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Research Article

Project-Based Learning Approach and Entrepreneurial Skills of Grade 9 TLE Cookery Students

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ABSTRACT

This study examined the effectiveness of project-based learning (PBL) in enhancing the entrepreneurial skills of Grade 9 TLE cookery students at Amontay National High School for SY 2024–2025. It aimed to assess pre- and post-test scores in entrepreneurial competencies, compare the effectiveness of haptic engagement and cooperative & team-based learning, and determine the significance of score differences. A quasi-experimental design with pre- and post-tests was used. Purposive sampling selected 80 students, split between haptic engagement and cooperative learning groups. A validated researcher-made assessment measured skills in business planning, marketing, financial literacy, leadership, creativity, problem-solving, and communication.

Findings showed significant improvement in entrepreneurial competencies after PBL. Both strategies enhanced skills, though cooperative learning showed higher post-test gains in most areas. T-test results confirmed statistically significant differences before and after PBL, affirming its effectiveness. The results suggest that structured PBL strengthens student competencies by offering real-world learning experiences.

The study recommends that teachers and school heads integrate structured PBL approaches into entrepreneurship instruction, supported by experiential learning and partnerships with industry. Curriculum developers are encouraged to embed PBL in TLE subjects to promote innovation and collaboration. Future research may explore its long-term impact, including employer perspectives and digital entrepreneurship integration. This study affirms PBL as a valuable tool for developing essential entrepreneurial skills and preparing students for active economic participation.

Keywords: *Project-Based Learning (PBL), Entrepreneurial Skills, Haptic Engagement, Cooperative & Team-Based Learning, Real-World Learning Experiences*

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Introduction

The integration of Project-Based Learning (PBL) into Technology and Livelihood Education (TLE) reflects a progressive shift in pedagogy that aligns with the goals of the K to 12 Basic Education Curriculum in the Philippines (DepEd Printing Office, 2019). In the TLE domain, particularly within Home Economics–Cookery, PBL serves as an innovative instructional approach that bridges academic learning with practical application, encouraging learners to develop not only technical proficiency but also entrepreneurial mindsets (DepEd Curriculum Guide, 2018). Grounded in constructivist and experiential learning theories, PBL empowers students to actively construct knowledge through real-world tasks. It enhances engagement, autonomy, and problem-solving skills (Hariyanto et al., 2023), (Almazroui, 2023).

Entrepreneurial competence is increasingly recognized as a vital 21st-century skill that supports economic adaptability, self-reliance, and innovation. Entrepreneurship fosters creativity, leadership, and effective communication—skills essential not just for employment but for sustainable livelihoods (Ghafar, 2020). Within basic education, entrepreneurship education provides foundational experiences that prepare students for the realities of work and enterprise, especially in technical-vocational fields like cookery where hands-on learning is essential (DepEd Curriculum Guide, 2018), (Okoro, 2021).

The relevance of this study is further underscored in the post-pandemic educational landscape. COVID-19 exposed systemic inequities and emphasized the need for flexible, skills-based, and resilient learning models. Students in low-income communities, particularly in cookery strands, often face compounded barriers such as financial hardship, limited market access, and inadequate training tools (Caliat, 2020). These challenges make it even more critical to provide contextualized, experiential opportunities that cultivate entrepreneurial thinking and economic self-sufficiency.

Despite policy support from national frameworks such as the Youth Entrepreneurship Act and DepEd Order No. 40, s. 2015 (RA 10679, 2015), (DepEd, 2015), many TLE teachers report that entrepreneurship instruction remains overly theoretical and disconnected from practice. Cookery 9, for example, consistently registers low performance in various districts, partly due to the lack of interactive, project-driven methodologies that could enhance student motivation and comprehension. PBL offers a dynamic learning environment where learners engage in inquiry, collaboration, and iterative problem-solving—traits that directly support entrepreneurial readiness (Shin, 2018), (Guo et al., 2020).

Recent literature confirms that PBL can close the gap between academic instruction and real-world application. Studies have shown that it facilitates Industry 4.0-aligned competencies and supports market-based entrepreneurship training (Zhai & Chen, 2024), (Harahap, 2023), (Agustino et al., 2022). Moreover, integrating PBL into TLE supports both national and international agendas for inclusive and equitable quality education, including Sustainable Development Goal 4 (UNESCO, 2024).

Yet, a notable research gap remains: while much has been written about PBL and entrepreneurship in general, few studies focus specifically on cookery students in Philippine secondary schools. Given the growing industry potential of culinary arts and its accessibility to marginalized youth, exploring how PBL can enhance entrepreneurial competencies in this context is both timely and necessary. This study thus examines the role of project-based learning in strengthening the entrepreneurial skills of junior high school Cookery students, in alignment with TESDA standards and DepEd competencies.

