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"Self-Efficacy in Cooking and Computational Skills: Contributing Ingredients to Commercial Cooking Proficiency"

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ABSTRACT

In the evolving landscape of culinary education, the integration of digital technologies, individual confidence, and analytical capabilities are becoming essential in shaping students' readiness for the commercial kitchen. This study explores how Technology Integration, Self-Efficacy in Cooking, and Computational Skills contribute to Commercial Cooking Proficiency among fourth-year Bachelor of Technology and Livelihood Education (BTLED) students majoring in Home Economics. Employing a descriptive-correlational research design, the study surveyed 135 students from a state university in Northern Mindanao using a combination of self-report questionnaires and performance-based assessments. Results revealed that although students exhibited a very high level of engagement with smart tools, automation, and AI technologies in cooking, technology integration alone did not significantly predict their overall cooking proficiency. In contrast, Self-Efficacy in Cooking and Computational Skills showed strong positive correlations with students' practical performance, especially in areas such as time management, measurement accuracy, and confidence in executing techniques. Multiple regression analysis indicated that Self-Efficacy and Computational Skills significantly influenced Commercial Cooking Proficiency, while Technology Integration did not. These findings suggest that while digital literacy enhances learning environments, students' internal belief systems and numerical reasoning are more critical in predicting success in high-pressure culinary tasks. The study recommends curricular reforms that prioritize the integration of computational thinking and self-efficacy-building strategies into culinary instruction. It also calls for a more contextualized and meaningful use of technology in hands-on settings. Preparing culinary students for future kitchen environments requires not just smart tools but also confident minds and capable hands.

Keywords: Commercial Cooking Proficiency, Self-Efficacy, Technology 4.0, Computational Skills, Culinary Education, BTLED, Vocational Training

INTRODUCTION

In recent years, integrating smart technologies, artificial intelligence, and digital tools has rapidly reshaped technical and vocational education. Nowhere is this transformation more visible than in culinary education, where precision, efficiency, and innovation are essential. Within this landscape, the Bachelor of Technology and Livelihood Education (BTLED) program specializing in Home Economics must prepare students to cook and excel in commercial kitchens equipped with both traditional methods and digital systems. However, beyond technological know-how, other key ingredients—namely, confidence and numeracy—are equally vital to success.

This study investigates the influence of three core variables—technology integration, self-efficacy in cooking, and computational skills—on the commercial cooking proficiency of BTLED students. While these areas have been independently researched, there remains a significant gap in understanding their combined effect on real-world culinary competence. Focusing on fourth-year students from a state university in Northern Mindanao, this research offers fresh insight into how these elements interact and contribute to skill development in a high-demand, tech-driven food industry.

Technology 4.0 in Culinary Education. The emergence of Industry 4.0 has brought advanced tools into the educational sphere. AI-driven recipe generators, automation, and smart kitchen technologies have enhanced learning engagement and operational precision. However, overreliance on these technologies can lead to diminished critical thinking and core skill development.

Self-Efficacy and Cooking Performance. Bandura (1997) posited that self-efficacy is a predictor of motivation and performance. Students with high self-efficacy are more likely to take initiative, persist through challenges, and actively engage with culinary tasks. Research shows that increased exposure to practical experiences and positive reinforcement improves learners' confidence.

Computational Skills in Vocational Learning. Numeracy skills are fundamental in culinary settings where accurate measurements, conversions, and portioning are routine. Literature supports that computational skills improve performance and adaptability, yet many students in non-STEM fields struggle in this domain. Incorporating math into context-based culinary instruction is a promising approach.

These three domains form an ecosystem that fosters practical competence in vocational students, yet few studies have examined their combined influence in culinary contexts. This study addresses that gap.

METHODOLOGY

A descriptive-correlational research design was adopted. Participants were 135 fourth-year BTLED students enrolled in Home Economics with prior exposure to commercial cooking and digital culinary tools.

