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MATHPRENEURSHIP AS AN INNOVATIVE APPROACH IN ENHANCING PROBLEM-SOLVING AND ENTREPRENEURIAL COMPETENCIES OF BUSINESS EDUCATION STUDENTS

MATHPRENEURSHIP SEBAGAI PENDEKATAN INOVATIF DALAM MENINGKATKAN KOMPETENSI PEMECAHAN MASALAH DAN KEWIRAUSAHAAN MAHASISWA PENDIDIKAN BISNIS

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ABSTRAK

Penelitian ini mengkaji bagaimana mathpreneurship memengaruhi pengembangan kemampuan kewirausahaan dan keterampilan pemecahan masalah di kalangan mahasiswa program studi Pendidikan Bisnis pada perguruan tinggi di Nigeria. Penelitian ini dipandu oleh dua tujuan penelitian, pertanyaan penelitian, dan hipotesis. Teknik sampling acak berstrata (stratified random sampling) digunakan untuk memilih 40 dosen dan 175 mahasiswa dari total masing-masing 85 dosen dan 580 mahasiswa. Data dikumpulkan menggunakan metode survei deskriptif dengan kuesioner terstandarisasi yang telah ditinjau secara menyeluruh oleh para ahli. Kuesioner disebarkan langsung oleh para peneliti. Konsistensi internal instrumen dibuktikan melalui uji reliabilitas yang menghasilkan koefisien Alpha Cronbach sebesar 0,82. Data dianalisis menggunakan statistik deskriptif sesuai dengan tujuan penelitian, sedangkan ANOVA digunakan untuk menguji hipotesis pada taraf signifikansi 0,05. Hasil penelitian menunjukkan bahwa mathpreneurship secara signifikan meningkatkan kemampuan pemecahan masalah mahasiswa (rata-rata = 3,17; SD = 0,61) dan juga meningkatkan kemampuan kewirausahaan mereka secara moderat (rata-rata = 2,58; SD = 0,57). Penelitian ini menyimpulkan bahwa mathpreneurship membekali mahasiswa Pendidikan Bisnis dengan kemampuan menerapkan konsep-konsep matematika dalam situasi dunia nyata serta mengembangkan kemampuan kewirausahaan yang dibutuhkan dalam perekonomian modern. Penelitian ini merekomendasikan integrasi permasalahan dunia nyata ke dalam kurikulum matematika agar pendidikan kewirausahaan dapat diintegrasikan secara efektif ke dalam praktik pembelajaran.

ABSTRACT

This study examined how mathpreneurship influence the development of entrepreneurial and problem-solving abilities among undergraduate business education students in Nigeria institutions. The study was guided with two objectives, research questions and hypotheses. Stratified random sampling techniques was used to select 40 instructors and 175 students among 85 and 580 respectively. Data were gathered using a descriptive survey with a standardized questionnaire that was thoroughly reviewed by experts. The questionnaires were administered by the researchers. The internal consistency was demonstrated through a reliability evaluation that produced a Cronbach's alpha coefficient of 0.82. The data were analysed using descriptive statistics in connection to the study's objectives, and ANOVA was used to test hypotheses at a significance level of 0.05. The results show that students' problem-solving abilities are greatly improved by mathpreneurship (mean=3.17; SD=0.61) and their entrepreneurial capabilities are somewhat improved (mean=2.58; SD=0.57). The study concluded that mathpreneurship equip business education students with mathematical ideas in real-world situations and entrepreneurial abilities required for the contemporary economy. The study recommended that the integration of real-world problems into the mathematics curriculum to seamlessly weave entrepreneurial education into their instructional practices.

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INTRODUCTION

Mathpreneurship occupies a central position in Nigeria's educational system due to its role in developing analytical thinking, logical reasoning, and problem-solving abilities essential for individual, national, and socioeconomic development. Beyond academic achievement, contemporary educational demands require learners who acquire transferable skills that promote creativity, adaptability, and economic productivity. In line with this shift, Nigeria's National Policy on Education emphasizes entrepreneurial education as a strategic response to youth unemployment and economic dependency. Consequently, Mathpreneurship is increasingly viewed not only as an academic discipline but also as a vehicle for skill development, innovation, and economic empowerment.

Despite its recognized importance, Mathpreneurship in Nigeria has struggled to achieve these broader outcomes. Many students find Mathpreneurship abstract, difficult, and disconnected from real-life applications (Sidi, 2020). Teaching approaches remain largely teacher-centered and examination-driven, emphasizing procedural memorization rather than conceptual understanding and practical application. As a result, learners often graduate with limited ability to apply Mathpreneurship knowledge to real-world problems. This situation is particularly concerning in the context of rising youth unemployment, where graduates are expected to demonstrate problem-solving skills, innovation, and entrepreneurial capacity. These disconnect between Mathpreneurship instruction and practical economic realities have therefore contributed to poor learner engagement, weak problem-solving skills, and limited employability skills of business education graduates.

Many students in Nigerian schools continue to demonstrate an inability to apply mathematical understanding to real-life situations, considering the subject's prominence in the curriculum. Awofala et al., (2020) revealed that, conventional methods of teaching mathematics still remain predominantly teacher-centered and focused on exams, encouraging rote learning of procedures rather than genuine engagement with subject areas. These ways of teaching frequently deny students the chance of engaging in real-world problem-solving exercises. In view of this, students often perceive mathematics as abstract, uninteresting, and unrelated to their daily economic and problem-solving demands (Agboola, 2020). Low achievement, unfavourable learner attitudes, and diminished capacity to utilize mathematics as a tool for creativity and entrepreneurship are all outcomes of these instructional limitations. One possible approach is mathpreneurship, an educational concept that blends mathematics with entrepreneurship theory and practice.