Objectives of the Study

The study investigated the effectiveness of the project-based learning (PBL) approach and its influence on the entrepreneurial skills of Grade 9 TLE cookery students at Amontay National High School for SY 2024–2025. It aimed to determine the profile of the respondents in terms of their age, sex, and parents' highest educational attainment. It also assessed the students' entrepreneurial skills based on their pre-test and post-test scores after being

exposed to two different strategies: haptic engagement and cooperative and team-based learning. Moreover, it evaluated the students' performance level in assigned tasks following the implementation of the project-based learning approach. The study further examined whether a significant difference existed between the post-test scores of the two groups and within each group's pre-test and post-test results. Lastly, it aimed to determine if a significant difference was evident in the overall performance levels of students who participated in haptic engagement compared to those in cooperative and team-based learning, with the goal of proposing recommendations for effective entrepreneurship instruction in the TLE curriculum.

Methodology

Research Method

This study employed a quasi-experimental research design under the quantitative research paradigm. It aimed to evaluate the effects of the project-based learning (PBL) approach on the entrepreneurial skills of Grade 9 TLE cookery students. The design was appropriate for assessing the effectiveness of two instructional strategies—haptic engagement and cooperative and team-based learning—since random assignment was not feasible. Naturally occurring groups were utilized to compare student outcomes through pre-test and post-test evaluations. This approach allowed for meaningful examination of instructional impact within the practical constraints of a school setting.

Population and Sampling Technique

The target population included all Grade 9 students enrolled at Amontay National High School in SY 2024–2025. Out of 161 Grade 9 students across four sections, 80 students were purposively selected from two specific sections: Generosity and Hope. These sections were identified based on low academic performance in entrepreneurship-related TLE subjects, weak assessment scores, and low classroom engagement. The Class of Generosity (40 students) was assigned to the haptic engagement strategy, while the Class of Hope (40 students) was assigned to the cooperative and team-based learning approach. Students were divided between two groups following their assigned section being a heterogenous section with both high and low performing students combined in the same section. Likewise, the use of purposive sampling ensured that the intervention addressed learners most in need of instructional support.

Research Instrument

The study utilized a researcher-made assessment tool that underwent expert internal and external validation by TLE and Entrepreneurship Master Teachers whose comments and suggestions were integrated (thus, some items were revised) but no pilot testing was conducted. The finalized instrument consisted of three parts. Part I gathered the demographic profile of students (age, sex, and parents' highest educational attainment). Part II was a 35-item multiple-choice pre-test aligned with Department of Education standards and designed to assess competencies in business planning, marketing, financial literacy, leadership and teamwork, creativity and innovation, problem-solving, and communication. Part III was the post-test, using rephrased but parallel items. The test items followed a Table of Specifications (TOS), and scoring adhered to DepEd Order No. 8, s. 2015 with verbal interpretations ranging from Needs Improvement to Excellent.

Data Collection Procedure

Permissions were obtained from the Schools Division Superintendent of Quezon, the District Supervisor of Pitogo, and the School Head of Amontay NHS. Following approval, pre-tests were administered with the assistance of the guidance counsellor. PBL strategies were then implemented over four weeks (as duration of the intervention) using lesson plans validated by a Master Teacher and the TLE department head. After the intervention, the post-test was administered to both groups. The researcher ensured full participation and collected all data on-site, which were then tabulated and analyzed with the guidance of a statistician and research adviser.

Statistical Treatment

Descriptive statistics including frequency, percentage, mean, and standard deviation were used to describe the respondents' profiles and their performance scores. Inferential statistics such as independent samples t-tests were employed to examine significant differences in pre-test and post-test scores within and between the two groups. These tests helped determine the impact of haptic engagement and cooperative and team-based learning on students' entrepreneurial competencies.

Ethical Considerations

The study followed all ethical protocols required by the Division of Quezon. Informed consent was secured through letters sent to school officials and parental consent forms for student participation. Anonymity and confidentiality were strictly observed. Participation was voluntary, and all data were handled with integrity and transparency, ensuring the welfare and rights of all student participants throughout the research process.

Results and Discussion

This section presents the findings based on the research objectives, including summaries, analyses, implications, and references to relevant literature and studies.

Table 1. Profile of the Respondents in terms of Age, Sex and Family Income

Age	Frequency	Percent
13	1	1.25
14	53	66.25
15	26	32.5
Total	80	100
Sex		
Male	35	43.75
Female	45	56.25
Total	80	100
Educational Attainment of Parents		
Father	Frequency	Percent
Elementary Level	10	12.5
Elementary Graduate	7	8.75
High School Level	15	18.75
High School Graduate	42	52.5
College Level	3	3.75
College Graduate	3	3.75
Total	80	100
Mother		
Elementary Level	8	10
Elementary Graduate	7	8.75
High School Level	11	13.75
High School Graduate	44	55
College Level	7	8.75
College Graduate	3	3.75
Total	80	100

The respondents' profile revealed that most Grade 9 students (66.25%) were 14 years old, indicating they are within the expected age for their level, with adequate cognitive maturity for entrepreneurial learning. A smaller portion (32.5%) were 15, and only 1.25% were 13. This aligns with findings by Meyers and Eisenberg (2021), who noted that age plays a role in

engagement with skill-based tasks. In terms of sex, 56.25% were female and 43.75% were male, showing that more girls are enrolled in TLE Cookery. This supports the observations of Rivard (2022) and Chi (2023), who reported increased female participation in vocational education and their strong academic performance. As for parental education, 52.5% of fathers and 55% of mothers were high school graduates, while fewer completed college. This suggests limited academic reinforcement at home, requiring schools to play a more active role in supporting entrepreneurial development. According to Torvik et al. (2020), students with better-educated parents tend to perform higher academically, and Lim et al. (2022) observed that lower parental education often limits access to advanced learning. These findings highlight the importance of instructional support and inclusive teaching strategies that consider varying learner backgrounds and capacities.

