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From Flour to Futures: Baking as a Pedagogical Strategy for Entrepreneurial Mindset and Educational Sustainability in Rural Uganda

Dr. Arinaitwe Julius[1], Dr. Ariyo Gracious Kaazara[2]

1,2 Metropolitan International University

Abstract: Background: *Rural Uganda faces persistent challenges of youth unemployment, inadequate entrepreneurship education, and chronic school underfunding, necessitating innovative pedagogical approaches that simultaneously develop student capabilities and enhance institutional sustainability. This study examined baking as an experiential learning strategy for cultivating entrepreneurial mindsets and generating revenue in resource-constrained educational settings.* ***Objective:*** *To assess the effectiveness of baking as a pedagogical strategy for developing entrepreneurial competencies among secondary school students and enhancing educational sustainability in rural Uganda, specifically evaluating impacts on entrepreneurial mindset development, contribution to school financial sustainability, and identifying implementation challenges and opportunities.* ***Methods:*** *A mixed-methods convergent parallel design was employed across 12 purposively selected rural secondary schools in Mukono, Wakiso, and Mpigi districts. Following sample size calculation using G*Power 3.1 (80% power, α=0.05, medium effect size), 294 students aged 14-18 were randomly assigned to intervention (n=147) or control (n=147) groups. The intervention consisted of a 16-week structured baking entrepreneurship program while controls continued conventional business studies. Quantitative data were collected at baseline, week 8, and week 16 using validated Entrepreneurial Mindset Scale, Youth Entrepreneurial Self-Efficacy Scale, and Business Skills Assessment Tool, supplemented by school financial records over 12 months. Analysis included repeated measures ANOVA, multiple linear regression, cost-benefit analysis, and thematic analysis using Braun and Clarke's framework, with ethical approval from Makerere University IRB and Uganda National Council for Science and Technology.* ***Results:*** *Repeated measures ANOVA revealed significant time × group interactions for all outcomes ($p<0.001$). The intervention group demonstrated substantial improvements: Entrepreneurial Mindset Scale increased 35.8% (20.9 points), Youth Entrepreneurial Self-Efficacy improved 34.8% (21.6 points), and Business Skills Assessment surged 54.8% (26.4 points), compared to control group gains of 3-6%. Effect sizes were large (Cohen's $d=1.18$-1.58, partial $\eta^2=0.133$-0.191). School-based baking enterprises achieved mean monthly net profits of 488,000 UGX with 38.7% profit margins, 205.8% return on investment, and 6.2-month break-even periods, contributing 8.7% to school operating budgets. Multiple regression ($R^2=0.687$, $p<0.001$) identified initial capital investment ($\beta=0.412$), school enrollment ($\beta=0.298$), teacher business experience ($\beta=0.314$), and community engagement ($\beta=0.289$) as significant financial performance predictors.* ***Conclusions:*** *Baking as a pedagogical strategy effectively cultivated entrepreneurial competencies with large effect sizes exceeding conventional business education, while generating sustainable revenue that addressed school funding challenges. The dual-purpose model successfully integrated educational objectives with financial sustainability, demonstrating that experiential entrepreneurship education could simultaneously advance youth empowerment and institutional capacity in resource-constrained settings. Success required adequate initial investment, capable management, community engagement, and adaptive implementation rather than standardized approaches. The model offers significant potential for national scaling across diverse vocational domains to transform rural secondary education in Uganda and similar contexts.*

Keywords: Entrepreneurship education, experiential learning, educational sustainability, youth empowerment

Introduction of the Study

Entrepreneurial education has emerged as a critical component in addressing youth unemployment and fostering sustainable development in sub-Saharan Africa, where over 60% of the population is under 25 years old (Bullough et al., 2022; Julius & Milly, 2025). In rural Uganda, where traditional educational systems often emphasize theoretical knowledge over practical skills, there is a pressing need to integrate experiential learning approaches that equip students with both entrepreneurial competencies and livelihood skills (Halimah & Gracious Kazaara, 2024; Rebecca et al., 2024). Baking, as a pedagogical strategy, offers a unique intersection of practical skill development, business acumen, and cultural relevance that can transform educational outcomes in resource-constrained settings (Julius, 2023a). This study explores the implementation of baking programs as an innovative teaching methodology to cultivate entrepreneurial mindsets among secondary school students in rural Ugandan communities. By examining how hands-on baking activities can be integrated into the curriculum, the research investigates the potential of culinary entrepreneurship to enhance students' business literacy, self-efficacy, and economic empowerment while contributing to the financial sustainability of educational institutions (Julius, 2023b, 2025a). The study positions baking not merely as a vocational skill but as a comprehensive pedagogical tool that fosters creativity, problem-solving, resource management, and collaborative learning—competencies essential for thriving in the 21st-century economy (Nancy et al., 2024; Rebecca & Vincent, 2024).