Mathpreneurship has emerged as an instructional approach capable of addressing these challenges. It refers to the integration of mathematical concepts with entrepreneurial thinking through practical, context-based activities such as budgeting, pricing, profit analysis, and financial decision-making. By embedding mathematics within real-world business and economic scenarios, mathpreneurship transforms the subject from an abstract discipline into a functional tool for value creation and decision-making. Grounded in constructivist and experiential learning theories, this approach encourages active learning, critical thinking, and problem-based engagement Aliyu et al., (2025). In the Nigerian context, where self-employment and small-scale enterprises play a vital economic role, mathpreneurship provides a relevant pathway for aligning mathematics education with societal and economic needs.

Mathpreneurship is the practice of teaching mathematical concepts through practical, context-based tasks such as pricing, profit analysis, budgeting, and financial decision-making (Idu, 2018). Mathpreneurship integrates real-world business and economic scenarios into mathematics lessons to help students grasp the value of mathematics in solving every day and corporate problems. The approach aligns with constructivist and experiential learning theories, which emphasise active participation, problem-based learning, and learning by doing (Ubogu, 2020). This implies that, mathpreneurship transforms mathematics from a purely academic subject into a practical entrepreneurial tool. This is especially relevant in Nigeria, where self-employment and small businesses are essential for economic survival. Mathpreneurship provides an attractive opportunity to close the gap between

theoretical mathematics and practical application by fostering entrepreneurial skills and problem-solving abilities.

Through engagement, hands-on learning, and practical application, mathpreneurship has the potential to transform mathematics education from a purely academic effort into a platform for socioeconomic development and personal empowerment (Urama, et al., 2025). Mathpreneurship, which deliberately integrates entrepreneurial methods and thinking with mathematics instruction, has emerged as a promising teaching approach. In order to help students, apply mathematical reasoning to real-world issue scenarios, mathpreneurship comprises establishing mathematical learning experiences that incorporate real-world business, financial, and economic scenarios into mathematical activities (Alalo & Alao, 2022). By blending mathematics into entrepreneurial operations including pricing strategies, cost analysis, budgeting, and revenue modelling, mathpreneurship extends learning beyond procedural computers to practical application. Learners who receive mathematics instruction in line with entrepreneurship objectives develop not only mathematical proficiency but also confidence, innovative thinking, and practical skills needed to succeed in the economy contexts (AbdulKarim & Allen, 2022

The results of these studies support the premise that embedding entrepreneurship-related content into maths lessons could improve traditional teaching strategies and make learning more applicable to students' socioeconomic situations. In response to these issues, mathpreneurship emphasises the development of problem-solving abilities, which is a fundamental goal of mathematics education. The ability to comprehend, evaluates, and react to new and complicated issues by using suitable techniques and mathematical reasoning is known as problem solving (Onoshakpokaiye, 2021). Because they are rarely exposed to teaching strategies that encourage critical thinking and active participation, research consistently demonstrates that students in Nigerian schools frequently struggle with higher order problem solving activities (Olabiyi & Awofala, 2021). Research indicates that instructional strategies such as project-based learning and interactive approaches can significantly improve students' problem-solving abilities by promoting deeper conceptual comprehension and engagement (Udonsa, 2015).

When mathematics is applied to entrepreneurial problem settings, students have to utilize competencies that mirror the analytical requirements of actual economic activity, such as scenario analysis, decision-making, and justification of answers. Thus, mathpreneurship fosters cognitive abilities that are applicable to a variety of life and professional situations in addition to targeting mathematical proficiency. In addition to problem solving, mathpreneurship is associated with the development of entrepreneurial qualities such as risk assessment, creativity, opportunity recognition, innovation, and strategic decision making. These skills are essential for helping students overcome financial obstacles, start their own businesses, and significantly contribute to both local and national development (Sodangi & Ibrahim, 2023). Building entrepreneurial talents is more successful when experiential, contextualised learning approaches are employed rather than isolated theoretical instruction, according to research on entrepreneurship education in Africa (Salami & Spangenberg, 2025).

Students are given the chance to apply analytical and quantitative abilities in relevant entrepreneurial contexts by incorporating entrepreneurial scenarios into mathematical coursework. This promotes an attitude that prioritises economic agency, adaptability, and creativity. The integration of mathpreneurship into mathematics education also addresses broader educational and social objectives. Giving students the opportunity to work with applied mathematics that reflects real-world economic circumstances boosts motivation, engagement, and the perceived relevance of mathematics (Salau & Popoola, 2020). Additionally, by discreetly emphasising problem-solving and entrepreneurial skills at the same time, mathpreneurship connects classroom instruction with national development goals and equips students with the skills they need to thrive in a creative and competitive economy. Despite its theoretical benefits, there is still a lack of empirical data on the implementation and effectiveness of mathpreneurship in Nigerian classrooms. This gap underlines the need for studies that analyse how mathpreneurship influences kids' capacity for problem-solving and entrepreneurial talents.