Table 2. Pre-Test and Post Test Scores in the Entrepreneurship Skills of the Students When Exposed to Haptic Engagement and Cooperative & Team-Based Learning in terms of Business Planning

Scores	Haptic Engagement			
	Pre-Test		Post Test	
	Frequency	Percent	Frequency	Percent
13-15	3	7.5	20	50
10-12	14	35	13	32.5
7-9	14	35	6	15
4-6	8	20	1	2.5
1-3	1	2.5	-	-
Total	40	100.0	40	100.0
	Cooperative & Team-Based Learning			
13-15	Frequency	Percent	Frequency	Percent
10-12	-	-	16	40
7-9	8	20	17	42.5
4-6	22	55	5	12.5
1-3	9	22.5	2	5
	1	2.5	-	-
Total	40	100.0	40	100.0

Legend: *13-15 Excellent; 10-12 Very Satisfactory; 7-9 Satisfactory; 4-6 Fairly satisfactory; 1-3 Needs Improvement*

Table 2 shows clear improvement in students' business planning skills after applying project-based learning. In haptic engagement, the number of students rated Excellent rose from 7.5% to 50.0%, while in cooperative learning, it increased from 0% to 40.0%. Haptic engagement allowed students to build confidence through hands-on repetition, while cooperative learning emphasized teamwork, communication, and shared decision-making. Both approaches proved effective, but cooperative learning appeared to promote stronger group-based outcomes. These results support Maulida et al. (2024), who found that project-based learning enhances entrepreneurial competencies through practical application, and Khan et al. (2021), who highlighted that structured business planning builds critical thinking and decision-making skills. Overall, the findings suggest that combining technical practice with collaborative learning strengthens both individual mastery and essential entrepreneurial traits.

Table 3. Pre-Test and Post Test Scores in the Entrepreneurship Skills of the Students When Exposed to Haptic Engagement and Cooperative & Team-Based Learning in terms of Financial Literacy

Scores	Haptic Engagement			
	Pre-Test		Post Test	
	Frequency	Percent	Frequency	Percent
13-15	2	5	21	52.5
10-12	15	37.5	12	30
7-9	15	37.5	4	10
4-6	7	17.5	3	7.5
1-3	1	2.5	-	-
Total	40	100.0	40	100.0
	Cooperative & Team-Based Learning			
13-15	Frequency	Percent	Frequency	Percent
10-12	0	0	17	42.5
7-9	6	15	14	35
4-6	18	45	7	17.5
1-3	14	35	2	5
	2	5	-	-
Total	40	100.0	40	100.0

Legend: *13-15 Excellent; 10-12 Very Satisfactory; 7-9 Satisfactory; 4-6 Fairly satisfactory; 1-3 Needs Improvement*

Table 3 reveals that both haptic engagement and cooperative learning led to notable gains in students' financial literacy. In haptic engagement, Excellent scorers rose from 5.0% to 52.5%, while in cooperative learning, they increased from 0% to 42.5%. Haptic engagement promoted gradual, independent mastery, while cooperative learning enabled quicker understanding through peer interaction. Though both were effective, cooperative learning led to more immediate improvement by supporting group problem-solving and shared insights. These findings align with Buchdadi et al. (2020), who emphasized the impact of experiential learning on financial skills, and Singla and Mallik (2021), who highlighted the value of interactive simulations in financial decision-making. The results suggest that combining both methods may optimize learning—fostering independent reasoning and collaborative growth in students' financial competencies.

Table 4. Pre-Test and Post Test Scores in the Entrepreneurship Skills of the Students When Exposed to Haptic Engagement and Cooperative & Team-Based Learning in terms of Creativity and Innovation

Scores	Haptic Engagement			
	Pre-Test		Post Test	
	Frequency	Percent	Frequency	Percent
13-15	3	7.5	20	50
10-12	12	30	13	32.5
7-9	15	37.5	5	12.5
4-6	9	22.5	2	5
1-3	1	2.5	-	-
Total	40	100.0	40	100.0
	Cooperative & Team-Based Learning			
13-15	Frequency	Percent	Frequency	Percent

10-12	2	5	21	52.5
7-9	9	22.5	10	25
4-6	13	32.5	5	12.5
1-3	13	32.5	4	10
	3	7.5	-	-
Total	40	100.0	40	100.0