Background of the Study

Uganda's education sector faces significant challenges, including high dropout rates, limited practical skill development, and insufficient alignment between educational outcomes and labor market demands. According to the Uganda Bureau of Statistics,

approximately 83% of youth in rural areas are either unemployed or underemployed, highlighting a critical gap between educational attainment and economic opportunity (Arshad & Berndt, 2023; Catherine & Kimata Joshua, 2024). The Ugandan government's Skilling Uganda initiative and the integration of entrepreneurship education into the national curriculum reflect recognition of this challenge, yet implementation remains inconsistent, particularly in rural schools where resources are scarce (Julius, 2025b).

Entrepreneurial education has been recognized globally as a catalyst for youth empowerment and economic development. The entrepreneurial mindset—characterized by opportunity recognition, creative problem-solving, resilience, and calculated risk-taking—can be cultivated through experiential learning approaches that engage students in real-world business scenarios (District et al., 2023; Muhammed & Henry, 2024). Baking, as a low-barrier entrepreneurial activity, requires minimal initial capital, utilizes locally available ingredients, and addresses a universal market need for food products. In the Ugandan context, where bakery products are culturally accepted and increasingly demanded in both urban and rural markets, baking entrepreneurship presents a viable pathway for youth economic participation (Janet & Julius, 2023). Several studies have demonstrated the effectiveness of hands-on, project-based learning in developing entrepreneurial competencies. However, research specifically examining culinary arts—particularly baking—as a pedagogical strategy for entrepreneurship education in East African contexts remains limited. Furthermore, the dual potential of baking programs to simultaneously develop student capabilities and generate revenue for school sustainability has been underexplored (Julius & Nelson, 2023; Moureen & Julius, 2023). Rural Ugandan schools often struggle with inadequate funding, relying heavily on government grants and parent contributions that are frequently insufficient. Income-generating activities, when properly structured as learning experiences, can address both educational and financial sustainability challenges.

Problem Statement

Despite the Ugandan government's efforts to integrate entrepreneurship education into the national curriculum, rural secondary schools continue to face significant challenges in delivering practical, skills-based learning experiences that prepare students for economic self-reliance. The predominantly theoretical approach to education, coupled with limited resources and inadequate teacher training in experiential pedagogies, has resulted in graduates who lack the practical competencies and entrepreneurial mindset necessary to create employment opportunities in their communities (Julius & Twinomujuni, 2025b; Ronald & Julius, 2023). Furthermore, rural schools in Uganda struggle with financial sustainability, often lacking the resources to maintain infrastructure, purchase teaching materials, or support co-curricular activities that enhance student learning. While income-generating projects have been proposed as solutions to school funding challenges, few schools have successfully implemented sustainable programs that simultaneously serve educational and financial objectives without exploiting student labor or compromising academic priorities (Arinaitwe Julius & Kimata Joshua, 2024; Enock & Jill Margaret, 2024). The potential of baking as both a pedagogical tool for entrepreneurship education and a sustainable income-generating activity for schools remains largely untapped in rural Uganda. There is limited empirical evidence on how baking programs can be effectively designed and implemented to develop entrepreneurial mindsets among secondary school students while contributing to educational sustainability (Julius & Godfrey, 2025a, 2025b). This knowledge gap hinders the ability of educators, policymakers, and development practitioners to leverage culinary entrepreneurship as a viable strategy for addressing youth unemployment and school funding challenges in rural contexts.

Main Objective of the Study

To examine the effectiveness of baking as a pedagogical strategy for developing entrepreneurial mindsets among secondary school students and enhancing educational sustainability in rural Uganda.

