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SELF-EFFICACY AND TPACK AS PREDICTORS OF TECHNOLOGY INTEGRATION IN FOOD TECHNOLOGY EDUCATION

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ABSTRACT

This descriptive-correlational study examined food technology educators' self-efficacy and Technological Pedagogical Content Knowledge (TPACK) and their relationship to technology integration in instruction. The participants were Junior and Senior High School teachers handling cookery-related subjects in Soccoro, Division of Siargao, Siargao del Norte. Data were collected through a validated questionnaire, with permission secured prior to administration, and analyzed using weighted mean and Pearson correlation. Findings revealed that educators generally possessed high levels of self-efficacy and TPACK, particularly in pedagogical knowledge and applied content integration. However, relative challenges were observed using specialized technologies, such as simulation tools and domain-specific software. Correlation analysis further indicated a significant positive relationship between teachers' self-efficacy and their ability to integrate technology, suggesting that greater confidence promotes stronger adoption of digital tools in instruction. The study highlights the need for targeted professional development to strengthen educators' capacity for technology integration, particularly in resource-constrained island settings.

KEYWORDS: Food technology education; Teacher self-efficacy; TPACK; Technology integration

INTRODUCTION

Technology integration in education has become indispensable, particularly in specialized fields such as food technology education, where hands-on demonstrations, simulations, and technical skills training are central to instruction. While access to digital tools and infrastructure is necessary, effective technology integration depends largely on teachers' confidence and competence in using technology. Two critical determinants shaping this process are teachers' self-efficacy in technology use and their Technological Pedagogical Content Knowledge (TPACK) (Scherer et al., 2017).

Research consistently demonstrates that teacher self-efficacy significantly influences technology adoption in educational settings. Li et al. (2016) found that technology self-efficacy, attitudes toward technology and perceived ease of use, were significant predictors of preservice teachers' intentions to adopt technology in their future classrooms. Teachers with higher self-efficacy are more likely to experiment with digital tools, apply innovative strategies, and navigate barriers to integration. Teachers' confidence directly impacts instructional quality in food technology education, where industry-relevant competencies such as food safety, preparation, and technical demonstrations are emphasized. Complementing this is the TPACK framework, which highlights the dynamic interplay of Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK) (Chai et al., 2011). For food technology educators, TPACK is vital in aligning digital resources with practical learning needs, ensuring technology enhances rather than substitutes real-world skill development.

At the policy level, the Philippine education system underscores the importance of technology integration. Republic Act No. 10533, or the *Enhanced Basic Education Act of 2013*, mandates the integration of ICT in the K to 12 curriculum to strengthen technical-vocational education. Similarly, DepEd Order No. 42, s. 2017, which implements the Philippine Professional Standards for Teachers (PPST), emphasizes teachers' technological competence as a core professional expectation. These are further reinforced by the DepEd ICT Strategic Plan, which advocates for teacher empowerment in using technology to improve instructional delivery. Collectively, these mandates highlight not only the necessity of integrating technology but also the responsibility of teachers to continuously develop their technological and pedagogical capacities.

Despite these strong policy directions, teachers in geographically isolated and disadvantaged areas face unique contextual barriers. In municipalities such as Socorro, Surigao del Norte—an island community under the Siargao Division—weak internet connectivity, limited access to modern digital tools, and logistical constraints hinder meaningful technology integration. Yet, empirical studies exploring how food technology teachers' self-efficacy and TPACK influence technology integration in such contexts remain scarce. Addressing this gap, the present study examines the relationship between these variables to provide evidence-based insights for policymakers, administrators, and teacher training providers. Ultimately, the findings aim to inform context-sensitive interventions that strengthen technology integration practices in food technology education, particularly within island and disadvantaged settings.

METHODOLOGY:

This study employed a descriptive-correlational research design to examine the self-efficacy and TPACK competencies of food technology educators in relation to their technology integration practices. The respondents comprised 66 Junior High School (JHS) and Senior High School (SHS) teachers from Socorro, Division of Siargao, Surigao del Norte, handling cookery-related subjects. Purposive sampling ensured that the participants represented educators directly engaged in food technology instruction.