JURNAL SAINTIFIK
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Lawal et al., (2025), postulated that, students are better equipped to understand how mathematics can be applied to address economic challenges, provide value, and advance sustainable development as a result of this integration. When students solve realistic and context-rich mathematical problems related to entrepreneurial applications, they acquire both cognitive and practical abilities that prepare them for lifelong learning, employment, and self-employment in a competitive global economy. These practices often limit students' exposure to real-world problem-solving, leading to perceptions of mathematics as abstract, irrelevant, and disconnected from everyday economic realities. Such limitations contribute to poor achievement, negative learner attitudes, and reduced capacity to use mathematics creatively and entrepreneurially. This implies that, there is still a lack of empirical data about the application and effectiveness of mathpreneurship in Nigerian mathematics classrooms. This disparity highlights the need for more research to thoroughly investigate how mathpreneurship could improve students' problem-solving and entrepreneurial abilities.

Statement of the Problem

Mathematics education seeks to develop learners' problem-solving talents and their capacity to apply logical thinking to real-life circumstances. However, research from Nigeria and other African nations reveals that a significant percentage of students finished their programs with poor problem-solving abilities and a restricted capacity to apply mathematical knowledge to real-world economic and practical situations. A significant number of teaching methods are still teacher-centered and examination-driven, placing more emphasis on procedural knowledge than on application, creativity, and critical thinking. The persistent discrepancy between the outcomes of mathematics education and the skills necessary for independence and economic engagement makes this study necessary (Ogunleye & Ajayi, 2021). Similar to this, there is a greater need for graduates with entrepreneurial skills including opportunity identification, decision-making, and value generation due to the rising rate of youth unemployment. Although entrepreneurship education has been introduced in Nigeria, it is usually taught as a stand-alone subject with little incorporation into basic courses like mathematics.

This separation makes it difficult for students to connect mathematical concepts to entrepreneurial tasks like resource management, cost analysis, and financial planning (Achor & Wilfred-Brown, 2020). One potential solution to these problems is mathpreneurship, which combines mathematical knowledge with an entrepreneurial mindset. However, there is a dearth of empirical data regarding the effectiveness of mathpreneurship in mathematics education, particularly in Nigeria and other African countries. There is a knowledge gap about the combined benefits of entrepreneurial education and mathematical problem-solving because most recent research focuses on these topics separately (Ezeudu & Ezinwanyi, 2022). If this gap is not filled, mathematics education may continue to be abstract and unrelated to practical demands, which would lead to graduates' lack of creativity and unemployment. In order to enhance problem-solving and entrepreneurial skills in mathematics education, it is imperative to look into mathpreneurship as a cutting-edge approach.

Purpose of the Study

The main purpose of this study is to examine mathpreneurship as an innovative approach to enhancing problem-solving and entrepreneurial competencies in mathematics education. Specifically, the study seeks to:

1. examine the extent to which mathpreneurship enhances students' problem-solving skills in mathematics education
2. determine the influence of mathpreneurship on the development of students' entrepreneurial competencies within mathematics learning

JURNAL SAINTIFIK
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Research Questions

1. To what extent does the use of mathpreneurship as an instructional approach enhance students' problem-solving skills in mathematics education?
2. To what extent does mathpreneurship improve students' entrepreneurial competencies within mathematics learning?

Hypothesis

H_{01}: Mathpreneurship has no significant impact on students' problem-solving skills in mathematics education base on gender.

H_{02}: Mathpreneurship has no significant impact on students' entrepreneurial competencies within mathematics learning based on institution.

Literature Review

Concept of Mathpreneurship in Mathematics Education

Integrating practical problem-solving, entrepreneurial thinking, and practical economic action, a cutting-edge teaching strategy known as "mathpreneurship" aims to get past the conventional constraints of mathematics education. In contrast to traditional mathematics education, which tends to emphasise procedural memorisation, abstract rules, and test preparation, mathpreneurship places mathematical concepts in real-world scenarios that require students to engage critically with real-world problems. These challenges give students the chance to apply mathematics as a tool for creativity, value creation, and strategic thinking because they frequently reflect the kinds of decisions made in business, commerce, and economic planning (Haara, 2025). Essentially, mathpreneurship integrates elements from entrepreneurial education into math curricula, including resource management, risk assessment, opportunity recognition, and decision-making.

By doing this, it transforms mathematics education from an abstract, theory-based activity into a practical, helpful process that prepares students to engage in society and the economy. Empirical research indicates that students exposed to mathematics instruction in entrepreneurial contexts demonstrate not only improved mathematical competence but also enhanced ability to apply mathematical reasoning in planning, budgeting, forecasting, and problem-solving activities relevant to business scenarios (Salami & Spangenberg, 2025). This implies that, when learners apply ratios, percentages, or algebraic models to financial decision-making or cost analysis, they develop the habit of linking classroom knowledge with practical challenges. This fosters both cognitive understanding and entrepreneurial disposition, encouraging students to approach problems strategically and innovatively.

According to Makinde (2020), students attending private secondary schools tend to make greater use of educational applications for learning mathematics than those in public schools. This suggests that innovative approaches that combine mathematics with practical and entrepreneurial experiences can be beneficial in enhancing students' engagement with the subject. Integrating mathpreneurship into mathematics education may therefore encourage learners to develop an entrepreneurial mindset, equipping them with skills that can contribute to improved economic opportunities and sustainable livelihoods.

The idea of mathpreneurship is especially pertinent in Nigeria and throughout Africa because of enduring economic issues like high rates of youth unemployment, underemployment, and restricted access to formal employment. In order to promote economic independence and entrepreneurship, scholars contend that mathematics education should go beyond theoretical competence. Research indicates that incorporating entrepreneurial applications into math classes improves students' ability to manage small businesses, analyse financial data, analyse markets, and make data-driven decisions skills essential for navigating both the formal and informal economies (Sodangi & Ibrahim, 2023). In order to enable students to transform their mathematical knowledge into useful and profitable

consequences, mathpreneurship offers a means of integrating mathematics courses with socioeconomic realities.