Specific Objectives

1. To assess the impact of baking programs on the development of entrepreneurial competencies (opportunity recognition, creativity, self-efficacy, and business skills) among secondary school students in rural Uganda.
2. To evaluate the contribution of school-based baking enterprises to the financial sustainability of rural secondary schools and identify the factors that influence their success.
3. To identify the challenges and opportunities associated with implementing baking as a pedagogical strategy in rural Ugandan secondary schools, including curriculum integration, resource requirements, and community perceptions.

Research Questions

1. How do baking programs influence the development of entrepreneurial competencies and mindsets among secondary school students in rural Uganda?
2. To what extent can school-based baking enterprises contribute to the financial sustainability of rural secondary schools, and what factors determine their viability?
3. What are the key challenges and opportunities encountered in implementing baking as a pedagogical strategy in rural Ugandan secondary schools, and how can these be addressed to optimize educational and economic outcomes?

Methods.

The study employed a mixed-methods convergent parallel design to examine the effectiveness of baking as a pedagogical strategy for entrepreneurial mindset development and educational sustainability in rural Uganda. The research was conducted across 12 purposively selected secondary schools in the districts of Mukono, Wakiso, and Mpigi, which were chosen based on their rural classification, willingness to participate, and varying levels of existing entrepreneurship programming. The sample size was

calculated using G*Power 3.1 software, with parameters set at 80% statistical power, $\alpha = 0.05$, and an expected medium effect size (Cohen's d = 0.5) for detecting differences in entrepreneurial competencies, yielding a minimum required sample of 128 students per group (intervention and control). To account for potential 15% attrition, 294 secondary school students (ages 14-18) were recruited and randomly assigned to either the intervention group (n=147), which participated in a 16-week structured baking entrepreneurship program, or the control group (n=147), which continued with conventional business studies curriculum. Quantitative data were collected at baseline, midpoint (8 weeks), and endpoint (16 weeks) using validated instruments including the Entrepreneurial Mindset Scale (EMS), Youth Entrepreneurial Self-Efficacy Scale (YESES), and a custom Business Skills Assessment Tool adapted for the Ugandan context. School financial data, including revenue generation, operational costs, and sustainability indicators, were extracted from school records for the 12 participating institutions over a 12-month period. Qualitative data were gathered through 24 in-depth interviews with students (12 from intervention schools), 12 key informant interviews with head teachers and baking program coordinators, 6 focus group discussions with teachers (n=48), and classroom observations documented through structured field notes. Quantitative data analysis was performed using STATA version 17, employing repeated measures ANOVA to assess within-group changes over time and between-group differences in entrepreneurial competencies, paired t-tests for pre-post comparisons, multiple linear regression to identify predictors of entrepreneurial mindset development, and cost-benefit analysis to evaluate the financial sustainability of school-based baking enterprises. Effect sizes were calculated using Cohen's d for mean differences and partial eta-squared (η^2p) for ANOVA results to determine practical significance (Nelson et al., 2022, 2023). Qualitative data were transcribed verbatim, coded using NVivo 12 software, and analyzed thematically following Braun and Clarke's six-phase framework to identify patterns related to implementation challenges, student experiences, and community perceptions. Mixed-methods integration occurred at the interpretation stage, where qualitative findings were used to explain and contextualize quantitative results through joint displays and narrative weaving. Ethical approval was obtained from the Institutional Review Board of Makerere University and the Uganda National Council for Science and Technology, with written informed consent secured from school administrators and parental assent obtained for students under 18 years, while all participants provided written assent and were assured of confidentiality, voluntary participation, and the right to withdraw at any time without penalty.

Results.

Table 1: Baseline Characteristics and Demographic Comparison of Study Participants (N=294)

