

Innovating Ginstevulin Leche Flan: Assessing Product Quality, Consumer Acceptance, and its Pedagogical Application in Technology and Livelihood Education

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Abstract

This study aimed to innovate *Ginstevulin Leche Flan* by evaluating its product quality, consumer acceptance, and pedagogical relevance within the Technology and Livelihood Education (TLE) curriculum. Specifically, it assessed the sensory acceptability of four Leche Flan variants—including Ginger (T1), Stevia (T2), Insulin Plant (T3), and Ginstevulin (T4)—in terms of appearance, taste, texture, aroma, and overall acceptability. Using convenience and purposive sampling, 30 respondents participated in the sensory evaluation, while 10 culinary experts and 10 food enthusiasts assessed its pedagogical implications. Data were analyzed using mean, standard deviation, ANOVA, and descriptive statistics. Results showed that the Stevia Leche Flan (T2) received the highest consumer rating (M=8.21), interpreted as “Like Extremely,” followed by Insulin Leche Flan (T3) (M=7.52), while the Ginger (T1) and Ginstevulin (T4) variants were rated moderately (M=6.63 and M=6.59, respectively). Sensory attributes of Ginstevulin Leche Flan were rated favorably overall (Grand Mean=7.24), particularly in terms of texture and taste. Consumer acceptance data revealed a strong perception of the product’s natural quality and market potential (Grand Mean=6.91). Furthermore, evaluations from culinary experts and food enthusiasts indicated a high level of agreement regarding the product’s pedagogical value in TLE, particularly in hands-on learning and curriculum integration (Grand Mean=7.61). The study concludes that Ginstevulin Leche Flan is a viable functional food innovation with strong educational potential, though further refinement in sensory attributes like aroma and appearance is recommended.

Keywords: *Ginstevulin Leche Flan, Sensory Evaluation, Consumer Acceptance, Food Innovation, Pedagogical Application*

INTRODUCTION

Ginstevulin Leche Flan is an innovative variation of the traditional dessert incorporating ginger, stevia, and insulin plant leaf extract. Evaluating its sensory qualities and consumer acceptance is essential in determining its product quality and identifying differences among its formulations. Sensory evaluation provides systematic information on consumers' perceptions, which can guide product improvement and development (Torres & Reyes, 2018; Lim & Cruz, 2021). Determining significant differences among treatments further supports the identification of formulations with varying levels of sensory acceptability (Villanueva, 2020).

Beyond food product development, Ginstevulin Leche Flan may also serve as a meaningful instructional resource in Technology and Livelihood Education (TLE). Its development and evaluation can provide students with opportunities to apply practical culinary skills, creativity, product development, and entrepreneurial concepts. Thus, this study aims to assess the product quality, sensory acceptability, and consumer preferences of Ginstevulin Leche Flan, determine significant differences among its formulations, and explore its potential pedagogical application in TLE. The study seeks to contribute to culinary innovation while supporting experiential and skills-based learning.

Objectives of the Study

This study aimed to develop a different variant of leche flan by incorporating ginger, stevia, and insulin plant as alternative ingredients; assess its product quality, and consumer acceptance; and explore its pedagogical application in Livelihood and Technology Education.

Specifically, the study aimed to:

1. Determine the sensory acceptability of Ginstevulin Leche Flan in terms of:
 1. Appearance;
 2. Taste;
 3. Texture;
 4. Aroma; and
 5. Overall acceptability.
2. Determine whether there is a significant difference in the sensory evaluation results among the different treatment groups.
3. Assess purchase intention of Ginstevulin Variant of Leche Flan.
4. Assess the perceived pedagogical implications of the product innovation in Technology and Livelihood Education, as evaluated by culinary experts and food enthusiasts.

METHODOLOGY

This study employed a quasi-experimental research design to analyze the effects of incorporating ginger, stevia and insulin plant into leche flan in terms of product quality, consumer acceptance, and health benefits. Additionally, a quantitative approach was used to

assess perception on its pedagogical applications in Livelihood and Technology Education (LTE) through survey questionnaires.

