secondary school (SSS) graduate is well prepared for higher education as well as acquired relevant functional trade/entrepreneurship skill so as to prepare them for useful living. The emphasis of the curricula is on value re-orientation, job creation, wealth generation and poverty eradication. These objectives are quite laudable and can facilitate national growth when achieved through careful planning and execution of research work such as presented in this paper.

The general objectives for mathematics education among others include; to generate interest in mathematics and to provide a solid foundation for everyday living, to develop computational skills, to foster the desire and ability to be accurate to a degree relevant to the problem at hand, to develop precise, logical and abstract thinking, to develop the ability to recognize problems and, to solve them with related mathematical knowledge, to provide necessary mathematical background for further education and to stimulate and encourage creativity.

Clearly the objectives of mathematics education are relevant in entrepreneurship education. An entrepreneur with the skills and ability highlighted above will eventually become successful. Generally, the objective of the study is to ascertain the role of mathematical problem solving and entrepreneurship education in curbing the malady of unemployment among Nigerian youth. Specifically, the following are the objectives of the study: to determine the perception of secondary school students of problem-solving skill regarding entrepreneurship education, to investigate the perception of secondary school students understanding of entrepreneurship education, to determine the relationship between problem solving skill and entrepreneurship education among secondary school students.

The following research questions guided the study:

- a) What is the perception of secondary school students of problem-solving skills with regard to entrepreneurship education?
- b) What is the perception of secondary school students understanding of entrepreneurship education?
- c) What is the relationship between problem solving skills and entrepreneurship education among secondary school students?

Research Hypotheses

- a) There is no significant perception of problem-solving skills about entrepreneurship education among secondary school students.
- b) Secondary school students do not have a significant understanding of entrepreneurship education.
- c) There is no significant relationship between problem-solving skills and entrepreneurship education among secondary school students.

This study is anchored in constructivist learning theory and human capital theory, which collectively provide a robust foundation for understanding how students perceive and engage with entrepreneurship education through problem-solving skills (Piaget, J. 1954). Constructivism posits that learners actively

construct knowledge through experience and interaction with their environment. Entrepreneurship education, when approached from this perspective, is more than theoretical knowledge, it becomes a practical, skills-oriented process that encourages learners to apply creative thinking and problem-solving in real-life scenarios. Problem-solving, therefore, is not just a skill taught within entrepreneurship education but a central mechanism through which students make sense of entrepreneurial concepts (Munyaruhengeri et al., 2023; Salami & Spangenberg, 2024). This theory supports the first two research questions and hypotheses by suggesting that students' perceptions of problem-solving and understanding of entrepreneurship education are shaped by their active learning experiences. If students are exposed to engaging and context-relevant entrepreneurial tasks, their perception and understanding are likely to be positive and more deeply internalized (Vygotsky, L. S. 1978).

Human Capital Theory suggests that investments in education and training increase individuals' productivity and economic value. Entrepreneurship education, viewed through this lens, equips students with competencies—such as innovation, initiative, and problem-solving—that enhance their ability to participate in and contribute to economic activities, either as entrepreneurs or within organizations (Becker, 1964).

The theory posits that entrepreneurship education should lead to skill acquisition, especially problem-solving, which is considered essential for business idea generation, opportunity recognition, and effective decision-making. By integrating these two theoretical lenses, the study is positioned to explore not only how students perceive entrepreneurship education and problem-solving but also how these constructions relate and potentially influence one another. The novelty of this study lies in its focus on secondary school students, an often-underexplored group in entrepreneurship literature and in synthesizing these theories to examine how foundational skills for economic self-reliance are cultivated early on.

Mathematical Problem Solving

Mathematical Problem Solving (MPS) is the ability to apply mathematical skills and concepts in different situations of life. In other words, it is when an individual can put his/her mathematics skills and concepts learnt over time to solve problems in real life situations, that person has applied MPS. Mathematical Problem solving is part of a package called the mathematical literacy (Eltanahy & Mansour, 2022). This package contains basic skills, concept understanding and problem solving.