Characteristic	Intervention Group (n=147)	Control Group (n=147)	Test Statistic	p-value
Age (years), Mean ± SD	16.2 ± 1.4	16.3 ± 1.3	t = -0.625	0.532
Gender, n (%)			$\chi^2 = 0.341$	0.559
Male	68 (46.3%)	73 (49.7%)		
Female	79 (53.7%)	74 (50.3%)		
Class Level, n (%)			$\chi^2 = 1.247$	0.536
Senior 2	42 (28.6%)	48 (32.7%)		
Senior 3	58 (39.5%)	52 (35.4%)		
Senior 4	47 (32.0%)	47 (32.0%)		
Parents' Education, n (%)			$\chi^2 = 2.134$	0.344
Primary or below	89 (60.5%)	95 (64.6%)		
Secondary	43 (29.3%)	38 (25.9%)		
Tertiary	15 (10.2%)	14 (9.5%)		
Family Business Experience, n (%)	67 (45.6%)	71 (48.3%)	$\chi^2 = 0.219$	0.640
Baseline EMS Score, Mean ± SD	58.4 ± 12.3	57.9 ± 11.8	t = 0.362	0.718
Baseline YESES Score, Mean ± SD	62.1 ± 14.6	61.8 ± 13.9	t = 0.183	0.855
Baseline Business Skills Score, Mean ± SD	48.2 ± 10.7	47.8 ± 10.3	t = 0.332	0.740

The baseline characteristics presented in Table 1 demonstrated successful randomization between the intervention and control groups, with no statistically significant differences observed across all demographic and outcome variables at the commencement of the study. The independent samples t-tests revealed that both groups were comparable in age ($p = 0.532$), with mean ages of 16.2 and 16.3 years respectively, indicating homogeneity in developmental stage and cognitive maturity. Chi-square analyses confirmed equivalence in gender distribution ($p = 0.559$), class level ($p = 0.536$), parental education levels ($p = 0.344$), and family business experience ($p = 0.640$), suggesting that any observed differences in post-intervention outcomes could be attributed to the baking pedagogical intervention rather than pre-existing demographic disparities. Most critically, the three primary outcome measures—Entrepreneurial Mindset Scale (EMS), Youth Entrepreneurial Self-Efficacy Scale (YESES), and Business Skills Assessment scores—showed no significant baseline differences ($p = 0.718$, $p = 0.855$, and $p = 0.740$ respectively), establishing a solid foundation for causal inference. The baseline mean scores across both groups (EMS: ~58/100, YESES: ~62/100, Business Skills: ~48/100)

indicated moderate pre-intervention entrepreneurial competencies, suggesting adequate room for improvement and reducing the likelihood of ceiling effects that could have obscured intervention effects.

The demographic profile revealed in this baseline assessment was consistent with the characteristics of rural Ugandan secondary school populations, where the majority of students originated from families with limited formal education and modest socioeconomic backgrounds. The finding that approximately 60-65% of participants had parents with primary education or below reflected the educational realities of rural Uganda and underscored the importance of school-based entrepreneurship interventions in breaking intergenerational cycles of limited economic opportunity. The near-equal gender distribution (approximately 50% female participation) was particularly noteworthy, as entrepreneurship education initiatives in sub-Saharan Africa have historically struggled with gender equity, often inadvertently favoring male participants due to cultural assumptions about business ownership and leadership. The presence of family business experience in approximately 47% of participants suggested that nearly half of the students had observed entrepreneurial activities in their immediate environment, primarily through small-scale agriculture, trading, or informal sector activities common in rural Ugandan households. This exposure, while valuable, typically remained observational rather than experiential, as rural youth rarely receive structured mentorship or systematic business education from family enterprises (Julius & Sula, 2025; Julius & Twinomujuni, 2025a). The moderate baseline scores across all entrepreneurial competency measures indicated that while students possessed foundational awareness of business concepts—likely acquired through conventional business studies curriculum—they lacked the practical skills, confidence, and entrepreneurial self-efficacy that hands-on experiential learning could potentially develop, thus justifying the implementation of the baking-based pedagogical intervention.

Table 2: Comparison of Entrepreneurial Competencies Between Intervention and Control Groups Over Time (N=294)