Formulation and Processing Procedure

The study employed a Completely Randomized Design (CRD) with four treatments, each replicated three times. The treatments consisted of four variations of leche flan: Treatment 1 – Ginger-Infused Flan, Treatment 2 – Stevia-Enhanced Flan, Treatment 3 – Insulin Plant-Enhanced Flan, and Treatment 4 – Ginstevulin Leche Flan, which combined ginger, stevia, and insulin plant extracts.

The basic ingredients used in the formulations included egg yolks, condensed milk, evaporated milk, and granulated sugar, with the corresponding treatments incorporating ginger juice, commercial stevia, insulin plant extract, and a combination of these ingredients. Treatment 1 contained 20 g of ginger, Treatment 2 contained 50 g of stevia, Treatment 3 contained 20 g of insulin plant extract, while Treatment 4 contained 20 g ginger + 50 g stevia + 20 g insulin plant extract.

For processing, the ginger was washed, peeled, sliced, and extracted using a juice extractor. The insulin plant leaves were washed, trimmed, cut into pieces, blended with water, and strained to obtain the extract. Commercial stevia was used as the sweetening ingredient. For all treatments, sugar was caramelized and placed in the flan molds. The egg yolks and milk ingredients were mixed gently, followed by the addition of the designated treatment ingredient and in the last is the combination of the 3 ingredients used in treatment 1-3. The mixture was strained, poured into caramel-lined molds, covered with aluminum foil, and steamed for approximately 35–50 minutes or until set. The finished leche flan was cooled to room temperature and refrigerated for at least three hours before serving and evaluation.

Respondents of the Study

The study involved a total of 30 respondents, divided into two main groups: 10 consumers and 20 individuals composed of Culinary Experts and Food Enthusiasts. These respondents evaluated the GINSTEVLIN Leche Flan based on key sensory attributes, including appearance, taste, texture, aroma, and overall acceptability. In addition to this evaluation, the group of Culinary Experts and Food Enthusiasts also provided insights regarding the potential pedagogical applications of the product within the Technology and Livelihood Education (TLE) curriculum.

Sampling Technique

For the selection process, 10 consumers and 10 Food Enthusiasts were recruited through convenience sampling, which allowed for the inclusion of participants who were readily available and willing to participate. Meanwhile, the 10 Culinary Experts were selected using purposive sampling to ensure that individuals with relevant expertise and professional experience in culinary arts were included in the evaluation.

This mixed sampling approach ensured a balanced representation of general consumer perspectives and expert opinions, thereby enriching the study's findings in terms of both sensory acceptability and educational relevance.

Data Gathering Instrument

To gather empirical data for the four experimental procedures, the researcher sought permission from the school principal to conduct the study. The Technology and Livelihood Education (TLE) Laboratory of Sto. Niño National High School served as the venue for formulating the mixtures. It was also where consumers, students, and teachers evaluated the product samples

During the evaluation of the GINSTEVLIN Leche Flan across the four treatments, each with three replications, the samples were coded to prevent identification by the respondents. Treatment 1 was labeled as Code A, Treatment 2 as Code B, Treatment 3 as Code C, and Treatment 4 as Code D. To ensure fairness in evaluation, each treatment was served in equal portion sizes.

Before distributing the score sheets, the researcher explained the procedure for evaluating the product. Each respondent was provided with a score sheet and a bottle of water to rinse their mouth after each sampling. The products were evaluated based on appearance, taste, texture, aroma, and overall acceptability. After the evaluation, the researcher collected the score sheets and proceeded with data analysis.

To determine the pedagogical application in TLE, a separate survey was answered by the Culinary Experts and Food Enthusiasts, including student participants. The survey used a Likert Scale to gather insights on the feasibility of integrating the study into the curriculum, as well as its effectiveness in teaching food innovation, entrepreneurship, and nutrition. It also explored the potential of the product as a basis for income-generating activities within the TLE framework.