Studies have also shown that many mathematics teachers lack the abilities, confidence, and pedagogical strategies required to properly integrate entrepreneurial concepts into their courses. They often focus on procedural mastery due to curriculum constraints and exam pressure, which limits students' ability to simultaneously develop mathematical and entrepreneurial abilities (Mahmud et al., 2022). This emphasises the necessity of curriculum modification, teacher professional development, and educational resources that specifically promote mathpreneurship-based instruction. Without such systematic support, the benefits of this approach might not be fully achieved. By implication, mathpreneurship broadens the goal of mathematics education to encompass not only the development of analytical and numerical skills but also the growth of entrepreneurial thinking and problem-solving talents. In situations where entrepreneurial abilities are becoming more and more important, it makes mathematics education more relevant, interesting, and transformative by positioning students to utilize mathematics as a strategic instrument for decision-making, creativity, and economic engagement.

Mathematics Education and Problem-Solving Skills

Problem-solving is widely recognised as one of the primary goals of mathematics education and a critical indicator of substantial mathematical learning. It requires more than just following instructions; it also requires the capacity to see trends, evaluate new situations, apply logic, and provide solutions. Students must be able to think critically, comprehend information, and apply mathematical concepts in a variety of contexts in order to solve problems effectively. In order to prepare students for real-world scenarios that need critical thinking and practical decision-making, problem-solving is crucial to mathematical literacy (Adu et al., 2020).

Research indicates that students' problem-solving skills are often deficient in a range of educational settings, despite its significance. In this regard, exam success, procedural fluency, and rote memorisation are given priority in Nigerian traditional mathematical education, usually at the expense of conceptual comprehension and critical thinking. This approach hampers students' ability to apply mathematical knowledge to real-world, practical situations and impedes the development of higher-order cognitive skills necessary for entrepreneurial and economic decision-making (Salami & Spangenberg, 2023). While they may be proficient in mathematics, learners may struggle to solve complex problems that call for the kind of analysis, reasoning, and creativity that are necessary in both everyday life and commercial settings.

Students' problem-solving skills are greatly improved by instructional strategies that include experiential, activity-based, and contextual approaches. For instance, research on problem-based learning (PBL) in mathematics show that students exposed to real-world scenarios such as budgeting, data analysis, and financial planning are more adept at solving problems than those taught through traditional lecture-based methods (Vira Lidiana & Sukestiyarno, 2023). Similar to this, adding economic and entrepreneurial contexts to mathematics problems helps students relate abstract mathematical concepts to real-world situations, which boosts engagement and develops practical abilities (Salami & Spangenberg, 2025). Furthermore, mathematical problem-solving and affective and cognitive outcomes are strongly correlated. In addition to developing their analytical ability, students who face problems that call for creative thinking and self-directed strategies also learn perseverance, ingenuity, and self-assurance when employing mathematics in unique scenarios. Studies conducted in Nigeria reveals that students working on entrepreneurship-related mathematics projects were better able to apply mathematical reasoning to decision-making tasks, demonstrating improved problem-solving performance and practical application skills (Sodangi & Ibrahim, 2023). This study highlights the significance of integrating entrepreneurship into maths classrooms to enhance students' problem-solving skills.

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Additionally, scholars argue that the problem-solving skills learned in mathematics classes prepare students for more broad skills like data analysis, strategic planning, and creative thinking that are required in the workforce of the twenty-first century. When mathematics education is combined with entrepreneurial applications, students are exposed to real-world problem-solving scenarios that represent problems in business, technology, and community development (Savicevic & Nikolic, 2019). This connection increases student interest, reinforces the importance of mathematics education, and equips students with the intellectual and practical abilities needed for self-employment and participation in the economy. In conclusion, conventional methods of instruction have hampered students' ability to apply their mathematical knowledge in a meaningful way, even though problem-solving is still a major goal of mathematics education. An effective way for strengthening the ability of learners to solve problems is through creative ways of mathpreneurship, that incorporates real-world entrepreneurial concerns into mathematics training. These methods make mathematics more applicable, interesting, and useful while improving mathematical comprehension as well as offering students the skills that are required to overcome challenging, real-world situations.

Entrepreneurial Competencies in Education

Entrepreneurial competencies are a set of abilities, mindsets, and behaviours that allow individuals to recognise opportunities, innovate, undertake sensible dangers, make wise choices, and efficiently manage resources. These abilities are increasingly recognised as essential learning outcomes, especially when formal job prospects are limited and economic engagement requires flexibility and independence (Okolie et al., 2022). In this sense, entrepreneurial skills help students enhance their creativity, critical thinking, and problem-solving abilities in addition to helping them launch business enterprises. In order to address youth unemployment and advance economic growth, educational policies in Nigeria and many other African nations have increasingly embraced entrepreneurial instruction. However, findings reveal that the theoretical delivery of entrepreneurship education and its scant integration with fundamental subjects like mathematics have frequently hindered its influence (Ogunleye & Ajayi, 2021). There are few opportunities for students to apply entrepreneurial skills in real-world situations or in other subject areas because many programs are offered as stand-alone courses.