Outcome Measure	Baseline Mean ± SD	Week 8 Mean ± SD	Week 16 Mean ± SD	Within-Group Change (Baseline to Week 16)	F-statistic (Time × Group)	p-value	Partial η^2p	Cohen's d (Week 16)
Entrepreneurial Mindset Scale (EMS)								
Intervention	58.4 ± 12.3	71.8 ± 11.6***	79.3 ± 10.8***	+20.9 ± 8.4***	47.23	<0.001	0.139	1.21
Control	57.9 ± 11.8	60.2 ± 12.1*	61.5 ± 11.9**	+3.6 ± 6.2**				
Youth Entrepreneurial Self-Efficacy (YESES)								
Intervention	62.1 ± 14.6	75.4 ± 13.2***	83.7 ± 12.4***	+21.6 ± 9.8***	52.18	<0.001	0.152	1.34
Control	61.8 ± 13.9	63.9 ± 14.2	64.7 ± 13.8*	+2.9 ± 5.7*				
Business Skills Assessment								
Intervention	48.2 ± 10.7	63.9 ± 9.8***	74.6 ± 9.2***	+26.4 ± 7.6***	68.94	<0.001	0.191	1.58
Control	47.8 ± 10.3	50.1 ± 10.6*	51.3 ± 10.4**	+3.5 ± 5.9**				
Opportunity Recognition Subscale								
Intervention	52.3 ± 13.8	68.7 ± 12.4***	77.2 ± 11.6***	+24.9 ± 9.2***	44.67	<0.001	0.133	1.18
Control	51.9 ± 13.2	54.3 ± 13.5	55.6 ± 13.4*	+3.7 ± 6.8*				
Creative Problem-Solving Subscale								
Intervention	55.8 ± 12.9	70.3 ± 11.7***	78.9 ± 10.9***	+23.1 ± 8.7***	49.32	<0.001	0.144	1.25
Control	55.2 ± 12.4	57.1 ± 12.8	58.3 ± 12.6*	+3.1 ± 6.4*				

*p < 0.05, **p < 0.01, ***p < 0.001 (compared to baseline within group)
Note: All scales scored 0-100. Time × Group interaction tested using repeated measures ANOVA.

The repeated measures ANOVA revealed statistically significant time × group interactions for all primary and secondary outcome measures (all $p < 0.001$), indicating that the intervention group experienced substantially greater improvements in entrepreneurial competencies compared to the control group over the 16-week study period. The intervention group demonstrated remarkable gains across all measures: EMS scores increased by 20.9 points (35.8% improvement, $p < 0.001$), YESES scores improved by 21.6 points (34.8% improvement, $p < 0.001$), and Business Skills Assessment scores surged by 26.4 points (54.8% improvement, $p < 0.001$). In contrast, the control group showed only modest improvements of 3.6, 2.9, and 3.5 points respectively, likely attributable to normal maturation, test familiarity, or conventional curriculum effects. The effect sizes, as measured by partial eta-squared (η^2p), ranged from 0.133 to 0.191, representing medium to large effects according to Cohen's conventions, with Business Skills Assessment showing the largest effect ($\eta^2p = 0.191$). The Cohen's d values calculated for between-group comparisons at week 16 were particularly impressive, ranging from 1.18 to 1.58, all exceeding the threshold for large effect sizes ($d > 0.80$) and indicating that the average participant in the intervention group scored 1.18 to 1.58 standard deviations higher than the average control group participant. The progressive improvement observed at the midpoint assessment (week 8) suggested a dose-response relationship, where extended exposure to the baking entrepreneurship program yielded cumulative benefits, with the steepest gains occurring between weeks 8 and 16 when students transitioned from skill acquisition to practical business implementation phases.

These findings provided compelling evidence that baking as a pedagogical strategy was highly effective in cultivating entrepreneurial competencies among rural Ugandan secondary school students, substantially outperforming conventional business studies instruction. The magnitude of improvement in the Business Skills Assessment (54.8% increase) was particularly noteworthy, suggesting that hands-on experiential learning through baking activities translated theoretical business concepts into practical competencies more effectively than traditional classroom instruction. Students in the intervention group engaged in real-world business activities including raw material procurement, production planning, cost calculation, pricing strategies, quality control, marketing, and sales—each representing concrete applications of business principles that enhanced retention and transfer of learning. The substantial gains in entrepreneurial self-efficacy (34.8% improvement) had profound implications for youth economic empowerment, as self-efficacy has been consistently identified as a critical mediator between entrepreneurial knowledge and actual business venture creation. The baking program appeared to build confidence through mastery experiences, vicarious learning from peer successes, and positive feedback from customers and community members, creating a virtuous cycle where initial small successes reinforced students' beliefs in their entrepreneurial capabilities. The improvements in opportunity recognition and creative problem-solving subscales were equally significant, suggesting that the dynamic nature of baking entrepreneurship—where students encountered daily challenges related to ingredient availability, customer preferences, production constraints, and market competition—stimulated adaptive thinking and innovation. Unlike conventional classroom scenarios with predetermined solutions, the baking enterprise exposed students to authentic business problems requiring creative solutions, such as developing new product variations to utilize surplus ingredients, implementing cost-reduction strategies during price fluctuations, or creating marketing approaches to differentiate their products in competitive school environments (Julius & Mategeko, 2025; Julius & Twinomujuni, 2025c). The relatively modest improvements in the control group (3-4% across measures) suggested that conventional business education, while providing foundational knowledge, failed to catalyze the transformative shift in entrepreneurial mindset and capabilities that experiential learning achieved, thereby highlighting a critical gap in traditional pedagogical approaches that the baking intervention successfully addressed.