Instruments included a Likert-scale questionnaire assessing technology use and self-efficacy, a multiple-choice computational skills test, and a rubric-based cooking proficiency evaluation. Cronbach\u2019s alpha scores (ranging from 0.771 to 0.849) confirmed instrument reliability. Data were analyzed using descriptive statistics and multiple regression to identify predictive relationships among variables. Ethical clearance was obtained, and participation was voluntary. Anonymity and confidentiality were maintained throughout the research. The total population of fourth-year BTLED-HE students during the academic year is approximately 200. To determine the appropriate sample size, the Taro Yamane formula (1967) was applied with a 5% margin of error. Using this calculation: To ensure the relevance of the data collected, the following inclusion criteria were established for selecting participants: 1) Must be currently enrolled in the BTLED program with a Home Economics specialization; 2) Must be currently taking or have previously completed cooking-related courses (e.g., commercial cooking or culinary arts); 3) Must have exposure to or experience using Technology 4.0 tools (such as smart appliances, automation tools, or AI-supported platforms) in their coursework; and 4) Must voluntarily participate and provide informed consent. To determine an appropriate and statistically significant number of participants, the Taro Yamane formula. Thus, a minimum of 133 students sufficiently represented the target population. The Exclusion Criteria will include the following: Students from other specializations outside Home Economics and students who have not taken any commercial cooking or culinary classes. Experts validated the content validity of the research instruments. Several experts who specialize in educational technology, vocational training as well as Home Economics education evaluated the questionnaire. The panel examined each included item to determine its clarity together with its relevance to the research aims while confirming that the instrument accurately measured the intended variables. A pilot test served to validate instrument reliability and improve its structure. Thirty BTLED students who participated in the instrument evaluation phase served as the sample exclusive to the pilot test. This The participants from the pilot study showed equivalent characteristics with members of the main study population regarding academic background. All students who are part III of BTLED and specialize in culinary arts have experienced Technology 4.0 through their education programs. There The researcher analyzed responses to evaluate both comprehension and clarification of ambiguous test items and the general use experience.   Prior to the conduct of the study, the research underwent ethical review and was granted clearance by the Lourdes College, Inc. Research Ethics Committee (LCREC). Following approval, the researcher secured permission letters from school administrators and course instructors to proceed with data collection. Each participant received an Informed Consent Form (ICF), which outlined their rights, the nature and purpose of the study, the voluntary nature of their participation, and the confidentiality of their responses. For participants who were minors, both parental or guardian consent and student assent were obtained. Data collection took approximately 30 to 45 minutes per participant—about 20 minutes were allocated for completing the questionnaire, and another 10 to 25 minutes for the performance task. To minimize academic disruption, the sessions were scheduled during free hours or weekends.

RESULTS AND DISCUSSION

Problem 1. To what extent do the participants integrate technology in cooking?

The data in Table 1 revealed that the participants demonstrated a very high extent of technology integration in cooking. A substantial majority, comprising 119 participants (88.15%), rated their technology use as "Very High" (4.51–5.00), while the remaining 16 participants (11.85%) rated it as "High" (3.51–4.50). No participants fell into the Moderate, Low, or Very Low categories. The overall mean score was 4.66, with a standard deviation of 0.22, indicating a strong and consistent inclination toward integrating technological tools and methods in their culinary practices. This high level of integration suggests that participants are not only familiar with, but also highly engaged in using technology to enhance their cooking efficiency, accuracy, and innovation**.** The examination of particular indicators concerning the incorporation of Artificial Intelligence (AI) in cooking showed a consistently elevated degree of involvement among BTLED students.

Table 1. Technology Integration in Cooking

Range	Interpretation	Frequency	Percentage
4.51-5.00	Very High	119	88.15
3.51-4.50	High	16	11.85
2.51-3.50	Moderate	0	0.00
1.51-2.50	Low	0	0.00
1.00-1.50	Very Low	0	0.00
	Total	**135**	**100.0**
	Overall Mean	**4.66**	
	Interpretation	**Very High**	
	SD	**0.22**	

The statement with the highest rating achieved a perfect mean score of 5.00 and a standard deviation of zero: "I utilize AI-powered tools (like chatbots or virtual assistants) to assist my cooking education," reflecting total consensus on the effectiveness of these tools. Other highly rated indicators consist of the utilization of automated kitchen devices (M = 4.80, SD = 0.44), smart gadgets such as connected scales and thermometers (M = 4.78, SD = 0.42), and digital timers or monitoring tools (M = 4.76, SD = 0.43), all demonstrating students' proactive engagement with technology to improve accuracy and efficiency. The least, yet still well-rated item, was "AI tools assist me in tailoring my cooking lessons according to my learning speed" (M = 4.60, SD = 0.51), indicating that although AI personalization is appreciated, it might be less accessible or known than other applications. In summary, these findings show that individuals actively incorporate AI-enhanced tools and intelligent technologies into their cooking routines, supporting the previous observation of an exceptionally high overall level of technology integration. Based on the findings observed that technology integration especially AI helps to boost both student training skills and motivation alongside confidence levels in the culinary field. The BTLED students utilize AI tools including virtual aides and recipe creators as they receive personalized learning experience that delivers better results. The modern concept of technology as mentor and inspiration emerges directly from the observation that it helps students align their competencies

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while delivering immediate performance assessments. The advancement of technology shows interest to understand how it impacts practical and sensory fields such as cooking.