Because of this, students may learn about the fundamentals of entrepreneurship but lack the skills essential to put them into practice. Research suggests that the best way to develop entrepreneurial competencies is to incorporate them into the curriculum rather than teaching them separately. In particular, incorporating entrepreneurship into mathematics enables students to practice abilities like financial planning, opportunity recognition, and decision-making while also strengthening mathematical ideas. According to research, students who receive mathematics teaching with embedded entrepreneurial projects exhibit improvements in their inventiveness, risk assessment, problem-solving skills, along with their capacity to apply information practically (Olajumoke & Spangenberg, 2025). In addition to improving students' preparedness for entrepreneurial endeavours, these competencies help them acquire transferable skills that are useful in a variety of social and economic setting.

Abdulrafiu et al. (2024) noted that strengthening entrepreneurial competencies among business education students for sustainable development require the adoption of innovative and deliberate approaches. They recommended, among other things, improving educational facilities, ensuring continuous professional development for teachers, and providing fair access to digital tools and technologies. According to them, these steps are essential for advancing entrepreneurship education and supporting socioecomic development. In this regard, mathpreneurship can serve as a fitting approach to stimulate students' interest in mathematics while also fostering entrepreneurial thinking, thereby contributing to economic sustainability and a more promising future.

JURNAL SAINTIFIK
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Furthermore, integrating entrepreneurial competencies into the curriculum coincides with global trends in curriculum development that emphasise 21st-century skills. These qualities are closely linked to entrepreneurship and include critical thinking, creativity, teamwork, flexibility, and invention (European Commission, 2017). For instance, students develop the cognitive and affective dispositions required for entrepreneurial success when they are encouraged to oversee virtual businesses, evaluate financial risks, or examine market forecasts. Based on recent research conducted in Nigeria, students who participate in project-based and experiential learning activities exhibit higher levels of initiative, practical problem-solving and entrepreneurial self-efficacy than their peers in traditional instruction settings (Sodangi & Ibrahim, 2023). Despite the acknowledged benefits, educational systems encounter it difficult to cultivate entrepreneurial competencies. Teachers typically lack appropriate training in entrepreneurial pedagogy, and curricula may not provide enough guidance for meaningfully integrating these competencies into core subjects.

However, students' exposure to real-world entrepreneurial activities is still restricted, which undermines the development of vital skills required for economic involvement (Mahmud et al., 2022). In order to guarantee that entrepreneurial education translates into useful skills, this challenge highlights the significance of professional development, curricular innovation, and resource assistance. Educational systems find it problematic to nurture entrepreneurial competencies, despite the recognized advantages. Curricula might not provide adequate direction for effectively integrating these competencies into core subjects, and teachers sometimes lack the necessary training in entrepreneurial pedagogy. As a result, students' exposure to actual entrepreneurial operations is still limited, weakening the development of critical skills necessary for economic engagement (Mahmud et al., 2022). This problem emphasizes the importance of professional development, curricular innovation, and resource support to ensure that entrepreneurial education translates into practical abilities.

Integration of Entrepreneurship into Mathematics Instruction

Achor and Wilfred-Brown, (2020) postulated that, the integration of entrepreneurship into mathematics curriculum is an educational approach designed to merge mathematical learning with real-world economic applications, entrepreneurial thinking, and problem-solving skills. This approach acknowledges that mathematics is a helpful instrument that may guide financial planning, creativity, and decision-making in addition to being a theoretical field of study. Students are given opportunities to apply mathematical reasoning to contemporary issues by integrating entrepreneurial contexts into mathematics instruction, which enhances their conceptual knowledge and capacity for entrepreneurial success. The fact that students are more enthused when maths is applied to pertinent, real-life situations is one of the primary arguments in favour of incorporating entrepreneurship into maths lessons.

Research demonstrates that students who encounter mathematical problems situated in entrepreneurial contexts, such as budgeting, cost analysis, sales forecasting, and profit calculation, are prone to develop problem-solving skills and retain mathematical concepts than those who are taught using abstract, context-free methods (Ezeudu & Ezinwanyi, 2022). For example, students who use mathematics to develop an independent business venture develop the critical thinking, creativity, and decision-making skills necessary for entrepreneurial engagement in addition to using analytical and numerical capabilities (Salami & Spangenberg, 2025).

Project-based learning (PBL) and problem-based learning approaches are particularly effective when integrating entrepreneurship into mathematics. These approaches to learning encourage students to collaborate in order to solve enduring, actual-life issues, assess both quantitative and qualitative data, and provide practical answers. Research shows that students who learn mathematics through entrepreneurship-oriented PBL have higher levels of entrepreneurial self-efficacy, a deeper understanding of mathematics, and greater capacity for solving problems than their peers in traditional lecture-based classrooms (Vira Lidiana & Sukestiyarno, 2023). Students are able that you understand

JURNAL SAINTIFIK
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the immediate significance of mathematics as a tool for economic planning and innovation because of these techniques' experiential character, which mimics the decision-making processes in business environments.

Incorporating entrepreneurship into mathematics promotes both practical and cognitive skills as well as emotional consequences including initiative, desire, and self-assurance. According to research, students that engage in entrepreneurship-integrated math activities are more motivated to employ mathematics outside of the classroom, exhibit higher levels of fascination, and are more persistent when offered with difficult tasks (Sodangi & Ibrahim, 2023). These personality characteristics are crucial for promoting entrepreneurial behaviour and lifelong learning as students learn to address problems creatively and thoughtfully. Despite its potential, rigorous preparation and assistance are needed for the successful integration of entrepreneurship into mathematics education. Numerous issues are brought to light by research, especially resource limitations, a lack of curriculum monitoring, and insufficient teacher preparation. The application of mathpreneurship may be complicated by the fact that many mathematics instructors are unfamiliar with entrepreneurial concepts and pedagogical techniques for incorporating them into their lessons (Mahmud et al., 2022). Professional development initiatives, curriculum changes, and the availability of instructional materials that clearly link mathematics education to entrepreneurial applications are all necessary to address these issues. All things considered, including entrepreneurship into math classrooms coincides with global educational trends that prioritise the growth of 21st-century skills of invention, creativity, critical thinking, and problem-solving. By integrating mathematics to real-world economic and entrepreneurial settings, learners acquire the cognitive and practical abilities required to manage difficult real-world circumstances. In beyond improving children's mathematical skills, this approach gives them the entrepreneurial abilities needed for self-reliance, creativity, and significant economic involvement.