Legend: *13-15 Excellent; 10-12 Very Satisfactory; 7-9 Satisfactory; 4-6 Fairly satisfactory; 1-3 Needs Improvement*

Table 4 shows significant improvement in students' creativity and innovation skills after exposure to project-based learning strategies. In the haptic engagement group, the number of students achieving Excellent scores rose from 7.5% in the pre-test to 50.0% in the post-test, indicating that individual, hands-on learning activities helped students generate and apply original ideas over time. This approach allowed learners to explore creative solutions at their own pace, build confidence through trial and error, and develop a stronger personal connection to entrepreneurial tasks. In cooperative and team-based learning, the proportion of students in the Excellent category increased from 5.0% to 52.5%, showing that collaboration played a key role in enhancing innovation. The shared learning environment supported idea exchange, group feedback, and dynamic problem-solving, which helped students refine their thinking and contribute more confidently to creative tasks. Both methods proved effective, but cooperative learning showed slightly stronger post-test outcomes, likely due to the influence of peer interaction. These findings reflect the importance of blending individual and group approaches in entrepreneurship education. According to Gajdzik and Wolniak (2022), creativity and innovation are essential entrepreneurial traits that flourish through structured learning with digitalization. Similarly, Bauman and Lucy (2021) noted that experiential learning boosts creative confidence and innovation readiness in students.

Table 5. Pre-Test and Post Test Scores in the Entrepreneurship Skills of the Students When Exposed to Haptic Engagement and Cooperative & Team-Based Learning in terms of Leadership and Teamwork

Scores	Haptic Engagement			
	Pre-Test		Post Test	
	Frequency	Percent	Frequency	Percent
13-15	-	-	21	52.5
10-12	7	17.5	10	25
7-9	19	47.5	4	10
4-6	9	22.5	5	12.5
1-3	5	12.5	-	-
Total	40	100.0	40	100.0
	Cooperative & Team-Based Learning			
13-15	Frequency	Percent	Frequency	Percent
10-12	-	-	16	40
7-9	1	2.5	12	30
4-6	9	22.5	9	22.5
1-3	25	62.5	3	7.5
	5	12.5	-	-
Total	40	100.0	40	100.0

Legend: 13-15 Excellent; 10-12 Very Satisfactory; 7-9 Satisfactory; 4-6 Fairly satisfactory; 1-3 Needs Improvement

Table 5 shows strong improvements in students' leadership and teamwork skills following project-based learning. In haptic engagement, the number of students scoring Excellent rose from 0% in the pre-test to 52.5% in the post-test. For cooperative learning, Excellent scorers increased to 40.0%, showing steady gains as well. Haptic engagement allowed students to build leadership skills through hands-on tasks that promoted independent decision-making and responsibility, strengthening self-confidence and initiative. However, limited peer interaction may have slowed their exposure to collaborative dynamics. In contrast, cooperative and team-based learning offered students opportunities to lead, manage group roles, and engage in open communication—mirroring real-world entrepreneurial teamwork. This approach helped students develop adaptability and interpersonal leadership traits. The results suggest that both strategies are effective but offer distinct strengths: haptic engagement supports self-directed leadership, while cooperative learning enhances team coordination and shared responsibility. These findings are reinforced by [27] Kuroda et al. (2020), who found that structured leadership training improves decision-making and team management, and [28] Mareque and Pino-Juste (2022), who emphasized that group-based learning fosters collaboration and strategic thinking. Together, these insights support using a blended instructional model to build well-rounded leadership competencies in entrepreneurship education.

Table 6. Pre-Test and Post Test Scores in the Entrepreneurship Skills of the Students When Exposed to Haptic Engagement and Cooperative & Team-Based Learning in terms of Communication Skills

Scores	Haptic Engagement			
	Pre-Test		Post Test	
	Frequency	Percent	Frequency	Percent
13-15	-	-	17	42.5
10-12	11	27.5	13	32.5
7-9	16	40	10	25
4-6	12	30	-	-
1-3	1	2.5	-	-
Total	40	100.0	40	100.0
	Cooperative & Team-Based Learning			
13-15	Frequency	Percent	Frequency	Percent
10-12	-	-	15	37.5
7-9	10	25	13	32.5
4-6	18	45	9	22.5
1-3	9	22.5	3	7.5
	3	7.5	-	-
Total	40	100.0	40	100.0

Legend: *13-15 Excellent; 10-12 Very Satisfactory; 7-9 Satisfactory; 4-6 Fairly satisfactory; 1-3 Needs Improvement*

Table 6 shows clear improvement in students' communication skills after exposure to both instructional strategies. In haptic engagement, Excellent scorers increased from 0% to 42.5%, while in cooperative learning, they rose to 37.5%. Haptic engagement helped students express ideas independently by following structured tasks and articulating outputs, gradually building clarity and self-confidence. Though gains were steady, the absence of peer interaction limited immediate feedback. In contrast, cooperative and team-based learning promoted verbal communication through real-time dialogue, peer discussions, and collaborative sharing. These interactions strengthened

students' listening, articulation, and negotiation abilities—key skills in entrepreneurship. Both methods proved effective, but cooperative learning offered more rapid improvements in interpersonal communication. These findings are supported by [29] Ngoc Huy (2021), who emphasized that structured communication training enhances students' confidence in business interactions, and [30] Mozahem and Adlouni (2021), who found that public speaking and group activities significantly improve communication skills. Overall, blending both approaches—one fostering independence, the other collaboration—can provide students with a more comprehensive foundation for effective entrepreneurial communication.