Statistical Treatment

To analyze the sensory evaluation results of the four treatments of Ginstevulin Leche Flan, the researcher used mean and standard deviation to determine the level of acceptability based on the respondents' ratings. These statistical tools helped summarize how each treatment performed in terms of appearance, taste, texture, aroma, and overall acceptability.

To determine whether there were significant differences in the acceptability of the product among the four treatments, a one-way Analysis of Variance (ANOVA) was applied. This statistical test allowed the researcher to compare the treatments and assess whether any of the variations in sensory scores were statistically meaningful.

Meanwhile, to interpret the responses from the survey on the pedagogical application of the study in TLE, descriptive statistics were used. These helped summarize the respondents'

perceptions on the educational relevance, feasibility for classroom integration, and potential for use in entrepreneurship and food innovation lessons.

RESULTS AND DISCUSSIONS

Sensory Evaluation of Ginstevulin Leche Flan across Key Attributes

Table 4. Sensory Acceptability Ratings for Ginger-Infused Leche Flan (Treatment 1)

Attribute	Mean	SD	Interpretation
Appearance	6.38	1.85	Like Moderately
Taste	6.69	1.67	Like Moderately
Texture	7.28	1.35	Like Very Much
Aroma	6.26	1.74	Like Moderately
Overall Acceptability	6.53	1.50	Like Moderately
Attribute	Mean	SD	Interpretation
Appearance	6.38	1.85	Like Moderately
Taste	6.69	1.67	Like Moderately

The table presents the results of the sensory acceptability of Ginger Leche Flan (Treatment 1) based on five key attributes: appearance, taste, texture, aroma, and overall acceptability. Among these, texture received the highest mean score of 7.28, indicating that the product's consistency and mouthfeel were highly favored by the evaluators. Taste followed with a mean of 6.69, suggesting that the combination of traditional leche flan and ginger was generally well received. The overall acceptability obtained a mean score of 6.53, reflecting that the product was liked and found satisfactory.

Appearance received a mean of 6.38, which points to a visually acceptable product. However, the relatively higher standard deviation under this attribute may suggest that respondents had differing views on the product's visual presentation. Aroma garnered the lowest mean score of 6.26. While still within an acceptable range, this result may be attributed to the strong and distinct scent of ginger, which not all respondents found appealing.

The section mean of 6.63 indicates that the Ginger Leche Flan was generally well accepted across all sensory dimensions. These findings support current literature on the viability of incorporating functional ingredients like ginger into traditional desserts, both for their health-promoting properties and their contribution to novel flavor profiles (Nguyen et al., 2023; Yildirim et al., 2022).

Table 5. Sensory Acceptability Ratings for Stevia-Infused Leche Flan (Treatment 2)

Attribute	Mean	SD	Interpretation
Appearance	8.24	0.75	Like Extremely
Taste	7.99	0.95	Like Very Much
Texture	8.36	0.79	Like Extremely
Aroma	8.19	0.85	Like Extremely
Overall Acceptability	8.29	0.69	Like Extremely

The table presents the sensory acceptability scores of Stevia Leche Flan (Treatment 2), evaluated across five key attributes: appearance, taste, texture, aroma, and overall acceptability. The mean scores across all attributes are notably high, with texture receiving the highest rating at 8.36 (SD = 0.79), indicating that the product's mouthfeel was especially well received. This was followed by overall acceptability at 8.29 (SD = 0.69), appearance at 8.24 (SD = 0.75), aroma at 8.19 (SD = 0.85), and taste at 7.99 (SD = 0.95).

Moreover, the relatively low standard deviations across all parameters suggest a strong level of agreement among the panelists regarding the product's sensory qualities. These results underscore the successful use of stevia as a sugar substitute in leche flan, maintaining desirable sensory characteristics while offering a healthier alternative. The findings are consistent with recent research indicating that stevia can be effectively incorporated into traditional desserts without compromising sensory appeal (Nguyen et al., 2023; Yildirim et al., 2022).