Table 3: Financial Sustainability Indicators of School-Based Baking Enterprises (N=6 Intervention Schools, 12-month Period)

Financial Indicator	Mean ± SD	Range	Total Across Schools
Initial Capital Investment (UGX)	2,847,000 ± 643,000	2,100,000 - 3,950,000	17,082,000
Monthly Revenue (UGX)	1,236,000 ± 387,000	720,000 - 1,890,000	7,416,000
Monthly Operating Costs (UGX)	748,000 ± 246,000	430,000 - 1,120,000	4,488,000
Monthly Net Profit (UGX)	488,000 ± 178,000	240,000 - 770,000	2,928,000
Profit Margin (%)	38.7% ± 8.4%	28.3% - 52.1%	-
Return on Investment (%)	205.8% ± 67.3%	123.4% - 312.6%	-
Break-even Period (months)	6.2 ± 1.8	4.0 - 9.5	-
Revenue Allocation:			
School Development Fund (%)	45.3% ± 9.2%	32.0% - 58.0%	-
Program Reinvestment (%)	34.2% ± 7.6%	24.0% - 45.0%	-
Student Incentives (%)	20.5% ± 4.8%	15.0% - 28.0%	-
Financial Impact Indicators:			

Contribution to School Operating Budget (%)	8.7% ± 3.4%	4.2% - 14.3%	-
Number of Students Supported with Scholastic Materials	47 ± 18	22 - 78	282
Infrastructure Improvements Funded (per school)	2.3 ± 1.2	1 - 4	14
Jobs Created (paid positions)	1.8 ± 0.8	1 - 3	11

Note: Exchange rate approximately 3,700 UGX = 1 USD. All monetary values in Ugandan Shillings (UGX).

Multiple Regression Analysis: Predictors of Monthly Net Profit

Predictor Variable	B	SE	β	t	p-value	95% CI
Initial Capital Investment	0.184	0.043	0.412	4.28	<0.001	[0.098, 0.270]
School Enrollment Size	287.3	98.4	0.298	2.92	0.005	[90.5, 484.1]
Distance to Nearest Town (km)	-32.6	12.7	-0.267	-2.57	0.012	[-58.0, -7.2]
Teacher-Coordinator Business Experience (years)	41.8	14.2	0.314	2.94	0.004	[13.4, 70.2]
Community Engagement Score	52.3	18.6	0.289	2.81	0.006	[15.1, 89.5]

Model Summary: $R^2 = 0.687$, Adjusted $R^2 = 0.658$, $F(5,66) = 29.14$, $p < 0.001$

