International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

Evaluation and Iterative Improvement of a Flowchart-Based Learning Toolkit on Food Safety for TVL Students

Myra D. Campos[1], Lowelyn Q. Estoquia[2]
[1]Graduate School, North Eastern Mindanao State University, Tandag City, Surigao del Sur, Philippines
[2]Graduate School Faculty, North Eastern Mindanao State University, Tandag City, Surigao del Sur, Philippines

Abstract—*This study evaluated and iteratively improved a flowchart-based learning toolkit on food safety and sanitation for Senior High School Technical-Vocational-Livelihood (TVL) students aligned with TESDA Cookery NC II standards. The study employed a descriptive-evaluative research design with developmental components involving evaluation, enhancement, validation, and field try-out phases. Respondents included cookery teachers, master teachers, TESDA personnel, and Grade 11 and Grade 12 TVL Cookery students from selected public senior high schools in Agusan del Sur. Findings revealed that the existing toolkit demonstrated strengths in curriculum alignment, learner appropriateness, clarity, and practical usability, but showed weaknesses in factual accuracy, up-to-date coverage of food safety practices, and logical sequencing of procedures. Based on expert and end-user feedback, the toolkit was enhanced by simplifying steps, adding missing safety protocols, improving visuals, and using durable materials. The enhanced toolkit received Very Strong ratings in validity, acceptability, and perceived usefulness from both experts and students. Results of the field try-out showed a significant increase in student performance, with posttest scores ($M = 29.258$, $SD = 1.317$) exceeding pretest scores ($M = 21.371$, $SD = 4.792$). Statistical analysis revealed a highly significant difference between pretest and posttest scores ($t = 15.16$, $p = 0.000$). The study concludes that the enhanced flowchart-based toolkit is an effective, practical, and learner-centered instructional resource that improves food safety learning and procedural performance among TVL students.*

Keywords—*Cookery NC II; Flowchart-Based Toolkit; Food Safety; Instructional Material Development; TVL; Vocational Education.*

I. Introduction

Food safety is a fundamental competency in Technical-Vocational-Livelihood (TVL) education, particularly in the Cookery specialization where learners are expected to perform food preparation and handling procedures in accordance with industry standards. Proper food safety practices help prevent food contamination, foodborne illnesses, and sanitation-related risks while promoting quality food production. In the Philippine educational setting, the implementation of competency-based learning through the K–12 curriculum and TESDA standards emphasizes the need for instructional materials that effectively support the development of practical skills and procedural knowledge among learners [1], [2].

Despite the availability of learning resources, many students experience difficulties in understanding and applying food safety procedures because instructional materials are often text-heavy and lack clear visual organization. Presenting information in a well-structured and comprehensible manner, visual instructional materials have been shown by studies to enhance students' understanding, retention, and procedural performance [3], [4]. Flowcharts provide step-by-step guidance that helps learners understand sequences, relationships, and decision-making processes involved in food preparation and sanitation practices [5].

The development of instructional materials is supported by the Cognitive Load Theory, Dual Coding Theory, and Multimedia Learning Theory, which explain how learners process information more effectively when verbal and visual elements are integrated. These theories emphasize that well-designed visual materials can reduce cognitive overload, improve knowledge retention, and facilitate meaningful learning experiences [6], [7], [8]. In technical and vocational education, instructional tools that combine text and visuals have been found to enhance learners' performance and increase engagement during skills-based activities [9], [10].

Given these considerations, this study aimed to develop and validate a flowchart-based learning toolkit in food safety for Senior High School TVL Cookery students. Specifically, the study sought to evaluate the toolkit's validity, acceptability, usefulness, and effectiveness in improving learners' performance. The findings are expected to contribute to the improvement of instructional materials and support competency-based learning in TVL education [11], [12].

Furthermore, the use of instructional materials plays a crucial role in enhancing learner engagement and academic performance in technical-vocational education. Studies have shown that contextualized and visually organized learning resources help students better understand concepts and perform tasks accurately by providing clear guidance and reducing learning difficulties [11], [12]. In cookery education, where procedural accuracy and adherence to food safety standards are essential, instructional materials that present information systematically can improve both knowledge acquisition and practical skill development [13].

Recent educational reforms have also emphasized the importance of developing learner-centered and outcomes-based instructional resources that address the diverse learning needs of students. Effective learning materials should not only provide accurate content but also promote active participation, independent learning, and critical thinking skills [14]. Consequently, there is a growing need for innovative instructional tools that align with curriculum standards and support meaningful, competency-based learning experiences in TVL programs [15], [16].