Table 6. Sensory Acceptability Ratings for Insulin Plant-Infused Leche Flan (Treatment 3)

Attribute	Mean	SD	Interpretation
Appearance	7.47	1.62	Like Very Much
Taste	7.57	1.16	Like Very Much
Texture	7.41	1.40	Like Very Much
Aroma	7.64	1.20	Like Very Much
Overall Acceptability	7.50	1.21	Like Very Much

Table 6 presents the sensory acceptability results for Insulin Leche Flan under Treatment 3, assessed across five key sensory attributes: appearance, taste, texture, aroma, and overall acceptability. Each attribute received high mean scores, all ranging from 7.41 to 7.64, on a scale likely based on a 9-point hedonic scale, where higher scores denote greater consumer liking. Aroma achieved the highest mean rating (7.64 ± 1.20), suggesting it was the most appealing attribute, followed closely by taste (7.57 ± 1.16), while texture received the lowest score (7.41 ± 1.40), although it still falls within the "Like Very Much" category.

The overall acceptability averaged 7.50 (± 1.21), reinforcing the product's favorable reception among evaluators. The section mean was 7.52 with a standard deviation of 1.32, signifying consistent sensory quality across attributes. These findings suggest that the insulin-enriched leche flan formulation is well accepted in terms of sensory qualities, supporting its

potential as a functional dessert product. This aligns with recent studies emphasizing consumer willingness to accept functional foods if they maintain desirable sensory characteristics (Kaur & Das, 2023).

Table 7. Sensory Acceptability Ratings for GINSTEVLIN (Ginger, Stevia, Insulin Plant) Leche Flan (Treatment 4)

Attribute	Mean	SD	Interpretation
Appearance	6.34	2.00	Like Moderately
Taste	6.68	1.80	Like Moderately
Texture	6.79	1.54	Like Moderately
Aroma	6.62	1.64	Like Moderately
Overall Acceptability	6.54	1.80	Like Moderately

Table 7 provides a detailed evaluation of the sensory acceptability of Ginstevulin Leche Flan (Treatment 4), focusing on five sensory attributes: appearance, taste, texture, aroma, and overall acceptability.

All attributes were rated within the "Like Moderately" range based on the 9-point hedonic scale. Among the attributes, texture received the highest mean score of 6.79 (± 1.54), indicating relatively higher consumer approval of the mouthfeel, while appearance scored the lowest at 6.34 (± 2.00), suggesting room for improvement in visual appeal. Taste (6.68 ± 1.80) and aroma (6.62 ± 1.64) followed closely, showing that while the flavor and smell were satisfactory, they did not reach the "Like Very Much" threshold. Overall acceptability scored 6.54 (± 1.80), indicating a generally favorable but moderate consumer response.

These results highlight that while the Ginstevulin-infused Leche Flan is acceptable to consumers, it may require formulation refinement to enhance its sensory impact. This aligns with findings by Lee et al. (2023), who reported that consumer acceptance of functional foods containing herbal or bioactive components is often limited by sensory drawbacks, even if health benefits are evident.

Table 8. Summary of Sensory Acceptability Ratings for Leche Flan across Four Treatments

Treatment	Appearance		Taste		Texture		Aroma		Overall Acceptability	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Treatment 1	6.38 ^c	1.85	6.69 ^c	1.67	7.28 ^b	1.35	6.26 ^b	1.74	6.53 ^c	1.50
Treatment 2	8.24 ^a	0.75	7.99 ^a	0.95	8.36 ^a	0.79	8.19 ^a	0.85	8.29 ^a	0.69
Treatment 3	7.47 ^b	1.62	7.57 ^b	1.16	7.41 ^b	1.40	7.64 ^{ab}	1.20	7.50 ^b	1.21
Treatment 4	6.34 ^c	2.00	6.68 ^c	1.80	6.79 ^c	1.54	6.62 ^b	1.64	6.54 ^c	1.80

^a = Ginger LF, ^b = Stevia LF, ^c = Insulin LF, and ^d = Ginstevulin LF.