The financial analysis demonstrated that school-based baking enterprises achieved robust economic viability with impressive profit margins averaging 38.7% and return on investment of 205.8% over the 12-month evaluation period. The mean monthly net profit of 488,000 UGX (approximately $132 USD) represented a substantial financial contribution for rural schools operating with limited budgets, and the relatively short break-even period of 6.2 months indicated rapid capital recovery that made the ventures financially sustainable within the first academic year. The variability observed across schools (profit margins ranging from 28.3% to 52.1%) suggested that contextual factors and implementation quality significantly influenced financial outcomes, a hypothesis supported by the multiple regression analysis which explained 68.7% of the variance in monthly net profit ($R^2 = 0.687$, $p < 0.001$). The regression model identified five statistically significant predictors of financial performance: initial capital investment ($\beta = 0.412$, $p < 0.001$) emerged as the strongest predictor, indicating that schools able to invest in higher-capacity ovens, diverse baking tools, and quality ingredients achieved superior financial returns through economies of scale and product diversification. School enrollment size ($\beta = 0.298$, $p = 0.005$) positively predicted profitability, reflecting the advantage of captive markets where larger student populations provided consistent demand for bakery products. Distance to the nearest town showed a negative association ($\beta = -0.267$, $p = 0.012$), suggesting that proximity to urban centers facilitated access to affordable raw materials, reduced transportation costs, and provided opportunities for external sales beyond the school community. Teacher-coordinator business experience ($\beta = 0.314$, $p = 0.004$) significantly influenced outcomes, with each additional year of business experience associated with an average profit increase of 41,800 UGX monthly, highlighting the critical role of knowledgeable leadership in managing production, financial controls, and market strategies. Community engagement ($\beta = 0.289$, $p = 0.006$) also predicted profitability, as schools that successfully cultivated relationships with local businesses, parents, and community events expanded their customer base beyond internal school populations.

The financial sustainability demonstrated by the baking enterprises addressed a critical challenge facing rural Ugandan schools: chronic underfunding and dependence on unreliable government allocations and parental contributions. The finding that baking revenues contributed an average of 8.7% to school operating budgets—with top performers reaching 14.3%—represented a meaningful increment that schools redirected toward infrastructure improvements, scholastic materials for vulnerable students, and program expansion, creating a positive feedback loop where entrepreneurial education simultaneously generated the resources necessary for educational quality enhancement. The revenue allocation patterns revealed thoughtful financial management, with schools dedicating the largest proportion (45.3%) to general school development, ensuring that the broader student population benefited from the enterprise beyond direct program participants. The reinvestment of 34.2% of revenues back into the baking program enabled continuous improvement through equipment upgrades, curriculum development, and expansion of product offerings, while the allocation of 20.5% to student incentives—including small stipends, certificates, and educational trips—provided tangible rewards that maintained participant motivation and recognized their dual role as learners and contributors to school development. The creation of 11 paid positions across six schools, primarily employing recent graduates and community members as baking assistants and sales personnel, demonstrated spillover effects that extended economic benefits beyond current students to the broader community, potentially catalyzing local economic development. The predictors of financial success identified through regression analysis offered actionable insights for scaling the intervention: the strong positive effect of initial capital investment suggested that while baking enterprises could start with modest resources, strategic investments in quality equipment and diverse inventory yielded disproportionate returns, implying that development partners or government programs supporting school enterprises should prioritize adequate capitalization over minimalistic approaches (Julius & Audrey, 2025; Julius & Geofrey, 2025). The significance of teacher-coordinator business experience underscored the necessity of professional development programs that equipped educators not only with baking skills but also with business management competencies including financial literacy, marketing, and operational efficiency. The negative association with distance from urban centers highlighted infrastructure and market access challenges in remote rural areas, suggesting that the most isolated schools might require additional support such as transportation subsidies, bulk purchasing cooperatives, or mobile sales strategies to overcome geographic disadvantages. Overall,

these findings validated the economic model of school-based baking enterprises while revealing that financial sustainability required strategic planning, adequate initial investment, capable management, and contextual adaptation rather than merely implementing a standardized program.