The primary data-gathering tool was a structured questionnaire developed from established literature on teacher self-efficacy and the Technological Pedagogical Content Knowledge (TPACK) framework. To ensure content validity, the instrument was reviewed by education and educational technology experts, after which necessary revisions were incorporated. Permission to conduct the study was secured from the appropriate school authorities, and ethical protocols such as informed consent and voluntary participation were strictly observed.

For data analysis, descriptive statistics, including the mean and standard deviation, were employed to determine the levels of self-efficacy and TPACK among respondents. The Pearson product- moment correlation coefficient was utilized to test the relationship between self-efficacy and technology integration. This statistical tool was chosen to examine the strength and direction of linear relationships between continuous variables. The results of these analyses provided a basis for identifying significant associations and drawing inferences regarding the predictive role of self-efficacy in technology integration.

RESULTS AND DISCUSSION:

Table 1. Level of Self-Efficacy among food technology educators in technology integration

Indicators	Weighted Mean	Verbal Description	SD
I am confident in using digital tools in food technology teaching.	4.23	Strongly Agree	0.497
I can handle unexpected technical problems during food technology lessons.	4.00	Agree	0.577
I am able to design food technology lessons that integrate appropriate technology.	4.23	Strongly Agree	0.617
I can teach food technology concepts effectively using online platforms.	4.10	Agree	0.651

I can adapt my teaching strategies to include technology even in limited-resource settings.	4.29	Strongly Agree	0.529
I am motivated to learn and experiment with new educational technologies.	4.61	Strongly Agree	0.558
I feel competent in selecting suitable technologies for specific food technology topics.	4.23	Strongly Agree	0.617
I am able to facilitate hands-on food technology activities using virtual simulations.	3.97	Agree	0.605
I am comfortable guiding students in using technology for food technology tasks.	4.13	Agree	0.619
I can successfully integrate technology even when faced with challenges.	4.10	Agree	0.651
Average Mean	4.19	Agree	0.421

Legend: 1.00 – 1.79 Strongly Disagree 1.80 – 2.59 Disagree 2.60 – 3.39 Undecided 3.40 – 4.19 Agree 4.20 – 5.00 Strongly Agree

Table 1 presents the self-efficacy levels of food technology educators in technology integration. The overall mean score of 4.19 (SD = 0.421) reflects a generally high confidence level among educators in incorporating technology into their teaching practices. The relatively low standard deviation indicates a shared and consistent perception across respondents, suggesting a broadly positive outlook on their technological capabilities.

The highest-rated indicators, "I am motivated to learn and experiment with new educational technologies" (M = 4.61, SD = 0.558) and "I can adapt my teaching strategies to include technology even in limited-resource settings" (M = 4.29, SD = 0.529), underscore strong motivational and adaptive dimensions of self-efficacy. These findings align with those of Kamran et al. (2024), who found a positive correlation (r = .38) between teachers' self-efficacy and technology integration intention, with self-efficacy serving as a significant predictor of technology adoption willingness.

Conversely, the items with lower mean scores, "I am able to facilitate hands-on food technology activities using virtual simulations" (M = 3.97, SD = 0.605) and "I can handle unexpected technical problems during food technology lessons" (M = 4.00, SD = 0.577), suggest more moderate levels of confidence. The relatively higher standard deviations for these items indicate variability in teachers' experiences, with some expressing competence while others reveal hesitation or lack of familiarity with advanced technological tools. This variation echoes the findings of Silva-Díaz et al. (2023), who emphasized that

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comprehensive training pathways are vital for bridging the gap between technological potential and effective classroom integration.