- Means within the same column with different superscript letters (^a, ^b, ^c) are significantly different at $p < 0.05$ level
- Means with the same superscript letter are not significantly different

This study evaluated four different leche flan formulations using alternative sweeteners to assess consumer preference across multiple sensory attributes. Using a standardized 9-point hedonic scale, researchers measured appearance, taste, texture, aroma, and overall acceptability for treatments containing ginger (Treatment 1), stevia (Treatment 2), insulin (Treatment 3), and Ginstevulin (Treatment 4). The results demonstrated a clear hierarchy in consumer preference, with the stevia-based formulation (Treatment 2) achieving superior performance across all sensory dimensions, recording the highest overall acceptability score of 8.29 ± 0.69 . This significantly outperformed other treatments, which ranged from 6.53 to 7.50 in overall acceptability.

The stevia formulation also exhibited consistently low standard deviations (0.69-0.95), indicating strong consumer consensus and reliable acceptance patterns. These findings align with current research demonstrating that stevia can be effectively incorporated into dairy-based products while maintaining sensory quality (Smith et al., 2023). Treatment 3 (insulin-based) achieved moderate acceptance with a score of 7.50 ± 1.21 , while Treatments 1 and 4 showed lower but still acceptable scores around 6.5. The higher standard deviations in Treatments 3 and 4 (1.21 and 1.80 respectively) suggest more polarized consumer responses compared to the stevia formulation.

From a practical perspective, these results indicate that traditional Filipino desserts can be successfully reformulated using alternative sweeteners without compromising consumer acceptance. The stevia-based leche flan emerges as the most commercially viable option, offering health-conscious consumers and individuals with dietary restrictions a palatable alternative that maintains the sensory characteristics expected in this traditional dessert while potentially providing benefits associated with natural, low-calorie sweetening.

Table 9. Purchase Intention on the Ginstevulin Leche Flan

	Indicators	Mean	SD	Interpretation
1.	I intend to buy this product if available in the market.	6.65	1.42	Agree
2.	This product seems natural to me	7.15	1.42	Strongly Agree
3.	I would recommend this product to others	6.85	1.76	Agree
4.	The product is suitable for special occasions	7.00	2.10	Agree
	Grand Mean	6.91	1.68	Agree

Table 9 presents the results of consumer acceptance and preference for the GINSTEVLIN Leche Flan, based on four key indicators. The highest mean score was recorded for the statement “This product seems natural to me” with a mean of 7.15 (SD = 1.42), interpreted as Strongly Agree. This suggests that the product effectively conveys a sense of

naturalness, a characteristic that is increasingly valued among health-conscious consumers. Other indicators, including purchase intention (6.65 ± 1.42), willingness to recommend the product (6.85 ± 1.76), and perceived suitability for special occasions (7.00 ± 2.10), all received mean scores interpreted as Agree.

These findings reflect a generally favorable perception of the product, indicating strong potential for market acceptance. The relatively high ratings for naturalness and occasion-based appeal suggest that the product resonates well with consumer expectations for functional, plant-based desserts. The grand mean of 6.91 (SD = 1.68) reinforces this positive reception.

These results are consistent with recent studies showing that consumer preferences in the functional and plant-based food sectors are heavily influenced by perceptions of naturalness, health benefits, and appropriateness for social or celebratory contexts (Chen et al., 2023). Highlighting these attributes in product development and marketing may further enhance consumer interest and support the success of GINSTEVLIN Leche Flan in the health-conscious food market.

Table 10. Perceived Impact of Research Innovation on TLE Curriculum Enhancement: Insights from Culinary Experts and Food Enthusiasts

	Statements	Mean	SD	Interpretation
1.	The activity can be aligned well with TLE learning competencies	7.65	2.01	Strongly Agree
2.	The innovation can be integrated multiple TLE skills effectively.	7.55	1.70	Strongly Agree
3.	The activity can be promoted 21st-century skills (creativity, collaboration).	7.55	1.43	Strongly Agree
4.	The innovation can be encouraged entrepreneurial thinking	7.20	2.55	Agree
	Section Mean	7.49	1.92	Strongly Agree

Table 10 presents the perceived pedagogical implications of the research innovation for Technology and Livelihood Education (TLE) curriculum enhancement, as evaluated by culinary experts and food enthusiasts.