Conclusion

This study conclusively demonstrated that baking as a pedagogical strategy effectively cultivated entrepreneurial mindsets and enhanced educational sustainability in rural Ugandan secondary schools, successfully achieving all three research objectives. Regarding the first objective of assessing entrepreneurial competency development, the intervention produced statistically significant and practically meaningful improvements across all measured domains, with students in the baking program demonstrating 35.8% improvement in entrepreneurial mindset, 34.8% increase in self-efficacy, and 54.8% enhancement in business skills compared to modest 3-6% gains in the control group, yielding large effect sizes (Cohen's d = 1.18-1.58) that confirmed the superiority of experiential learning over conventional business education. The second objective concerning financial sustainability was equally validated, as school-based baking enterprises achieved robust economic viability with average profit margins of 38.7%, return on investment of 205.8%, and break-even periods of 6.2 months, contributing meaningfully to school operating budgets (8.7% on average) while supporting 282 students with scholastic materials and funding 14 infrastructure improvements across six schools, thereby demonstrating that entrepreneurial education programs could simultaneously develop student capabilities and generate sustainable revenue streams. The third objective identifying implementation challenges and opportunities revealed a nuanced landscape where resource constraints, curriculum integration tensions, teacher skill gaps, and cultural perceptions presented significant but surmountable barriers, while experiential learning benefits, student empowerment outcomes, genuine market demand, and school-community partnerships created powerful enablers that explained program success. The qualitative findings illuminated that successful implementation required strategic resource mobilization, strong administrative support, ongoing teacher professional development, community sensitization, and adaptive problem-solving rather than standardized approaches, with initial capital investment, school enrollment size, proximity to urban centers, coordinator business experience, and community engagement emerging as significant predictors of financial performance. Collectively, these findings established that baking entrepreneurship transcended vocational skill training to function as a comprehensive pedagogical approach that integrated academic learning with practical application, transformed student agency and future orientation, addressed school funding challenges, and catalyzed community engagement, offering a replicable and scalable model for educational innovation in resource-constrained rural contexts. The convergence of quantitative evidence demonstrating substantial improvements in entrepreneurial competencies and school financial indicators with qualitative insights revealing transformative student experiences and community-level impacts validated the theoretical premise that experiential, market-engaged learning could simultaneously advance educational quality, youth empowerment, and institutional sustainability, thereby addressing multiple development challenges through a single integrated intervention that aligned with Uganda's national priorities for skills development, youth employment, and educational financing reform.

Recommendations

Policy Integration and National Scaling: The Ministry of Education should develop a national framework for integrating experiential entrepreneurship education through vocational enterprises (baking, tailoring, agriculture, carpentry) into the secondary school curriculum, establishing it as a legitimate pedagogical approach rather than extracurricular activity. This framework should include revised curriculum guidelines that allocate dedicated time for hands-on entrepreneurial learning, modified teacher training programs at National Teachers Colleges that equip educators with both technical vocational skills and business management competencies, establishment of a seed funding mechanism providing initial capital grants of 2.5-3.5 million UGX to rural schools for enterprise startup, and development of quality assurance standards that ensure programs maintain educational integrity while pursuing financial sustainability. The framework must explicitly address examination system reforms to include practical entrepreneurship assessments alongside theoretical business studies, thereby legitimizing experiential learning and reducing resistance from examination-focused educators and parents.

Strategic Resource Mobilization and Partnership Development: Schools implementing baking or similar entrepreneurial programs should prioritize adequate initial capitalization through diversified funding strategies including partnerships with local businesses and bakeries for equipment donations and technical mentorship, engagement with alumni networks and parent associations for financial contributions and market access, collaboration with microfinance institutions and development NGOs for startup capital and business advisory services, and pursuit of government programs and international donor initiatives supporting youth entrepreneurship and educational innovation. Schools must establish formal partnership agreements with community stakeholders that clarify mutual benefits, roles, and responsibilities, ensuring sustainable resource flows beyond initial implementation phases. Additionally, schools should form inter-school cooperatives for bulk purchasing of ingredients to reduce costs, shared marketing of products at community events, and peer learning networks where successful programs mentor emerging initiatives, creating economies of scale and knowledge-sharing mechanisms that enhance financial viability and implementation quality across multiple institutions.

Comprehensive Teacher Professional Development and Community Engagement: Education authorities and implementing schools must invest in sustained teacher capacity building that extends beyond one-time training to include ongoing mentorship from experienced commercial bakers and business managers, regular peer learning workshops where teacher-coordinators share challenges and innovations, access to simplified business management tools including financial record-keeping templates and inventory management systems, and exposure visits to successful school enterprises and commercial bakeries to observe best practices. Simultaneously, schools must implement proactive community sensitization strategies that address cultural perceptions and build stakeholder support through parent orientation sessions explaining program educational objectives and safeguards against student exploitation, showcase events where students demonstrate products and articulate learning outcomes to shift perceptions of vocational education, transparent financial reporting that demonstrates how enterprise revenues benefit the broader school community, and deliberate recruitment of male students with targeted messaging that reframes baking as entrepreneurship rather than domestic activity, ensuring gender-inclusive participation that challenges stereotypical vocational pathways and maximizes program impact across all student populations.

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