Furthermore, the consistency of responses within the mid-range standard deviations (0.497–0.651) indicates that educators generally feel secure in their use of basic digital tools, pointing to a solid foundation in essential technology skills. However, sustained professional development remains necessary to bridge confidence gaps in more advanced applications. This observation resonates with Joshi (2023), who found that structured training interventions enhance teachers' TPACK-related self-efficacy, thereby strengthening their ability to integrate technology in classroom practice.

Overall, the results highlight the central role of self-efficacy in technology adoption. Crossan (2019) further supported these findings by demonstrating that digital competence, outcome expectations, and IT support significantly influence teachers' self-efficacy toward educational technology integration. This underscores the importance of institutional support and ongoing professional development in sustaining educators' confidence and capacity for technology-enhanced instruction.

Table 2: The level of TPACK among food technology educators

TPACK	Indicators	Weighted Mean	Verbal Description	SD
TK	I am knowledgeable about different software and applications applicable to food technology.	3.71	Agree	0.643
	I can effectively operate educational platforms like Google Classroom, Moodle, or MS Teams.	4.10	Agree	0.700
	I can use multimedia tools (audio, video, animations) to support food technology teaching.	4.32	Strongly Agree	0.541
	I am capable of troubleshooting fundamental technical problems during class.	3.81	Agree	0.601
	I know how to use technology to improve student engagement.	4.16	Agree	0.688
	Average	**4.02**	**Agree**	0.471
PK	I know various teaching methods suited to food technology	4.19	Agree	0.543
	I can manage classroom activities effectively to accommodate technology use.	4.48	Strongly Agree	0.508

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	I can implement assessment strategies that incorporate technology.	4.06	Agree	0.574
	I can successfully integrate technology even when faced with challenges.	4.03	Agree	0.605
	I can adapt my teaching styles based on student needs using technology.	4.35	Strongly Agree	0.608
	I am able to facilitate collaborative learning using digital platforms.	4.16	Agree	0.638
	Average	**4.22**	**Strongly Agree**	0.450
CK	I have deep knowledge of food technology principles.	3.87	Agree	0.670
	I can effectively relate food technology concepts to real-life applications	4.32	Strongly Agree	0.475
	I can integrate food safety and industry-standard knowledge in teaching.	4.39	Strongly Agree	0.495
	I can design food technology lessons that meet curriculum standards.	4.13	Agree	0.619
	I am updated on current trends and innovations in food technology.	3.94	Agree	0.772
	Average	**4.13**	**Agree**	0.489

The overall average mean of 4.12 (SD = 0.470) indicates that food technology educators generally perceive themselves as possessing a high level of TPACK, reflecting a solid foundation across the Technological, Pedagogical, and Content Knowledge domains essential for technology integration in 21st-century teaching. Within the technological domain, the mean score of 4.02 (SD = 0.471) suggests that educators are confident in using digital tools, particularly multimedia resources such as audio, video, and animations (M = 4.32, SD = 0.541), which received the highest rating. The relatively low standard deviation indicates consistent agreement, underscoring a shared strength in this area. However, the lowest-rated item, "I am knowledgeable about different software and applications applicable to food technology" (M = 3.71, SD = 0.643), points to more limited confidence in specialized applications. Research consistently demonstrates a strong positive relationship between TPACK self-efficacy and successful technology integration in educational settings. Zeng et al. (2022) confirmed that teachers' confidence in using information technology is closely associated with their TPACK, reinforcing the vital role of self-efficacy in effective technology integration.

Pedagogical knowledge emerged as the strongest domain, with the highest average mean of 4.22 (SD = 0.450). The top-rated item, "I can manage classroom activities effectively to accommodate technology use" (M = 4.48, SD = 0.508), demonstrates educators' confidence in managing classroom dynamics within technology-enhanced instruction. In contrast, the lowest item, "I can successfully integrate technology even when faced with challenges" (M = 4.03, SD = 0.605), reflects slightly lower confidence in handling unexpected issues, suggesting the need for training in troubleshooting and adaptive strategies. Research demonstrates that pedagogical proficiency is fundamental to effective technology integration in educational settings. Teachers with high pedagogical competence are better equipped to create effective learning environments, design activities for diverse learning styles, and select appropriate technological tools that align with their teaching objectives (Mariscal et al., 2023).