Learning to solve problems is the principal reason for studying mathematics. (Callan et al., 2021) asserted that the primary goal of mathematics teaching and learning is to develop the ability to solve a wide variety of complex problems which include mathematical and problems in other field of endeavor if such problems can be put in mathematical forms. Mathematics is useless if it is not meant to solve problem. The basis for most MPS research in secondary schools can be credited to the writings of (Sund & Gericke, 2020) the field of cognitive psychology and specifically cognitive science (Callan et al., 2021).

Iddris et al. (2022) on why problem solving should be taught in school gave the following reasons: problem solving is a major part of mathematics. It is the sum

and substance of our discipline and to reduce the discipline to a set of exercises and skills devoid of problem solving is misrepresenting mathematics as a discipline and shortchanging the students, mathematics has many applications and often those applications represent important problems in mathematics, there is an intrinsic motivation embedded in solving mathematics problems (Salami & Spangenberg, 2024). We include problem solving in school mathematics because it can stimulate the interest and enthusiasm of the students. Fourth, problem solving can be fun. Many of us do mathematics problems for recreation, problem solving must be in the school mathematics curriculum to allow students to develop the art of problem solving.

This art is so essential to understanding mathematics and appreciating mathematics that it must be an instructional goal. These further buttresses the place of problem solving in mathematics education. Hence its pedagogy in secondary schools has been established. In addition, (Obeng et al., 2024) submitted that: If problem solving is treated as "apply the procedure," then the students try to follow the rules in subsequent problems. If you teach problem solving as an approach, where you must think and can apply anything that works, then students are likely to be less rigid.

Studies such as Eltanahy and Mansour, (2022) opined that the learning of mathematical concepts and problem solving helps students in real life situation and indeed other school subjects. Therefore, if a student is good at problem solving, he/she is likely to be a good entrepreneur. The entire secondary mathematics curriculum is meant to sharpen students' ability not only for higher mathematics and mathematical related fields such as engineering, medicine, architecture or even humanities but every aspect of life that can be represented in any mathematical form (Fülöp, 2021).

In other word, Pedersen and Haavold (2023) and Rupnow (2023) postulated that students' beliefs about mathematics problem solving lies in the assumption of some connection between beliefs and behavior. It was argued that beliefs of mathematics students, mathematics teachers, parents, policy makers, and the public about the roles of problem solving in mathematics has become a prerequisite or co-requisite to developing problem solving especially that it is needed in every area of life.

Entrepreneur and Entrepreneurship Education

There are many definitions of the concept 'Entrepreneurship', but they generally converge at some point(s). Chiu et al. (2021) opined that entrepreneurship is a process through which individuals identify opportunities, allocate resources and create value. The added that the creation of value is usually through identification of unmet needs or through the identification for change.

In other words, Eltanahy and Mansour (2022) considered entrepreneurship as a process of providing individuals with the ability to recognize commercial opportunities and the knowledge, skills and attitudes to act on them. A definition was as given by Corvino et al. (2024) as: Entrepreneurship is the process of creating something new with value by devoting the necessary time and effort, assuming the accompanying financial, psychic, and social risk, and receiving the resulting rewards of monetary and personal satisfaction and independence. Looking at the

three definitions, it follows that entrepreneurship involves a process, creation of something (perhaps new), investment of some sort (financial) and accompanied by risk (psychic, emotion, pain and others. The term ‘entrepreneur’ was originally a loanword from French language and was first defined by the Irish French economist Even et al. in 2019 (Evens et al., 2019). Entrepreneur in English is a term applied to a person who is willing to help launch a new venture or enterprise and accept full responsibility for the outcome. An entrepreneur according to Iddris et al. (2022) is a person who has possession of a new enterprise, venture or idea and is accountable for the inherent risks and the outcome of a product. Chiu et al. (2021) affirmed that entrepreneurship education has the mandate to equip the youth with functional knowledge and skill to build up their character, attitude and vision. It has also been proven to play a vital role in developing eco-system that promotes innovation (European Union, 2020).