RESEARCH METHOD

This study employed a descriptive survey research approach to evaluate how mathpreneurship enhances problem-solving and entrepreneurial skills among undergraduate students in Kwara State, Nigeria. Because it enables the methodical collection of data from a precisely defined group to reflect current practices, perceptions, and conditions as they occur naturally, the descriptive survey approach was deemed appropriate. The study's participants were 580 undergraduate students and 85 instructors from Kwara State's public education institutions. The instructors were from the Departments of Mathematics Education and Business Education, and the undergraduate students were enrolled in courses related to both business and mathematics. These responses were considered appropriate because they were directly involved in the teaching and learning procedures that facilitate the application of mathpreneurship. Stratified random sampling was used to choose the study's sample. To guarantee sufficient representation of both sectors, the population was originally split into lecturers and undergraduate students.

From these strata, 175 undergraduate students and 40 lecturers from the business education and mathematics education departments of the chosen institution were picked at random. By using this sampling technique, bias is reduced and the sample's representativeness is increased. Data for the study was obtained through a systematic questionnaire entitled Mathpreneurship: *Problem-Solving and Entrepreneurial Competencies in Mathematics Education Questionnaire (MPEMEQ)*. To guarantee the validity of the instrument, expert in business education, mathematics education, and educational measurement and evaluation from Kwara State University, Al-Hikmah University, and the University of Ilorin, respectively, reviewed its face and content. Their comments contributed to the needed changes that strengthened the reliability, relevance, and clarity of the questionnaire items.

JURNAL SAINTIFIK
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Before the primary data collection, a pilot study was carried out to assess the instrument's dependability. 20 respondents from public institutions outside the study area were given the questionnaire; they were not included in the final sample. The Cronbach's Alpha reliability coefficient was used to analyse the data from the pilot study, and the result was 0.82. This coefficient exceeded the minimum acceptable criterion of 0.70, suggesting that the instrument possessed a high level of internal consistency and was dependable for the investigation. A four-point Likert rating scale, spanning from Strongly Agree to Strongly Disagree, was used to structure the questionnaire items. A decision mean of 2.50 was employed to decode the responses. Items having a mean score of 2.50 or more were categorised as agreed, and those with a mean score of less than 2.50 were categorised as disagreed. With the aid of trained research assistants, the researcher personally distributed the questionnaires to the respondents in order to ensure proper administration and a high rate of return. The data was analysed through both descriptive and inferential statistics.

The mean and standard deviation were employed in responding to the study questions; the mean reflected the general trend of respondents' opinions, while the standard deviation indicated the degree of variation in their responses. The hypotheses were tested using Analysis of Variance (ANOVA) at the 0.05 level of significance to determine whether significant differences existed in respondents' views. In testing the hypotheses, any null hypothesis with a p-value less than or equal to 0.05 was rejected, while those with p-values greater than 0.05 were accepted.

RESULT AND DISCUSSION

Research Question 1: To what extent does the use of mathpreneurship as an instructional approach enhance students' problem-solving skills in mathematics education?

Table 1. Mean and standard deviation of responses on the extent to which mathpreneurship enhance students' problem-solving skills in mathematics education

S/N	ITEMS	MEAN	SD
1	Adoption of mathpreneurship in helps me understand how to solve real-life problems using mathematical concepts.	3.40	0.63
2	Mathpreneurship-based activities improve my understanding in analyzing problems before attempting a solution.	3.42	0.64
3	Learning mathematics through entrepreneurial enhance my understanding to apply problem-solving strategies.	3.10	0.87
4	Mathpreneurship-based instruction helps me connect mathematical problems to real business and economic situations.	2.90	0.74
5	Mathpreneurship enables me to break complex mathematical problems into simpler and manageable steps.	3.01	0.55
	Weighted average	**3.17**	**0.69**

Source: Field work, 2026

The results in Table 1 show how employing mathpreneurship approach enhances students' problem-solving skills in mathematics classrooms. The results indicate that most respondents thought mathpreneurship had a positive effect on their problem-solving skills because all of the item means scores were greater than the decision mean of 2.50. Specifically, a high mean score of 3.40 with a standard deviation of 0.63 shows that respondents believed that embracing mathpreneurship improved their understanding of how to apply mathematical concepts to real-life problems. This suggests that mathpreneurship increases the applicability and utility of mathematics by enabling students to apply their mathematical knowledge in practical settings. With a mean of 3.42 and a standard deviation of 0.64, mathpreneurship-based activities were also thought to enhance students' capacity to assess problems before attempting solutions.