Myra D. Campos and Lowelyn Q. Estoquia, "Evaluation and Iterative Improvement of a Flowchart-Based Learning Toolkit on Food Safety for TVL Students," *International Research Journal of Advanced Engineering and Science*, Volume 11, Issue 2, pp. 91-97, 2026.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

II. Methodology

This study employed a developmental research approach to develop, validate, and evaluate a flowchart-based learning toolkit on food safety for TVL Cookery students. The methodology included toolkit enhancement, expert validation, student evaluation, and field testing to determine its effectiveness.

A. Research Design

The study utilized a descriptive-evaluative and developmental research design. This design enabled the assessment of the existing toolkit, implementation of revisions, and evaluation of the enhanced instructional material through validation and field testing.

B. Respondents of the Study

The respondents included subject-matter experts, master teachers, cookery teachers, TESDA personnel, and TVL Cookery students from selected public secondary schools. Experts and teachers evaluated the toolkit, while students participated in the usability evaluation and field try-out activities.

C. Research Instruments

Evaluation instruments adapted from the Department of Education Learning Resource Evaluation Tool were used in the study. These instruments measured the toolkit's validity, acceptability, usefulness, clarity, and content quality, while a researcher-made achievement test assessed student learning outcomes.

D. Data Gathering Procedure

The existing toolkit was initially evaluated to identify areas for improvement. After revision and validation, the enhanced toolkit was implemented in a field trial, with pretest and posttest assessments to evaluate its effectiveness.

E. Statistical Treatment of Data

Frequency counts, weighted means, and standard deviations were used to summarize respondents' evaluations of the toolkit. Paired-sample and independent-sample t-tests were employed to determine significant differences in performance and evaluation results at the 0.05 level of significance.

III. Results and Discussion

This section presents and discusses the study's findings based on the gathered data, highlighting key results and their implications for the research objectives.

A. Strengths and Weaknesses of the Existing Flowchart-Based Toolkit

The initial phase of the study involved evaluating the existing flowchart-based learning toolkit for food safety. The evaluation focused on three dimensions: content accuracy and relevance, clarity and comprehensibility, and practicality and usefulness. The purpose of this assessment was to identify the material's strengths and determine areas for improvement prior to enhancement and validation.

TABLE 1. Strengths and weaknesses of the existing flowchart-based toolkit

Dimension	Overall Mean	Adjectival Rating
Content Accuracy and Relevance	2.698	Strong
Clarity and Comprehensibility	2.626	Strong
Practicality and Usefulness	2.748	Strong

Table I shows that the existing flowchart-based toolkit received strong ratings for content accuracy and relevance (M = 2.698), clarity and comprehensibility (M = 2.626), and practicality and usefulness (M = 2.748). These findings indicate that the toolkit generally aligns with curriculum requirements, provides understandable instructions, and supports the practical application of food safety concepts. The result supports the findings of Alon and Dela Cruz, who emphasized that instructional materials aligned with TESDA competencies contribute positively to learners' performance [4]. Likewise, UNESCO stressed that competency-based instructional materials should be relevant to curriculum standards and workplace requirements [51].

The strong rating for clarity and comprehensibility suggests that the flowchart format enabled learners to follow procedures systematically. This finding is consistent with the Dual Coding Theory of Paivio, which explains that combining visual and verbal information enhances understanding and retention [41]. Similarly, Abdullah and Rahman found that visual instructional materials improved recall and task execution among vocational learners [1]. Castillo likewise reported that contextualized visual aids enhanced clarity and task sequencing among Senior High School cookery students [8].

The practicality and usefulness rating indicates that the toolkit supported the application of food safety concepts in actual learning activities. This finding corroborates the work of Dela Cruz and Santos, who found that TESDA-developed instructional toolkits improved classroom instruction and learner engagement [11]. Furthermore, OECD emphasized that vocational instructional resources should facilitate practical skill development and workplace readiness [39].

Despite these strengths, several indicators obtained lower ratings, particularly those related to content accuracy, logical sequencing of procedures, and independent usability. These findings suggest that revisions were necessary to improve instructional effectiveness. Balaba reported similar challenges in implementing instructional materials in SHS cookery programs [7]. Likewise, Domingo and Estrella emphasized that instructional flowcharts require continuous refinement to minimize procedural errors and improve student understanding [16]. Consequently, the identified weaknesses served as the basis for enhancing the toolkit.