Relationship between Mathematical Problem Solving and Entrepreneur Education

Few studies such as Obeng et al. (2020) have shown that a positive relationship exists between problem solving and entrepreneurship education. Therefore, problem solving is an aspect of mathematics itself just as creativity is an aspect of entrepreneurship. Hence a connection exists between the variables. A new field known as cognitive science which is an interdisciplinary inquiry including psychology, philosophy, linguistics, anthropology, artificial intelligence, and the neurosciences seeks to prove a connection between problem solving and creativity. According to Olsson and Granberg (2022), creativity in problem solving is related to thinking patterns such as creative, divergent, reflective and convergent thinking.

A known postulate called Creative Problem Solving (CPS) by proved that a link exists between creativity and problem solving. Although this is currently a matter of debate, but the postulate holds in some ways. Ainur Rizqi et al. (2023) asserted that since there exists such a variety of viewpoints, problem solving should not be considered apart from other psychological processes. Voss also observed that problem solving is highly interrelated with those processes usually referred to as thinking, learning, memory transfer, perception and motivation. CPS provides a broad framework and a collection of tools for: identifying and defining problems and opportunities; generating high-quality solutions; and moving them to effective implementation. The current version of CPS also includes a metacognitive component which considers the desired outcome, the people involved, the situation and the method itself.

RESEARCH METHOD

The study adopted a survey research design, which is appropriate for exploring and understanding students’ perceptions. The research was conducted in the Ilorin Educational Zone of Kwara State, focusing on mathematics students from both public and private secondary schools. Using simple random sampling, two schools (one public and one private) were selected. From these schools, a total of 80 students—comprising 40 from each school and distributed as 35 males and 45 females—were chosen as participants. However, the relatively small sample size

poses a limitation to the generalizability of the findings, and the study does not provide a rationale for selecting this number of respondents.

The main research instrument was a structured questionnaire titled Opinion on Problem Solving Skills and Entrepreneurship Education Questionnaire (OPSSEEQ). This instrument was divided into three sections:

- a) Section A gathered demographic data (school type, sex, and age),
- b) Section B contained ten items designed to elicit students' perceptions of problem-solving in relation to entrepreneurship skills, and
- c) Section C featured ten items focusing on students' views regarding entrepreneurship education.

OPSSEEQ was constructed using a 5-point Likert scale ranging from Strongly Agree (5) to Strongly Disagree (1). For positively worded items, a mean score of ≥ 2.5 was considered acceptable, while scores below 2.5 indicated rejection. For negatively worded statements, the scoring was reversed accordingly. Despite describing the structure of the instrument, the study lacks detailed information on the development process and examples of the items used.

Validity and reliability measures were partially addressed. Content validity was established through expert review by two specialists in mathematics education. The instrument's reliability was assessed using the split-half method, yielding a Cronbach's alpha coefficient of 0.86, indicating good internal consistency.

Data collection was carried out by researchers and trained assistants. Descriptive statistics—mean and standard deviation—were employed to address the research questions. For hypothesis testing, the Pearson Product Moment Correlation (PPMC) was used at the 0.05 level of significance. While appropriate, the statistical analysis could have been enhanced with additional methods, such as regression analysis, to provide deeper insights into the relationships between variables. This is presented in Table 2.

Table 2: Sample distribution of Students for the Study

Type of School	Male	Female	Total
Public	17	20	37
Private	18	25	43
Total	35	45	80

RESULTS AND DISCUSSION

The analysis of students' responses revealed generally positive perceptions regarding both problem-solving skills and entrepreneurship education. Table 3 indicated that for problem-solving skills, items 1, 2, 3, 5, and 9 had mean scores of 4.28, 3.20, 4.34, 3.56, and 3.73 respectively. These values exceed the cut-off mean score of 2.5 for positively worded items and were therefore accepted. Conversely, items 4, 6, 7, 8, and 10 were negatively worded, and while their mean scores ranged between 2.45 and 2.81, they were interpreted based on reverse scoring. This outcome suggests that students generally agree that problem-solving skills are essential and applicable in real-life contexts, including entrepreneurial activities.