JURNAL SAINTIFIK
MULTI SCIENCE JOURNAL
PISSN 1693-668X
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This suggests that the method encourages critical thinking, which is essential for solving problems successfully. Additionally, a mean score of 3.10 and a standard deviation of 0.87 demonstrate that when students learnt mathematics in entrepreneurial contexts, their comprehension of how to use problem-solving techniques improved. The standard deviation is slightly higher, but it still indicates that most responders concur. Respondents also agreed that mathpreneurship-based training helps people relate mathematical problems to real-world business and economic conditions, with a mean score of 2.90 and a standard deviation of 0.74, suggesting that the approach improves the contextual application of mathematical concepts. Additionally, respondents expressed how mathpreneurship helps them break down challenging mathematical problems into smaller, more manageable steps, as shown by a mean score of 3.01 and a standard deviation of 0.55. This proves that students' ability to reason logically and solve problems systematically has increased. The weighted average mean of 3.17 with a standard deviation of 0.69 indicates that students generally believe that mathpreneurship enhances their problem-solving skills in mathematics education. It appears that the respondents' opinions were consistent based on the relatively low standard deviation. The results above demonstrate that mathpreneurship is an effective instructional method for improving math students' problem-solving skills.

Research Question 2

Research Question 2: How does mathpreneurship improve students' entrepreneurial competencies within mathematics learning?

Table 2. Mean and standard deviation of responses on the extent to which mathpreneurship improve students' entrepreneurial competencies within Mathematics learning

S/N	ITEMS	MEAN	SD
1	Mathpreneurship in mathematics lessons helps me develop creativity in solving business-related problems.	2.55	0.53
2	Mathpreneurship improves my ability to make informed decisions based on numerical data	2.42	0.24
3	Mathpreneurship encourages me to think innovatively when applying mathematics to real-life economic situations.	2.10	0.71
4	Mathematics lessons that involve entrepreneurial activities increase my confidence in starting and managing small business ventures.	2.80	0.72
5	Mathpreneurship encourages me to think innovatively when applying mathematics to real-life economic situations.	3.05	0.65
	Weighted Average	**2.58**	**0.57**

The results presented in Table 2 addresses Research Question 2 on how mathpreneurship improves students' entrepreneurial competencies within mathematics instruction. Mathpreneurship has a somewhat positive effect on students' entrepreneurial competencies, according to the weighted average mean score of 2.58, which is greater than the decision mean of 2.50. This indicates that most respondents thought mathpreneurship helped pupils improve their entrepreneurial abilities. With a mean score of 2.55 and a standard deviation of 0.53, respondents firmly agreed that mathpreneurship in math classrooms helps them develop innovation in addressing business-related issues. This implies that including entrepreneurial contexts into mathematical education encourages original problem-solving and imaginative approaches to business ventures.

JURNAL SAINTIFIK
MULTI SCIENCE JOURNAL
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Students' confidence in starting and operating small firms is also increased by entrepreneurial activities in mathematics classrooms, according to a mean score of 2.80 and a standard deviation of 0.72. This implies that mathpreneurship boosts pupils' self-esteem and readiness for entrepreneurial pursuits. Additionally, respondents strongly agreed that mathpreneurship fosters innovative thinking when applying mathematics to real-world economic difficulties, as demonstrated by the highest mean score of 3.05 with a standard deviation of 0.65. This suggests that mathpreneurship effectively encourages innovation and the practical use of mathematical knowledge in commercial settings. However, respondents disagreed that mathpreneurship improves their ability to make informed decisions based on numerical data, with a mean score of 2.42 and a standard deviation of 0.24. They also disagreed that mathpreneurship encourages innovative thinking when applying mathematics to real-life economic situations in one of the items, which recorded a mean score of 2.10 and a standard deviation of 0.71.

These findings indicate that, despite the general positive perception, some aspects of entrepreneurial competence particularly data-driven decision-making and consistent innovative application may not yet be fully developed through current mathpreneurship practices. Overall, the weighted average standard deviation of 0.57 indicates a relatively low dispersion in responses, suggesting consistency in respondents' views. Based on these findings, it can be concluded that mathpreneurship improves students' entrepreneurial competencies within mathematics learning to a moderate extent, though certain competency areas may require further instructional emphasis and structured implementation.

Testing of Hypothesis

H_{01}: There is no significant difference in the mean responses of lecturers and students' on the extent to which mathpreneurship influence problem-solving skills

Table 3. t-test statistical table on mathpreneurdhip influence on influence students entrepreneurial competencies based on teachers and students

Group	N	Mean	SD	t-cal	DF	P-value	Decision
Lecturers	40	3.11	0.72	0.56	201	0.64	NS
Students	175	3.06	0.82				

Source: Field work, 2026

Both groups broadly concur that mathpreneurship improves problem-solving abilities, as seen by the extremely close mean scores for lecturers and students (3.11 vs. 3.06). The significance criterion of 0.05 is exceeded by the t-test's t-value of 0.56 and p-value of 0.64. The null hypothesis (H01) is not rejected since $p > 0.05$. This suggests that lecturers' and students' opinions about how mathpreneurship affects problem-solving abilities do not differ statistically significantly. To put it another way, both groups believe that mathpreneurship enhances students' ability to solve mathematical problems. Mathpreneurship is regularly regarded by instructors and students as a successful strategy for improving problem-solving abilities, and any observed variation in mean scores is not statistically significant.