Table 7. Pre-Test and Post Test Scores in the Entrepreneurship Skills of the Students When Exposed to Haptic Engagement and Cooperative & Team-Based Learning in terms of Problem-Solving Skills

Scores	Haptic Engagement			
	Pre-Test		Post Test	
	Frequency	Percent	Frequency	Percent
13-15	-	-	13	32.5
10-12	-	-	9	22.5
7-9	17	42.5	10	25
4-6	17	42.5	6	15
1-3	6	15	2	5
Total	40	100.0	40	100.0
	Cooperative & Team-Based Learning			
13-15	Frequency	Percent	Frequency	Percent
10-12	-	-	7	17.5
7-9	-	-	16	40
4-6	19	47.5	13	32.5
1-3	18	45	4	10
	3	7.5	-	-
Total	40	100.0	40	100.0

Legend: *13-15 Excellent; 10-12 Very Satisfactory; 7-9 Satisfactory; 4-6 Fairly satisfactory; 1-3 Needs Improvement*

Table 7 reveals progress in students' problem-solving skills after using project-based learning strategies. In haptic engagement, Excellent scorers rose to 32.5%, while in cooperative learning, 17.5% reached the same level. Haptic engagement supported students in developing independent decision-making by allowing them to solve tasks through trial, error, and reflection, leading to steady growth in logical thinking. In contrast, cooperative learning promoted shared problem-solving, where students analyzed challenges together, exchanged ideas, and developed solutions as a team. This interaction encouraged strategic thinking and adaptability. While both methods were effective, haptic engagement led to stronger individual improvement, while cooperative learning nurtured group-based reasoning. These results align with [31] Pardo-Garcia and Barac (2020), who emphasized the role of experiential learning in building innovative problem-solving abilities, and [32] Huang et al. (2022), who found that collaborative learning enhances critical thinking. Together, these findings suggest that blending independent and collaborative problem-solving activities can strengthen students' entrepreneurial readiness, equipping them to navigate both solo and team-based challenges.

Table 8. Pre-Test and Post Test Scores in the Entrepreneurship Skills of the Students When Exposed to Haptic Engagement and Cooperative & Team-Based Learning in terms of Marketing Skills

Scores	Haptic Engagement			
	Pre-Test		Post Test	
	Frequency	Percent	Frequency	Percent
13-15	-	-	20	50
10-12	3	7.5	7	17.5
7-9	17	42.5	7	17.5
4-6	17	42.5	6	15
1-3	3	7.5	-	-
Total	40	100.0	40	100.0
	Cooperative & Team-Based Learning			
13-15	Frequency	Percent	Frequency	Percent
10-12	-	-	13	32.5
7-9	-	-	13	32.5
4-6	9	22.5	10	25
1-3	28	70	4	10
	3	7.5	-	-
Total	40	100.0	40	100.0

Legend: *13-15 Excellent; 10-12 Very Satisfactory; 7-9 Satisfactory; 4-6 Fairly satisfactory; 1-3 Needs Improvement*

Table 8 highlights notable improvements in students' marketing skills after using project-based learning. In haptic engagement, Excellent scorers rose to 50.0%, while in cooperative learning, they reached 32.5%. Haptic engagement allowed students to explore marketing strategies like branding and pricing through independent, hands-on tasks, promoting deeper personal understanding through trial and error. Cooperative learning, on the other hand, helped students refine marketing ideas through peer interaction, feedback, and group presentations, leading to faster application of effective techniques. Both methods contributed to better outcomes, but haptic engagement showed stronger gains in independent mastery, while cooperative learning enhanced collaborative thinking and creativity. These results align with [33] Sariwulan et al. (2020), who emphasized the importance of marketing skills in entrepreneurship and the impact of experiential learning, and [34] Rohm et al. (2021), who found that collaborative marketing projects improve strategy development and market analysis. Together, these findings suggest that blending individual exploration and group-based collaboration can provide students with a stronger foundation in entrepreneurial marketing.