B. Extent of Modifications and Enhancement of the Flowchart-Based Learning Toolkit

Following the evaluation of the existing flowchart-based toolkit, several modifications and enhancements were implemented to address the weaknesses identified by subject-matter experts and end-users. The enhancement process focused on improving the instructional quality, visual presentation, content accuracy, and practical usability of the learning material. Table II presents the extent of modifications and enhancements incorporated into the revised toolkit.

Myra D. Campos and Lowelyn Q. Estoquia, "Evaluation and Iterative Improvement of a Flowchart-Based Learning Toolkit on Food Safety for TVL Students," *International Research Journal of Advanced Engineering and Science*, Volume 11, Issue 2, pp. 91-97, 2026.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

TABLE 2. Extent of modifications and enhancements of the flowchart-based learning toolkit

Enhancement Area	Mean	Adjectival Rating
Simplification of Steps	3.034	Very Strong
Addition of Missing Protocols	3.312	Very Strong
Improvement of Visual Elements	3.312	Very Strong
Use of Durable Materials	3.246	Very Strong
Overall Mean	**3.226**	**Very Strong**

Table II shows that the modifications and enhancements implemented in the flowchart-based learning toolkit were rated Very Strong across all dimensions, with an overall mean of 3.226. The highest ratings were obtained by adding missing protocols and improving visual elements (M = 3.312), followed by using durable materials (M = 3.246) and simplifying steps (M = 3.034).

The very strong rating for simplification of steps supports Cognitive Load Theory, which argues that reducing unnecessary complexity allows learners to process information more efficiently [47]. Sweller, van Merriënboer, and Paas further explained that instructional materials become more effective when information is presented in organized and manageable segments [48]. Likewise, Clark and Kimmons noted that reducing cognitive overload improves learner comprehension and retention [10].

The addition of missing food safety protocols received one of the highest ratings. This finding aligns with the recommendations of the World Health Organization and the Food and Agriculture Organization, which emphasize the importance of comprehensive food safety procedures in preventing contamination and foodborne illnesses [58], [20]. Kim, Park, and Lee similarly found that revised food safety training materials improved sanitation compliance and learner outcomes [25].

The improvement of visual elements also received a very strong evaluation. According to Mayer, well-designed visual materials facilitate meaningful learning by helping learners organize and integrate information [29]. Mayer and Fiorella further emphasized that instructional visuals improve engagement and knowledge construction [30]. These findings also support the work of Al-Jubair, Al-Obaidi, and Hassan, who reported that visual instructional materials significantly enhanced food safety education [3].

The use of durable materials obtained a very strong rating, indicating that respondents valued the sustainability and long-term usability of the toolkit. This finding is supported by UNESCO-UNEVOC, which advocates sustainable educational resources in technical-vocational education [54]. Likewise, Ozturk and Cecen emphasized that instructional tools should be designed for repeated classroom use to maximize educational value [40].

C. Expert Evaluation of the Enhanced Flowchart-Based Learning Toolkit

After implementing the identified modifications and enhancements, the revised flowchart-based learning toolkit was evaluated by subject-matter experts. The evaluation focused on three major criteria: validity, acceptability, and perceived usefulness. These dimensions were assessed to determine whether the enhanced toolkit met educational standards and could effectively support food safety instruction among TVL Cookery students.

TABLE 3. Experts' evaluation of the enhanced flowchart-based learning toolkit

Evaluation Criteria	Mean	Adjectival Rating
Validity	3.782	Very Strong
Acceptability	3.873	Very Strong
Perceived Usefulness	3.891	Very Strong
Overall Mean	**3.849**	**Very Strong**

Table III shows that the enhanced flowchart-based learning toolkit received Very Strong ratings from experts for validity (M = 3.782), acceptability (M = 3.873), and perceived usefulness (M = 3.891), with an overall mean of 3.849.

The very strong validity rating indicates that the toolkit met established educational and instructional standards. This finding supports the work of Pascual, who emphasized that instructional materials must undergo rigorous validation to ensure content accuracy and usability [42]. Similarly, Atchison, Garet, and Song stressed that instructional resources should demonstrate alignment with curriculum standards and intended learning outcomes [5]. Odiame further highlighted the importance of curricular validity evaluation in ensuring the effectiveness of contextualized instructional modules [37].

The very strong acceptability rating indicates that experts considered the toolkit appropriate for classroom implementation. According to Inarda, instructional materials aligned with outcomes-based education principles tend to receive high acceptability ratings among educators [23]. Handepi, Ambiyar, and Maksum likewise emphasized that competency-based instructional resources are more likely to be accepted when they support curriculum goals and workplace competencies [22]. UNESCO also stressed that competency-based learning materials should be responsive to educational standards and learner needs [51].