JURNAL SAINTIFIK
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H_{02}: There is no significant difference in the mean responses' on the extent to whichmathpreneurship influence students entrepreneurial competencies based on institution

Table 4. t-test statistical table on mathpreneurdhip influence on influence students entrepreneurial competencies based on institution

Group	N	Mean	SD	t-cal	DF	P-value	Decision
Public	38	2.11	0.62				
				0.81	201	0.41	NS
Private	177	3.60	0.92				

Hypothesis 2 examined whether the type of institution (public versus private) had a significant impact on respondents' mean evaluations of how mathpreneurship enhances students' entrepreneurial skills. The findings showed that respondents from public universities had a mean score of 2.11 (SD = 0.62), whereas those from private institutions had a mean score of 3.60 (SD = 0.92). The estimated t-value of 0.81 at 201 degrees of freedom generated a p-value of 0.41, which is greater than the significance criterion of 0.05, despite this fluctuation in mean values. This indicates that there is no statistically significant difference in the mean responses. Consequently, the null hypothesis (H02) is accepted. This suggests that respondent' opinions of the degree to which mathpreneurship influences students' entrepreneurial competencies are not much influenced by the type of institution (public or private). Despite differences in their mean scores, respondents from both public and private institutions generally have a similar opinion on the impact of mathpreneurship on entrepreneurial competencies.

Discussion

Mathpreneurship significantly improves students' problem-solving abilities in mathematics education, according to the results of research question one and the correspondence hypothesis. This result implies that rather than mechanical memorisation, incorporating commercial circumstances into math training fosters higher conceptual comprehension and analytical reasoning. This suggests that students must evaluate problems, choose suitable tactics, and defend solutions all essential elements of successful problem-solving when they work on real-world tasks like pricing, profit analysis, and budgeting. There is widespread agreement on the educational usefulness of mathpreneurship, as both groups agreed that it improves problem-solving abilities. This alignment shows that mathpreneurship is both pedagogically sound and practically observable by both instructors and learners, entrepreneurial experiences can be beneficial in enhancing students' engagement with the subject. Integrating mathpreneurship into mathematics education may therefore encourage learners to develop an entrepreneurial mindset, equipping them with skills that can contribute to improved economic opportunities and sustainable livelihoods. Supporting earlier findings that entrepreneurship-linked mathematics instruction improves analytical thinking and application skills (Sodangi & Ibrahim, 2023; Makinde, 2020).

The study equally revealed that entrepreneurial competencies are somewhat improved by mathpreneurship, with a weighted mean score of 2.58. These results show that by linking mathematical reasoning with opportunity recognition and value creation, mathpreneurship makes a major contribution to the growth of entrepreneurial mindsets. This outcome is consistent with research by Salami & Spangenberg (2025), who demonstrated that personalised learning and experience, as opposed to solitary academic instruction, are the greatest ways to develop entrepreneurial competencies. Incorporating entrepreneurial tasks into math classes exposes students to real-world decision-making scenarios that need initiative, creativity, and strategic thinking. Abdulrafiu et al. (2024) noted that strengthening entrepreneurial competencies among business education students for sustainable development require the adoption of innovative and deliberate approaches. In this regard,

mathpreneurship can serve as a fitting approach to stimulate students' interest in mathematics while also fostering entrepreneurial thinking, thereby contributing to economic sustainability and a more promising future.

CONCLUSION

The study concluded that mathpreneurship is an effective teaching strategy that enhances students' problem-solving abilities in mathematics education by enabling them to analyse real-life problems, apply suitable techniques, and break complex problems into manageable steps. It also improves students' entrepreneurial competencies to a moderate extent, especially with respect to creativity, confidence, and innovative thinking; though areas like data-driven decision-making and consistent innovation require further development. Moreover, perceptions of its effectiveness were consistent across instructors, students, and institution types, indicating that it has the potential to align mathematics education with the country's national goals of skill acquisition, self-reliance, and economic empowerment.

Recommendations

Based on the research questions and findings of the study, the following recommendations are made:

1. *Strengthening problem-solving instruction through mathpreneurship*: Since mathpreneurship has been shown to greatly improve students' problem-solving abilities, mathematics instructor should deliberately include real-world entrepreneurial tasks such as resource management, pricing, budgeting, and profit analysis in their classes. This would additionally enhance students' critical thinking abilities and their ability to apply mathematics to financial and real-world problems.
2. *Strengthening the development of entrepreneurial skills:* Educators and instructional designers need to emphasise data-driven decision-making, financial analysis, and innovation-based tasks in mathematics teaching since mathpreneurship only slightly strengthened entrepreneurial competencies. Attention should be given to structured assignments that place the burden on students to evaluate numerical facts and make smart business judgements.
3. *Increasing the capability of lecturers:* In order to aid mathematics instructors thrive in mathpreneurship, organisations should frequently offer workshops, seminars, and professional development courses. This will provide instructors the pedagogical know-how needed to successfully incorporate entrepreneurial ideas into maths lessons.

ETHICS AND DECLARATIONS

Ethical Approval and Consent

This descriptive survey involved 40 lecturers and 175 undergraduate Business Education students in Nigeria. Participants completed a questionnaire on mathpreneurship and its perceived contribution to students' problem-solving skills and entrepreneurial competencies.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to applicable participant confidentiality requirements.

Competing Interests

The authors declare that they have no financial or non-financial competing interests related to this study or its publication.

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Author Contributions

AbdulRafiu ABDULLAHI conceptualised the study, formulated the research objectives, and coordinated the research activities. Semiu Olawale MAKINDE developed the survey methodology, including the questionnaire and the stratified random sampling procedure. Shehu SAKARIYAHU coordinated questionnaire administration, organised the survey responses, and prepared the data for analysis. Adijat Omoladun OLAREWAJU conducted the statistical analyses and interpreted the findings on problem-solving skills and entrepreneurial competencies. All authors contributed to drafting and revising the manuscript and approved the final version for publication.

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