Table 9. Pre-Test and Post Test Scores in the Entrepreneurship Skills of the Students When Exposed to Haptic Engagement and Cooperative & Team-Based Learning in terms of Financial Literacy

Scores	BP		FL		CI		TL	
	f	%	f	%	f	%	f	%
9-10	1	2.5	8	20	2	5	9	22.5
7-8	26	65	14	35	35	87.5	28	70
5-6	12	30	17	42.5	1	2.5	3	7.5
3-4	1	2.5	1	2.5	1	2.5	-	-
0-2	-	-	-	-	1	2.5	-	-
Total	40	100	40	100	40	100	40	100

Scores	CS		PS		MS	
	f	%	f	%	f	%
9-10	-	-	1	2.5	-	-
7-8	32	80	31	77.5	34	85
5-6	7	17.5	7	17.5	5	12.5
3-4	1	2.5	1	2.5	1	2.5
0-2	-	-	-	-	-	-
Total	40	100	40	100	40	100

Legend: 9-10 Excellent; 7-8 Very Satisfactory; 5-6 Satisfactory; 3-4 Fairly satisfactory; 1-2 Needs Improvement

BP- Business Planning; FL- Financial Literacy; CI- Creativity and Innovation; TL-Team and Leadership; CS-Communication Skills; PS-Problem Solving; MS-Marketing Skills

Table 9 reveals that most students in the haptic engagement group performed at a Very Satisfactory level across entrepreneurial skills, with a few achieving Excellent. Creativity, marketing, problem-solving, and communication were areas where students showed strong practical performance, likely due to the hands-on, open-ended nature of the tasks. However, few students reached Excellent in business planning and financial literacy, indicating that while they understood basic concepts, they struggled with advanced strategic thinking and financial judgment. Leadership was the most developed skill, with several students attaining Excellent scores—likely due to task roles that allowed them to demonstrate initiative and coordination. These outcomes suggest that while haptic engagement builds foundational competencies through real-world application, it may need to be complemented by structured lessons, simulations, and reflection to deepen critical thinking. These findings are consistent with [35] LaunchX (2023), who emphasized the role of experiential learning in building adaptability and teamwork, and [36] Supardi et al. (2022), who found that entrepreneurship education significantly boosts leadership and communication. The results affirm that project-based learning supports the development of essential entrepreneurial skills.

Table 10. Pre-Test and Post Test Scores in the Entrepreneurship Skills of the Students When Exposed to Haptic Engagement and Cooperative & Team-Based Learning in terms of Financial Literacy

Scores	BP		FL		CI		TL	
	f	%	f	%	f	%	f	%
9-10	1	2.5	-	-	-	-	7	17.5
7-8	29	72.5	17	42.5	30	75	24	60
5-6	8	20	16	40	8	20	8	20
3-4	2	5	7	17.5	2	5	1	2.5
0-2	-	-	-	-	-	-	-	-
Total	40	100	40	100	40	100	40	100
Scores	CS		PS		MS			
	f	%	f	%	f	%		
9-10	6	15	4	10	-	-		
7-8	24	60	27	67.5	32	80		
5-6	8	20	7	17.5	7	17.5		
3-4	2	5	2	5	1	2.5		
0-2	-	-	-	-	-	-		
Total	40	100	40	100	40	100		

Legend: 9-10 Excellent; 7-8 Very Satisfactory; 5-6 Satisfactory; 3-4 Fairly satisfactory; 1-2 Needs Improvement
BP- Business Planning; FL- Financial Literacy; CI- Creativity and Innovation; TL-Team and Leadership; CS-Communication Skills; PS-Problem Solving; MS-Marketing Skills

Table 10 shows that students in the cooperative and team-based learning group generally performed well across entrepreneurial skills, with most scoring within the Very Satisfactory range. Strong results were observed in communication, teamwork, and leadership, where several students achieved Excellent scores. The collaborative setup likely provided frequent opportunities to interact, lead, and coordinate tasks—key factors in building interpersonal and leadership competencies. Creativity, business planning, and marketing skills remained at moderate levels, suggesting that while students shared ideas effectively, individual innovation and strategic thinking may have been limited by group dynamics. Financial literacy saw the lowest outcomes, with no students reaching the Excellent level, pointing to the need for more targeted instruction within team activities. These findings align with [37] Soltanifar et al. (2021), which emphasized the value of collaboration and leadership in entrepreneurship, and [38] OECD (2019), which underscored the importance of creativity and problem-solving in experiential education. The lower financial literacy scores also reflect [39] Aulet's (2024) observation that this area remains underdeveloped in many school-based programs. Overall, cooperative learning effectively enhanced social and applied skills.

Table 11. Significant Difference in the Post-Test Scores of two Groups in Their Entrepreneurial Skills when Exposed to Haptic Engagement and Cooperative and Team-Based Learning

Entrepreneurial skills	Haptic Engagement		Cooperative & Team-Based Learning		t	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Business Planning	12.00	2.50	11.78	2.80	0.39	39	0.696
Financial Literacy	11.95	2.86	11.45	2.80	0.77	39	0.445
Creativity and Innovation	12.08	2.80	11.68	3.18	0.61	39	0.547
Leadership and Teamwork	11.73	3.20	11.00	2.85	1.15	39	0.257
Communication Skills	11.30	2.70	10.95	3.67	0.61	39	0.545
Problem-Solving Skills	10.05	3.67	9.93	2.81	0.16	39	0.870
Marketing Skills	5.65	1.61	10.75	2.99	-11.92	39	.0000