Content knowledge also received high ratings, with an average mean of 4.13 (SD = 0.489), showing strong confidence in subject expertise. The highest-rated item, "I can integrate food safety and industry-standard knowledge in teaching" (M = 4.39, SD = 0.495), reflects teachers' ability to align instruction with relevant and practical applications. Meanwhile, "I have deep knowledge of food technology principles" (M = 3.87, SD = 0.670) received the lowest score, with higher variability suggesting differences in specialization and training among respondents. Research shows that variations in pedagogical content knowledge (PCK) are shaped by teachers' experience and training, highlighting the need for tailored professional development. Van Driel and Berry (2012) stress that PCK is topic, person, and situation-specific, requiring programs to be aligned with teachers' practice and include opportunities for reflection and strategy enactment. Taken together, the findings reveal that food technology educators demonstrate a strong sense of TPACK, with particular strengths in pedagogical and applied content integration, but comparatively lower confidence in advanced technological applications and adaptive strategies when faced with challenges.

Table 3. Significant values on the relationship between self-efficacy and technology integration

Variables	r-value	p-value	Decision	Interpretation
Self-efficacy & Technology Integration	0.563	0.001	Reject H_0	There is a significant relationship.

Table 3 presents the significant values on the relationship between self-efficacy and technology integration of food technology educators. As revealed, the correlation coefficient (r = 0.563) and the p-value (p = 0.001) indicate a positive and statistically significant relationship between teachers' self-efficacy and technology integration in teaching. This suggests that as teachers' confidence in their abilities grows, so does their inclination to integrate technological tools into their teaching. In education, research shows a

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positive link between teachers' self-efficacy and technology integration. Kamran et al. (2024) found that self-efficacy predicts teachers' willingness and intention to use technology in the classroom.

Research consistently demonstrates that higher TPACK self-efficacy strongly predicts technology integration among educators. Durak (2019) found that teachers' technology integration self-efficacy was the most significant variable in predicting TPACK levels, suggesting that developing teachers' beliefs about their capabilities is crucial for effective technology integration. Similarly, Abbitt (2011) identified significant positive correlations between TPACK knowledge domains and self-efficacy beliefs about technology integration among preservice teachers, with the relationship evolving over time. In general, the significant relationship between self-efficacy and technology integration points the direction towards building teachers' confidence through ongoing professional development, access to resources, and supportive environments. This enables educators to effectively utilize technology to enhance student learning outcomes.

CONCLUSION

The findings of this study demonstrate that food technology educators exhibit a generally high level of self-efficacy and TPACK when integrating technology into their instructional practices. High overall mean scores across the domains indicate that educators are confident in adopting technology, particularly in using multimedia resources, managing classroom activities with digital tools, and aligning instruction with industry-relevant content such as food safety. These strengths reflect a strong foundation in essential technological, pedagogical, and content knowledge, underscoring their readiness to support technology-enhanced learning in food technology education.

Nonetheless, the results also reveal specific areas requiring further attention. Educators expressed comparatively lower confidence in handling specialized software applications, facilitating hands-on activities through virtual simulations, and addressing unexpected technical challenges. These gaps suggest that while teachers are competent in fundamental technology integration, they remain less assured when confronted with advanced digital applications or adaptive problem-solving. The observed variability in responses also points to differences in exposure, training, and professional experience among educators.

Taken together, these findings underscore the critical role of continuous professional development in sustaining and strengthening educators' technological confidence. Structured training interventions, tailored workshops on emerging technologies, and institutional support are necessary to bridge gaps in advanced applications and troubleshooting. By fostering ongoing capacity-building initiatives, higher education institutions can ensure that food technology educators are fully equipped to deliver effective, industry-relevant, and technology-driven instruction.

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