The data reveals a strong consensus on the educational value of the activity, with the highest mean score (7.65 ± 2.01) indicating that respondents “Strongly Agree” the activity aligns well with TLE learning competencies. Similar strong agreement is reflected in statements about the integration of multiple TLE skills (7.55 ± 1.70) and promotion of 21st-century skills such as creativity and collaboration (7.55 ± 1.43), both underscoring the innovation’s versatility and relevance in modern pedagogy. While slightly lower, the promotion of entrepreneurial thinking also received a positive rating (7.20 ± 2.55), interpreted as “Agree.” Overall, the section mean of 7.49 (± 1.92) reflects strong affirmation of the innovation’s potential to enrich curriculum design and execution in TLE.

This supports contemporary findings that emphasize the integration of contextualized, skill-based activities in technical-vocational education as a driver for holistic student development and future workforce readiness (Calleja & Ruiz, 2023).

Table 11. Perceived Impact of Research Innovation on Hands-on Learning in TLE/TVL: Insights from Culinary Experts and Food Enthusiasts

	Statements	Mean	SD	Interpretation
1.	Food innovation could provide meaningful hands-on learning experiences	7.90	1.77	Strongly Agree
2.	Students could actively engage in practical food preparation activities	7.80	1.67	Strongly Agree
3.	The activity can be developed technical skills through direct experience.	8.55	0.94	Extremely Agree
4.	Students can be learned by doing rather than just observing.	7.25	2.63	Strongly Agree
5.	The innovation could encourage experimentation and trial-and-error learning.	7.25	2.43	Strongly Agree
6.	Students could gain confidence through practical skill demonstration.	8.05	1.61	Strongly Agree
7.	The activity could promote learning through sensory experiences.	8.20	1.20	Strongly Agree
Section Mean		7.86	1.75	Strongly Agree

Table 11 illustrates the implications of the research innovation for pedagogical application in TLE/TVL, specifically focusing on hands-on learning, as perceived by culinary experts and food enthusiasts.

The findings reveal a consistently high level of agreement regarding the value of food innovation in enhancing experiential learning. Notably, the highest mean score (8.55 ± 0.94) indicates that respondents “Extremely Agree” that the activity helps develop technical skills through direct experience. Other statements, such as promoting sensory-based learning (8.20 ± 1.20), building confidence through practical demonstrations (8.05 ± 1.61), and enabling student engagement in actual food preparation (7.80 ± 1.67), received “Strongly Agree” ratings, demonstrating broad endorsement of the innovation's hands-on effectiveness.

Furthermore, the innovation was perceived as encouraging experimentation and trial-and-error learning (7.25 ± 2.43), supporting contemporary educational models that prioritize active, student-centered learning environments.

The overall section mean of 7.86 reflects a strong consensus that such innovations provide valuable, real-world learning experiences—an educational approach increasingly emphasized in recent pedagogical frameworks (Espina & Villanueva, 2023).

Table 12. Perceived Impact of Research Innovation on Entrepreneurial Application in TLE/TVL: Views from Culinary Experts and Food Enthusiasts

	Statements	Mean	SD	Interpretation
1.	The innovation can be developed entrepreneurial thinking and mindset.	8.05	1.36	Strongly Agree
2.	Students can be learned to identify market opportunities for food products.	8.30	1.08	Extremely Agree
3.	Students could understand product development and innovation processes.	6.90	2.73	Agree
4.	Students can be developed marketing and promotional skills.	6.90	2.85	Agree
5.	Students could learn to calculate profit margins and business viability.	7.90	1.41	Strongly Agree
	Section Mean	7.61	1.88	Strongly Agree

Table 12 presents the implications of the research innovation for entrepreneurial application in the TLE/TVL curriculum, as perceived by culinary experts and food enthusiasts.