Table 11 compares the post-test performance of students in entrepreneurial skills between haptic engagement and cooperative & team-based learning. For business planning, no significant difference was found between the groups, $t(39) = 0.393$, $p = 0.696$, indicating both methods were equally effective in helping students' structure and present business ideas. In financial literacy, the result was also not significant, $t(39) = 0.772$, $p = 0.445$, suggesting both groups gained a basic understanding but needed more in-depth instruction. Creativity and innovation yielded no significant difference, $t(39) = 0.607$, $p = 0.547$, as both approaches provided opportunities for idea generation in unique ways. Leadership and teamwork similarly showed no significant difference, $t(39) = 1.150$, $p = 0.257$, highlighting that both strategies supported skill development—through autonomy in haptic tasks and group coordination in cooperative learning. Communication skills also showed parity between groups, $t(39) = 0.610$, $p = 0.545$, reflecting shared improvements through consistent interaction. In problem-solving, the results remained statistically similar, $t(39) = 0.164$, $p = 0.870$, as both groups tackled challenges via hands-on or collaborative thinking.

However, marketing skills revealed a statistically significant difference favoring cooperative learning, $t(39) = -11.919$, $p < .001$. The higher performance in this group may be

attributed to the inherently social and presentation-driven nature of marketing, which thrives in collaborative environments. These findings align with [40] Ferreras-Garcia and Hernández-Lara (2021), who observed that cooperative learning enhances marketing strategy development and decision-making more effectively than independent approaches. Similarly, Rohm et al. (2021) emphasized that project-based learning fosters creativity and group interaction, explaining the comparable results across most skills. Lastly, Saleh et al. (2023) noted that leadership and teamwork flourish in interactive settings, supporting the strong outcomes in both groups.

Table 12. Significant Difference Between the Pretest and Post-Test Scores using Haptic Engagement Groups

Entrepreneurial skills	Haptic Engagement		Cooperative & Team-Based Learning		t	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Business Planning	8.58	2.59	11.95	2.86	-9.209*	39	.000
Financial Literacy	8.78	2.40	11.95	3.20	-6.969*	39	.000
Creativity and Innovation	8.28	2.95	12.08	2.80	-8.963*	39	.000
Leadership and Teamwork	7.20	3.20	11.73	3.20	-11.127*	39	.000
Communication Skills	7.65	2.39	11.30	2.70	-9.566*	39	.000
Problem-Solving Skills	6.08	2.35	10.05	3.67	-8.218*	39	.000
Marketing Skills	6.45	1.88	11.45	3.67	-9.052*	39	.000

Table 12 presents the pre- and post-test comparison of students' performance in the haptic engagement group across entrepreneurial skills, all showing statistically significant improvement. Business planning yielded $t(39) = -9.209$, $p < .001$, indicating that hands-on planning tasks helped students internalize business structures through practical application. Financial literacy showed significant growth, $t(39) = -6.969$, $p < .001$, likely due to real-world budgeting and pricing tasks embedded in the projects. Creativity and innovation also improved significantly, $t(39) = -8.963$, $p < .001$, with students benefiting from open-ended design opportunities that encouraged experimentation.

Leadership and teamwork scores increased, $t(39) = -11.127$, $p < .001$, as students assumed responsibility in small-group tasks, fostering initiative and collaboration. Communication skills improved significantly, $t(39) = -9.566$, $p < .001$, due to regular verbal interactions and the need to present ideas clearly during activities. Similarly, problem-solving showed gains, $t(39) = -8.218$, $p < .001$, reflecting students' ability to address real-time challenges and adapt strategies. Lastly, marketing skills improved, $t(39) = -9.052$, $p < .001$, likely because students applied promotional strategies in product presentations and mock sales tasks. These findings are supported by [21] Maulida et al. (2024), who emphasized that experiential learning enhances student mastery of business and marketing concepts, and [36] Supardi et al. (2022), who noted the positive effects of entrepreneurship education on communication and financial literacy.

Table 13. Significant Difference Between the Pretest and Post-Test Scores among Cooperative and Team-Based Learning Group

Entrepreneurial skills	Haptic Engagement		Cooperative & Team-Based Learning		t	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Business Planning	7.45	2.34	11.78	2.80	-11.344*	39	.000
Financial Literacy	7.05	2.25	11.45	2.80	-11.419*	39	.000
Creativity and Innovation	7.43	2.82	11.68	3.18	-9.276*	39	.000
Leadership and Teamwork	5.65	1.78	11.00	2.85	-11.475*	39	.000

Entrepreneurial skills	Haptic Engagement		Cooperative & Team-Based Learning		t	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Communication Skills	7.48	2.45	10.95	2.74	-11.207*	39	.000
Problem-Solving Skills	6.20	1.79	9.93	2.81	-10.731*	39	.000
Marketing Skills	5.65	1.61	10.75	2.99	-11.919*	39	.000

Table 13 compares the pre- and post-test scores of students in the cooperative and team-based learning group, revealing statistically significant improvement across all entrepreneurial skills. Business planning showed strong gains, $t(39) = -11.344$, $p < .001$, as students refined planning skills through shared tasks and peer feedback. Financial literacy improved significantly, $t(39) = -11.419$, $p < .001$, likely due to collaborative discussions and group budgeting activities that clarified concepts and reinforced calculations. Creativity and innovation rose, $t(39) = -9.276$, $p < .001$, supported by idea exchange and co-development of innovative outputs. Leadership and teamwork showed major improvement, $t(39) = -11.475$, $p < .001$, as students managed group roles and responsibilities through authentic collaboration.