Table 2. shows the Frequency, Percentage and Mean Distribution of the Participants' Self Efficacy. The results indicated that the majority of participants demonstrated a high level of self-efficacy in cooking. Specifically, 82 participants (60.74%) fell within the "High" range (3.51–4.50), while 25 participants (18.52%) reported a "Very High" level (4.51–5.00). Additionally, 27 participants (20.00%) exhibited a "Moderate" level of self-efficacy (2.51–3.50), and only one participant (0.74%) fell under the "Low" category (1.51–2.50). No participants were classified under the "Very Low" range. The computed overall mean was 3.93, with a standard deviation of approximately 0.55, which corresponds to a High level of self-efficacy. These findings suggest that, overall, the participants perceive themselves as confident in their cooking abilities, which may positively contribute to their performance in commercial cooking settings.

Problem 2. What is the participants' level of self-efficacy in cooking?'

Table 2 Frequency, Percentage and Mean Distribution of the Participants' Self Efficacy

Range	Interpretation	Frequency	Percentage
4.51-5.00	Very High	25	18.52%
3.51-4.50	High	82	60.74%
2.51-3.50	Moderate	27	20.00%
1.51-2.50	Low	1	0.74%
1.00-1.50	Very Low	0	0.00%
Total		**135**	**100.0%**
Mean = 3.93	**High**		

Table 2. shows the Frequency, Percentage and Mean Distribution of the Participants' Self Efficacy. The results indicated that the majority of participants demonstrated a high level of self-efficacy in cooking. Specifically, 82 participants (60.74%) fell within the "High" range (3.51–4.50), while 25 participants (18.52%) reported a "Very High" level (4.51–5.00). Additionally, 27 participants (20.00%) exhibited a "Moderate" level of self-efficacy (2.51–3.50), and only one participant (0.74%) fell under the "Low" category (1.51–2.50). No participants were classified under the "Very Low" range. The computed overall mean was 3.93, with a standard deviation of approximately 0.55, which corresponds to a High level of self-efficacy. These findings suggest that, overall, the participants perceive themselves as confident in their cooking abilities, which may positively contribute to their performance in commercial cooking settings.

The itemized analysis of participants' self-efficacy in cooking shows consistently high levels of confidence across all ten indicators. Notably, the highest-rated items, with a perfect mean score of 5.00 and no variation (SD = 0.00), were: "I am confident in choosing high-quality ingredients for commercial cooking" and "I believe my confidence in cooking positively impacts my overall performance." These suggest unanimous agreement among participants on the importance of ingredient selection and the empowering role of confidence. The participants' utilization of AI tools and advanced kitchen technology demonstrates a transformation in the teaching of culinary skills today—more effectively, accurately, and with enhanced involvement

What is the participants' level of computational skills?

Table 3. shows the Frequency, Percentage and Mean Distribution of the Participants' Computational skills. The spread of participants' computing abilities showed that most of those surveyed demonstrated low degrees

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of proficiency. In particular, 81 individuals, representing 60.00% of the overall sample, were categorized in the "Low" range (scores of 3–4), whereas 53 individuals (39.26%) showed a "Moderate" level (scores of 5–6). No participants were categorized as "Very High," "High," or "Very Low." The general average score for computational abilities was 3.85 (SD = 0.60), which is categorized within the "Low" interpretation range. These findings suggest that, on average, participants have restricted computational abilities, potentially affecting their efficiency in tasks that necessitate numerical reasoning, measurements, and time management in commercial cooking situations.

Table 3 Frequency, Percentage and Mean Distribution of the Participants' Computational skills

Range	Interpretation	Frequency	Percentage
9-10	Very High	0	0.00
7-8	High	0	0.00
5-6	Moderate	53	39.26
3-4	Low	81	60.00
1-2	Very Low	0	0.00
	Total	**135**	**100.0**
	Overall Mean	**3.85**	
	Interpretation	**Low**	
	SD	**0.60**	

Research conducted by Sari et al. (2024) highlights that students lacking in computational skills find it difficult to entirely participate in digital learning tools, stressing the importance of specific digital literacy programs. In a similar vein, Williams and Parker (2023) discovered that numerous students pursuing STEM disciplines exhibit inadequate computational skills, frequently impeding their capacity to utilize technology effectively in problem-solving scenarios. This skill gap is further examined by Hernandez et al. (2023), who observed that although university students demonstrate strong general digital skills, many still lack critical computational thinking skills, especially in non-technical fields. Additionally, the study conducted by Brown and Mitchell (2022) indicates that vocational education programs encounter difficulties with students displaying weak computational abilities, highlighting an urgent requirement for incorporating computational skills training into hands-on educational programs. The research results along with several studies indicate that students need supplemental help to improve their computational skills which matches the findings demonstrating low computational ability among participants. Future student success in education and workplace demands organized interventions and curriculum frameworks to address this educational shortage domain to promote effective digital learning for an ever-changing digital environment. This research establishes an important educational concern through its discovery of prevalent low computational ability among participants.