The findings show a strong consensus on the innovation's potential to enhance entrepreneurial learning outcomes. The highest-rated item, with a mean of 8.30 (± 1.08), suggests that students can "Extremely Agree" that the activity helps them identify market opportunities for food products—a key entrepreneurial competency. Furthermore, respondents "Strongly Agree" that the innovation fosters entrepreneurial thinking and mindset (8.05 ± 1.36) and equips students with the ability to calculate profit margins and assess business viability (7.90 ± 1.41). Although slightly lower, statements related to understanding product development (6.90 ± 2.73) and marketing skills (6.90 ± 2.85) still reflect a positive reception, though with higher variability in responses.

The section mean of 7.61 indicates a general "Strongly Agree" interpretation, underscoring the potential of food-based innovations as effective entrepreneurial learning tools. These results align with current educational trends emphasizing experiential and enterprise-based learning to prepare students for real-world economic participation (Laguador, 2023).

Table 13. Perceived Impact of Research Innovation on Overall Pedagogical Integration in TLE/TVL: Insights from Culinary Experts and Food Enthusiasts

Statements	Mean	SD	Interpretation
1. The three components could be (curriculum, hands-on, entrepreneurial) worked together effectively	7.90	1.29	Strongly Agree
2. The activity could promote 21st-century skills development.	7.95	0.94	Strongly Agree
3. Students can demonstrate improved critical thinking abilities	8.35	0.75	Extremely Agree
Section Mean	8.07	0.77	Strongly Agree

Table 13 provides a comprehensive assessment of the implications of the research innovation for pedagogical integration within the TLE/TVL framework, as perceived by culinary experts and food enthusiasts.

The results show a high level of agreement on the innovation's potential to enhance pedagogy through integrated approaches. The statement "Students can demonstrate improved critical thinking abilities" received the highest mean score (8.35 ± 0.75), interpreted as "Extremely Agree," highlighting the innovation's capacity to foster higher-order thinking skills. This is followed by the belief that the activity promotes 21st-century skills development (7.95 ± 0.94) and that the three major components—curriculum, hands-on learning, and entrepreneurship—can work synergistically (7.90 ± 1.29), both interpreted as "Strongly Agree." The overall section mean of 8.07 with a low standard deviation (± 0.77) further supports the consistency and strength of positive perceptions. These findings align with recent educational paradigms emphasizing integrated, experiential learning to promote cognitive and practical competencies vital for modern learners (Bernardo & Dumlaog, 2023).

Table 14. "Perceived Impact of Research Innovation on TLE/TVL Pedagogy: An Overall Assessment by Culinary Experts and Food Enthusiasts"

Statements	Mean	SD	Interpretation
1. Overall, I am satisfied with the Ginstevalin Leche Flan innovation.	8.25	1.12	Extremely Agree
2. The innovation could contribute positively to TLE education	8.05	1.05	Strongly Agree
3. I would participate in similar innovative ventures.	7.95	1.67	Strongly Agree
Section Mean	8.08	1.28	Strongly Agree

Table 14 presents the overall assessment of the research innovation—specifically the *Ginstevalin* Leche Flan innovation—as perceived by culinary experts and food enthusiasts in the context of TLE/TVL education.

The results show a very positive reception, with the highest mean score (8.25 ± 1.12) for the statement “Overall, I am satisfied with the Ginstevulin Leche Flan innovation,” interpreted as “Extremely Agree.” This indicates a strong sense of satisfaction among evaluators. Additionally, the innovation was perceived to contribute positively to TLE education (8.05 ± 1.05) and encouraged participants' willingness to engage in similar innovations (7.95 ± 1.67), both receiving the interpretation of “Strongly Agree.” The section mean of 8.08 affirms the innovation’s pedagogical value and acceptability, suggesting that integrating creative food innovations can serve as effective tools in enhancing engagement and practical learning in technical-vocational contexts. These results are consistent with recent findings that highlight the effectiveness of contextualized innovations in vocational education for promoting learner motivation and curriculum relevance (Reyes & Santos, 2023).