Communication skills also progressed, $t(39) = -11.207$, $p < .001$, driven by constant peer interaction and structured group dialogue. Problem-solving strengthened, $t(39) = -10.731$, $p < .001$, with students engaging in shared analysis and applying critical thinking to complex tasks. Marketing skills recorded the most significant growth, $t(39) = -11.919$, $p < .001$, as students collaboratively designed and pitched promotional content, simulating real marketing scenarios. These findings are supported by [37] Soltanifar et al. (2021), who emphasized that team-based learning enhances students' ability to apply business principles, and [36] Supardi et al. (2022), who highlighted the positive effect of entrepreneurship education on leadership and communication.

Table 14. Significant Difference in the Performance Level of the Two Groups after Using the Project Based Learning Approach

Entrepreneurial skills	Haptic Engagement		Cooperative & Team-Based Learning		t	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Business Planning	6.85	1.10	6.83	1.26	.095*	39	.925
Financial Literacy	7.03	1.56	5.93	1.70	3.356*	39	.002
Creativity and Innovation	7.20	1.09	6.83	1.28	1.391*	39	.172
Leadership and Teamwork	7.28	1.06	7.45	1.28	-.685*	39	.497
Communication Skills	6.95	0.90	7.30	1.47	-1.181*	39	.245
Problem-Solving Skills	7.20	1.04	6.95	1.32	.896*	39	.376
Marketing Skills	7.13	0.99	6.93	1.00	.822*	39	.416

Table 14 compares post-test performance levels between students exposed to haptic engagement and those in cooperative and team-based learning. The analysis showed no significant difference in business planning, $t(39) = 0.095$, $p = .925$, suggesting both strategies effectively supported students in structuring business plans through guided, goal-oriented tasks. Financial literacy, however, showed a statistically significant difference favoring haptic engagement, $t(39) = 3.356$, $p = .002$, likely due to the direct, hands-on management of budgeting and transaction simulations that reinforced individual decision-making. Creativity and innovation showed no difference, $t(39) = 1.391$, $p = .172$, as both approaches offered open-ended challenges that encouraged imaginative thinking.

Leadership and teamwork also showed comparable outcomes, $t(39) = -0.685$, $p = .497$, possibly because both methods integrated leadership roles, whether through individual

responsibility or group coordination. Communication skills, t(39) = -1.181, p = .245, and problem-solving, t(39) = 0.896, p = .376, also produced no significant difference, indicating that both methods allowed students to practice expression and critical thinking under realistic conditions. Marketing skills followed the same pattern, t(39) = 0.822, p = .416, as both groups likely engaged in similar project-based tasks involving product promotion and audience engagement.

These findings suggest that while most entrepreneurial skills developed equally across instructional formats, financial literacy improved more through individual, experience-driven tasks. This supports [38] OECD (2019), who stressed that entrepreneurial competencies—like leadership, financial literacy, and problem-solving—are best cultivated through structured yet flexible learning programs. Additionally, [39] Aulet (2024) emphasized the importance of practical training in bridging the gap between theory and application, aligning with the advantage seen in haptic-based financial literacy tasks.

Conclusion and Recommendation

The study concluded that project-based learning—whether delivered through haptic engagement or cooperative and team-based strategies—effectively enhances students' entrepreneurial competencies. Significant improvements were observed in both groups across all skills from pre-test to post-test, confirming the effectiveness of the instructional methods. However, when comparing the two groups, most entrepreneurial skill areas—including business planning, creativity and innovation, leadership, communication, and problem-solving—showed no significant difference in post-test performance. Notably, cooperative and team-based learning was more effective in developing marketing skills, while haptic engagement led to better outcomes in financial literacy. These findings suggest that both strategies can produce comparable results in most areas, but each has distinct advantages depending on the entrepreneurial skill being targeted.

In light of the findings, school heads are encouraged to institutionalize project-based learning (PBL) in entrepreneurship education by allocating resources for teacher training, acquiring relevant instructional materials, and forging partnerships with local industries to provide real-world exposure. Teachers are advised to implement experiential and student-centered teaching strategies that align with competency-based standards, using tools such as digital platforms, case simulations, and collaborative projects to enhance learning outcomes. Students should engage meaningfully in entrepreneurial tasks, build essential business competencies, and apply their skills through internships, school-based enterprises, and competitions. Curriculum developers must incorporate structured PBL modules into the entrepreneurship curriculum, focusing on practical skill-building, critical thinking, and real-world decision-making. Future researchers are advised to investigate complementary instructional models, track the long-term effects of PBL on entrepreneurial success, and analyze how learner demographics may influence outcomes in entrepreneurship education

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