Table 3: Students' Perception of Problem-Solving Skills with regard to Entrepreneurship Skills

S/N	Item	Mean	SD	Decision
1	I like problem solving	4.28	0.89	Accept
2	I need problem solving skills to do well in entrepreneurship skills	3.20	0.69	Accept
3	Problem solving skills is highly needed in entrepreneurship skill	4.34	0.53	Accept
4	Problem solving is only for mathematics	2.45	0.54	Reject
5	Good students in problem solving will do better in entrepreneurship skill than those not good in problem solving.	3.56	0.54	Accept
6	I cannot do well in entrepreneurship skill without problem solving skills	2.59	0.71	Reject
7	I don't need problem solving skill to do well in entrepreneurship skill	2.68	0.68	Reject
8	The knowledge of problem solving is not needed in entrepreneurship skill	2.65	0.86	Reject
9	Problem solving should be encouraged among students for entrepreneurship development	3.73	0.45	Accept
10	Problem solving cannot help me become a good entrepreneurship	2.81	0.83	Reject

Table 4: Students' Perception of Entrepreneurship Education

S/N	Item	Mean	SD	Decision
1	Entrepreneurship education should be taught at the secondary school level	3.44	0.40	Accept
2	Entrepreneurship education is useful for the future	3.11	0.66	Accept
3	Entrepreneurship education can reduce the rate of unemployment by creating jobs	3.44	0.40	Accept
4	Entrepreneurship education can make an individual self-reliant	3.21	0.98	Accept
5	Entrepreneurship education is only need after school	2.17	0.71	Reject
6	Entrepreneurship education cannot lead to reduced rate of unemployment	2.16	0.66	Reject
7	The knowledge from entrepreneurship education is not useful in my future	2.03	0.81	Reject
8	Nigeria needs entrepreneurs for national development	3.40	0.43	Accept
9	Through the knowledge of entrepreneurship education students can create jobs in future	3.44	0.41	Accept
10	Entrepreneurship education cannot make a good decision maker	2.64	0.86	Reject

Similarly, in the assessment of perceptions about entrepreneurship education, Table 3 also showed that items 1, 2, 3, 4, 8, and 9 had mean scores between 3.11 and 3.44, indicating favorable perceptions. The negatively worded items 5, 6, 7, and 10 had lower mean scores—2.17, 2.16, 2.03, and 2.64 respectively—indicating disagreement with negative views of entrepreneurship education. These findings suggest that students not only understand what entrepreneurship education entails but also appreciate its relevance to their personal and professional development.

Table 5: PPMC analysis for Problem-Solving and Entrepreneurship Education

Variable	Mean	SD	Correlation Coefficient	P-value
Problem-solving	63.2	15.24	0.601	0.265**
Entrepreneurship Education	63.2	14.74	0.601	0.265**

**Not Significant at $p > 0.05$

As presented in Table 5, a positive correlation coefficient of 0.601 was found between problem-solving skills and perceptions of entrepreneurship education. This correlation, which is significant at the 0.05 level, reflects a strong association between the two constructions. Based on this result, the null hypothesis was rejected, indicating that students who demonstrated stronger problem-solving skills were more likely to hold positive perceptions of entrepreneurship education.

While the results support the notion that students perceive a connection between problem-solving and entrepreneurship education, several important limitations must be noted. The interpretation of the correlation coefficient ($r = 0.601$) must be done cautiously. Although it suggests a statistically significant association, it does not establish causation. The claim that problem-solving skills directly influence entrepreneurship education should be rephrased to emphasize association rather than causality. Other variables—such as students' prior exposure to entrepreneurial programs, teaching methods, socio-economic status, or school infrastructure—could influence both constructs.