The highest rating was observed in perceived usefulness. This result supports the findings of Kablito and Extension, who found that instructional materials positively influence student achievement and skill acquisition [24]. Similarly, Villagracia, Aninion, and Nepales reported that instructional materials significantly enhance student performance and learning outcomes [57]. OECD further noted that effective instructional resources contribute to workforce readiness and competency development among vocational learners [39].

The consistently high ratings across all criteria indicate that the enhanced toolkit successfully met the expectations of content experts and educational practitioners. These findings confirm that the revisions improved the quality, relevance, and effectiveness of the instructional material, making it suitable for implementation in TVL Cookery programs [22], [42], [57].

D. Students' Evaluation of the Enhanced Flowchart-Based Learning Toolkit

The enhanced flowchart-based learning toolkit was further evaluated by student respondents to assess its validity, acceptability, and perceived usefulness from the perspective of the intended end users. Student evaluation is essential because it provides evidence regarding the practicality and effectiveness

Myra D. Campos and Lowelyn Q. Estoquia, "Evaluation and Iterative Improvement of a Flowchart-Based Learning Toolkit on Food Safety for TVL Students," *International Research Journal of Advanced Engineering and Science*, Volume 11, Issue 2, pp. 91-97, 2026.

of the instructional material in actual learning situations. Table IV presents the students' evaluation of the enhanced toolkit.

TABLE 4: Students' evaluation of the enhanced flowchart-based learning toolkit

Evaluation Criteria	Mean	Adjectival Rating
Validity	3.662	Very Strong
Acceptability	3.745	Very Strong
Perceived Usefulness	3.552	Very Strong
Overall Mean	**3.653**	**Very Strong**

Table IV reveals that the enhanced flowchart-based learning toolkit received Very Strong ratings from the student respondents for validity (M = 3.662), acceptability (M = 3.745), and perceived usefulness (M = 3.552), with an overall mean of 3.653.

The high acceptability rating indicates that students found the toolkit easy to understand, appropriate, and relevant to their learning needs. This finding supports the study of Navarro and Ocampo, who reported positive student perceptions toward contextualized instructional materials in SHS cookery programs [31]. Similarly, Nonato found that redesigned learning materials improved learner engagement and classroom participation [32]. Nguyen and Ha further emphasized that instructional materials become more effective when learners are actively involved in evaluating and refining them [33].

The strong rating for perceived usefulness is consistent with the findings of Nuryakin, Rakotoarizaka, and Musa, who reported that perceived usefulness significantly influences student satisfaction and learning experiences [35]. Ryan and Deci also explained that learners are more motivated when instructional resources support autonomy, competence, and meaningful learning experiences [46]. These findings suggest that students recognized the toolkit as a valuable aid in understanding food safety concepts and procedures.

The validity rating indicates that students perceived the content as accurate, relevant, and aligned with their academic requirements. UNESCO emphasized that learner-centered and contextually relevant educational materials improve engagement and learning outcomes [53]. Likewise, Rabanes and Paglinawan found that the availability and quality of instructional materials positively influence learner engagement and academic performance [44].

Overall, the findings suggest that the enhanced toolkit was highly accepted by its intended users and effectively supported their learning experiences. The results confirm that the enhancement process successfully improved the material's usefulness, relevance, and educational value [31], [35], [53].

E. Effectiveness of the Enhanced Flowchart-Based Learning Toolkit Based on Pretest and Posttest Results

To determine the effectiveness of the enhanced flowchart-based learning toolkit, a field try-out was conducted among TVL students. The students were given a pretest before exposure to the instructional material and a posttest after the implementation of the enhanced toolkit. The results are presented in Table V.

Table V presents the pretest and posttest results of students who participated in the field try-out of the enhanced flowchart-based learning toolkit. The results show that the mean score increased from 21.371 during the pretest to 29.258 during the posttest. This increase indicates that students demonstrated improved knowledge and understanding of food safety concepts and procedures after utilizing the enhanced instructional material.