Problem 4. Do the participants' technology integration, self-efficacy in cooking, and computational skills significantly influence their commercial cooking proficiency?

Table 4 shows the correlational analysis conducted to determine the extent to which Technology Integration, Self-Efficacy in Cooking, and Computational Skills predict students' Commercial Cooking Proficiency. The model summary revealed a correlation coefficient (R) of 0.514, indicating a moderate positive relationship between the independent variables and the dependent variable. The coefficient of determination (R^2) was 0.264, suggesting that approximately 26.4% of the variance in Commercial Cooking Proficiency can be explained by the combined influence of the three predictors. The adjusted R^2 value of 0.247 further supports

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the model's moderate explanatory power when accounting for the number of predictors. The ANOVA results demonstrated that the regression model was statistically significant, with an F-value of 15.667 and a significance level (p-value) of 0.000. This indicates that the combination of Technology Integration, Self-Efficacy in Cooking, and Computational Skills significantly predicts Commercial Cooking Proficiency.

Table 4 Correlation Coefficient of technology integration, self-efficacy in cooking, and computational skills significantly influence their commercial cooking proficiency

Commercial Cooking Proficiency	**Measures**	**Technology**	**Self-Efficiency**	**Computational Skills**
Overall Com Cook Prof	Correlation Coefficient	-.067	.343**	.395**
	Sig. (2-tailed)	.443	.000	.000

** *significant in 0.05*

Table 4 presents the correlational analysis results showing how technology integration, self-efficacy in cooking, and computational skills influence the participants' commercial cooking proficiency. It includes the unstandardized coefficients (B), significance levels, and the model summary to explain how each independent variable affects students' actual cooking performance.

The overall model yielded an R value of 0.514 and an R Square of 0.264, meaning that about 26.4% of the variation in commercial cooking proficiency is explained by the three variables combined. The adjusted R Square was 0.247, which shows a moderately good fit. This result means that self-efficacy, computational skills, and technology integration collectively contribute to the differences in students' cooking performance. Caballero and Corpuz (2021) stated that an R Square around 0.25 is considered acceptable in educational studies, especially when explaining human performance, which is often influenced by many factors.

This finding may reflect that although students actively use technology, it may not always be applied in ways that improve practical cooking skills. Students might be using digital tools for passive tasks like watching videos or browsing recipes, instead of engaging in guided, interactive learning. Moreover, the lack of strong connection between technology use and actual performance may also be due to limited teacher supervision or integration into hands-on kitchen training. Tan and Reyes (2023) noted that the benefits of technology in vocational education depend on how well it is embedded into instructional strategies. Without meaningful guidance or skill-based application, technology alone may not be enough to improve cooking proficiency.

FINDINGS

The findings of the study provided insightful answers to the research questions:

Technology Integration among the participants was observed but did not emerge as a significant factor in predicting Commercial Cooking Proficiency. While some students reported engagement with technological tools, the results suggest that these tools were not effectively integrated into skill development processes.

Self-Efficacy in Cooking was found to be high among many respondents and significantly contributed to their cooking performance. Students who believed in their capabilities were more likely to succeed in cooking tasks, demonstrating initiative and resilience.

Computational Skills were also rated at a relatively high level, and their influence on Commercial Cooking Proficiency was statistically significant. Students who demonstrated stronger skills in math, measurement, and data handling were better able to manage and execute culinary tasks.

The correlation coefficient analysis confirmed that both Self-Efficacy in Cooking and Computational Skills had significant positive association on Commercial Cooking Proficiency, while Technology Integration did not show a significant association.

CONCLUSION AND RECOMMENDATIONS

This study concludes that while digital tools enrich learning environments, it is students' confidence and computational ability that most significantly drive proficiency in commercial cooking. Curricular initiatives should prioritize self-efficacy development through reflective practice and mastery experiences, and embed math instruction into culinary contexts. These findings support theoretical frameworks such as Bandura's (1997) self-efficacy theory, which posits that belief in one's capabilities enhances performance outcomes. Moreover, the significant impact of computational ability affirms the importance of applied numeracy and data handling in vocational settings, particularly in culinary environments where accuracy in measurements, costing, and timing is essential. Institutions should re-evaluate how technology is integrated, ensuring it enhances rather than replaces core skill development. Finally, professional development for educators should include training on fostering self-belief, critical thinking, and effective tech integration. Future research may examine additional factors such as prior kitchen experience, learning styles, or motivation levels using mixed methods to further enrich vocational education strategies

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