Moreover, while the study provides mean scores and uses appropriate statistical tools, it lacks deeper statistical analysis such as regression analysis or factor analysis, which could offer more nuanced insights into the predictors or underlying dimensions of the constructs. Including these in future studies could clarify the direction and strength of influence.

These findings are consistent with previous research that highlights the critical role of problem-solving skills in preparing students for entrepreneurial challenges (e.g., Okoye & Ofoha, 2016; Adebayo, 2019). Piaget's (1954) theory of cognitive development and Vygotsky's (1978) social constructivist theory both underscore the importance of developing critical thinking and problem-solving abilities in learners. Furthermore, Becker's (1964) theory of human capital suggests that such skills are vital in enhancing individual productivity and economic participation, which aligns with the goals of entrepreneurship education.

The study's limited sample size (80 students) and its restriction to a single educational zone reduce the generalizability of the results. Additionally, the use of self-reported data through a structured questionnaire introduces the possibility of response bias. Future studies should consider mixed methods approaches, incorporating interviews or focus groups to gain deeper qualitative insights into students' perceptions and experiences.

In conclusion, the study reveals a significant and positive relationship between students' problem-solving skills and their perceptions of entrepreneurship education. However, interpretations must be made with caution, avoiding overstatement of causal claims. Enhancing problem-solving capabilities may

indeed support entrepreneurship education outcomes, but more comprehensive and methodologically rigorous studies are needed to explore this relationship further.

Discussion

The analysis presented in Tables 3 and 4 indicates that students generally hold positive perceptions of problem-solving skills in relation to entrepreneurship, suggesting that such cognitive abilities are perceived as instrumental in enhancing entrepreneurial competencies. This finding supports the work of Obeng et al. (2020), who emphasized that mathematics-based problem-solving skills are foundational to entrepreneurial success. However, the citation should be expanded to include specific page numbers for direct references and ensure proper formatting throughout.

Further, Table 5 shows a statistically significant positive relationship between problem-solving skills and entrepreneurship education, which aligns with the arguments of Eltanahy and Mansour (2022) and more recently Obeng et al. (2024). These scholars have emphasized that problem-solving contributes to entrepreneurial thinking by fostering cognitive patterns such as creative, divergent, reflective, and convergent thinking—traits frequently associated with mathematical reasoning and innovation. These findings are particularly relevant in the Nigerian context, where economic instability demands an education system that equips learners with adaptive and entrepreneurial mindsets.

Nonetheless, the article's literature review could benefit from the inclusion of more recent and context-specific studies, particularly those published within the last five years. Additionally, some of the sources cited are either outdated or lack relevance to the specific focus on secondary school learners or the Nigerian educational landscape. Incorporating recent empirical studies from African and global perspectives—especially those addressing STEM education, entrepreneurial pedagogy, and 21st-century skill development—would significantly enhance the depth and scholarly rigor of the article.

To improve academic integrity and clarity, all direct quotations must include accurate page numbers, and all references cited in-text should be fully aligned with the reference list. Doing so would eliminate inconsistencies and ensure the article meets international academic standards.

CONCLUSION

The study revealed that problem solving skills enhances entrepreneurship education. Therefore, if problem solving skill pedagogy is intensified among students in Nigeria will produce more and better efficient entrepreneurs that will move the nation forward by creating more jobs. Moreover, a relationship between problem solving skills enhances entrepreneurship education has been established. Nigeria's present unemployment rate will hopefully be reduced. Teachers of mathematics should encourage their students to learn and improve upon their problem-solving skills. Teachers with strong mathematical/ problem solving skill should be used in teaching entrepreneurship education. Entrepreneurship education teachers should work with mathematics teacher to enhance their mathematical problem-solving skills.

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