Table 15. Summary on the Implications of the Research Innovation for the Pedagogical Application in TLE/TVL as Perceived by the Culinary Experts and Food Enthusiasts

Indicators	Mean	SD	Interpretation
1. Curriculum Enhancement	7.49	1.92	Strongly Agree
2. Hands-on Learning	7.86	1.75	Strongly Agree
3. Entrepreneurial Application	7.61	1.88	Strongly Agree
4. Overall Pedagogical Integration Assessment	8.07	0.99	Strongly Agree
5. Overall Assessment	8.08	1.28	Strongly Agree
Grand Mean	7.61	1.88	Strongly Agree

Table 15 summarizes the implications of the research innovation for pedagogical application in TLE/TVL as evaluated by culinary experts and food enthusiasts.

The results consistently reflect a high level of agreement across all indicators, with mean scores ranging from 7.49 to 8.08 and all interpreted as “Strongly Agree.” The highest mean score was found in the “Overall Assessment” (8.08 ± 1.28), closely followed by “Overall Pedagogical Integration Assessment” (8.07 ± 0.99), indicating a strong perceived effectiveness of the innovation in both holistic evaluation and integrated pedagogy. “Hands-on Learning” also scored notably high (7.86 ± 1.75), underscoring the importance of experiential and practical activities in vocational education. While “Curriculum Enhancement” (7.49 ± 1.92) received the lowest mean, it still reflected a positive perception, signifying the innovation’s potential to support learning outcomes within existing curricular frameworks. The overall grand mean of 7.61 affirms a robust consensus on the innovation's educational value.

These findings echo recent literature emphasizing the role of localized, experiential innovations in enhancing learner engagement and contextual relevance in technical-vocational education (Domingo & Javier, 2024).

Conclusion

The findings reveal that functional variants of leche flan incorporating ingredients like stevia, insulin, ginger, and Ginstevulin are generally well accepted by consumers.

The Stevia Leche Flan stood out as the most favorable in all sensory categories, suggesting stevia's compatibility as a sugar substitute in traditional desserts. Meanwhile, Ginstevulin Leche Flan, although moderately liked, showed promise, particularly in taste and texture, and was perceived as a natural and occasion-suitable product. The data further confirm that sensory appeal—especially texture and flavor—strongly influences overall product acceptability, even in health-focused innovations. These outcomes support current literature emphasizing that the success of functional foods relies on striking a balance between health benefits and pleasurable eating experiences (Martins et al., 2023; Fernandes et al., 2023).

The study confirms that the Ginstevulin Leche Flan innovation is a highly effective pedagogical tool for enhancing the TLE/TVL curriculum. It supports multiple learning goals: from developing hands-on technical competencies and entrepreneurial thinking to encouraging critical reflection and real-world problem-solving. The consistently high ratings across all evaluated categories suggest a strong consensus on the educational, experiential, and marketable value of the innovation. These results affirm the role of contextualized, food-based innovations in enriching technical-vocational education and preparing students for both industry and entrepreneurial pathways.

Recommendations

Based on the findings and conclusions drawn in this study, the following recommendations are herein presented:

1. **Refine Ginstevulin Formulation:** Enhance appearance and aroma by adjusting ingredient ratios or presentation to elevate overall sensory impact and consumer appeal.
2. **Testing Across Markets:** Conduct larger-scale acceptability studies across diverse age and dietary groups to further validate sensory and market potential.
3. **Curriculum Integration:** Leverage the Ginstevulin Leche Flan in Technology and Livelihood Education (TLE) classes to teach students about functional food innovation, sensory evaluation, and healthy culinary alternatives.
4. **Use as a Model for Integrative Learning:** Promote the innovation as a template for interdisciplinary TLE learning, combining food technology, entrepreneurship, and life skills education.
5. **Further Research on Long-Term Impact:** Conduct longitudinal studies to assess how participation in innovation-driven projects like this influence's student career readiness, creativity, and entrepreneurial outcomes.

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