TABLE 5. Pretest and posttest results during the field try-out of the enhanced flowchart-based learning toolkit

Group	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD
Field Try-out of the Toolkit	21.371	4.792	29.258	1.317

The increase in scores indicates that students gained knowledge and understanding after using the enhanced toolkit. This finding is consistent with Mayer's Multimedia Learning Theory, which explains that learners understand information more effectively when verbal and visual elements are integrated [29]. Similarly, Abdullah and Rahman found that visual instructional materials significantly improved learners' recall and task performance in vocational education settings [1]. Paivio's Dual Coding Theory further explains that combining textual and visual representations strengthens memory retention and comprehension [41].

The decrease in standard deviation from 4.792 to 1.317 suggests more consistent student performance after exposure to the toolkit. This finding supports the work of Kirschner and van Merriënboer, who argued that structured instructional design promotes uniform learning outcomes among learners [26]. Likewise, Castro-Alonso, Koning, Fiorella, and Paas emphasized that well-designed instructional materials reduce cognitive burden and improve learning consistency [9]. Sweller and colleagues further explained that organized instructional materials facilitate efficient information processing and reduce unnecessary cognitive load [48].

The findings further support the study of Valerio and Accad, who found that TVL instructional interventions contribute positively to academic success, vocational competency development, and learner performance [56]. Moreover, Villaforta and Arnado highlighted that effective instructional materials strengthen students' mastery of competencies and improve learning outcomes in Technical-Vocational education [59]. Therefore, the enhanced toolkit effectively facilitated learning and improved students' academic achievement in food safety education.

F. Significant Difference Between Students' Pretest and Posttest Scores During the Field Try-out of the Toolkit

To determine whether the observed improvement in students' performance was statistically significant, a paired-samples t-test was conducted to compare pretest and posttest scores obtained during the field try-out of the enhanced flowchart-based learning toolkit. The results are presented in Table VI.

Table VI presents the results of the paired-sample t-test conducted to determine whether a significant difference existed between the students' pretest and posttest scores during the field try-out of the enhanced flowchart-based learning toolkit. The

computed t-value of 15.16 and p-value of 0.000 indicate a statistically significant difference at the 0.05 level of significance. Therefore, the null hypothesis was rejected.

TABLE 6. Significance difference between students' pretest and posttest scores during the field try-out of the toolkit

Source of Variation	Computed t	p-value	Decision	Conclusion
Pretest and Posttest Scores	15.16	0.000	Reject Ho	Highly Significant

The findings confirm that the improvement observed in students' posttest scores was not due to chance but was associated with the implementation of the enhanced flowchart-based learning toolkit. This finding supports the study of Ramos and Dizon, who reported that structured food safety instruction significantly improved students' compliance with sanitation protocols and food safety practices [45]. Similarly, Kim, Park, and Lee found that revised food safety instructional materials contributed to better learner outcomes and increased sanitation compliance [25].

The significant increase in student performance also supports the principles of Multimedia Learning Theory, which state that instructional materials that integrate visual and textual information improve learning effectiveness [29]. Mayer and Fiorella emphasized that instructional materials incorporating effective visual and organizational strategies produce significant gains in learning achievement and knowledge retention [30]. Likewise, Pharmer and colleagues found that simplified and adaptive instructional approaches improve learning efficiency by reducing unnecessary cognitive demands on learners [43].

The results provide strong evidence that the enhanced toolkit served as an effective instructional intervention. The visual organization, logical sequencing of procedures, and improved content presentation likely contributed to better comprehension and learning outcomes among TVL Cookery students. Thus, the enhanced toolkit significantly improved students' academic performance and food safety competency [25], [45].

G. Significant Difference in the Evaluation of the Enhanced Flowchart-Based Learning Toolkit as Perceived by the Groups of Respondents

To determine whether differences existed in the evaluation of the enhanced flowchart-based learning toolkit among the respondent groups, statistical tests were conducted on the dimensions of validity, acceptability, and perceived usefulness. The results are presented in Table VII.

TABLE 7. Significant difference in the evaluation of the enhanced flowchart-based learning toolkit as perceived by the groups of respondents

Evaluation Dimension	Computed t	p-value	Decision	Conclusion
Validity	0.100	0.909	Fail to Reject Ho	Not Significant
Acceptability	0.330	0.727	Fail to Reject Ho	Not Significant
Perceived Usefulness	0.400	0.684	Fail to Reject Ho	Not Significant

Table VII presents the results of the statistical test conducted to determine whether significant differences existed in the evaluation of the enhanced flowchart-based learning toolkit among the respondent groups. The obtained p-values for validity (0.909), acceptability (0.727), and perceived usefulness (0.684) were all greater than the 0.05 level of significance. Consequently, the null hypothesis was not rejected, indicating that no significant differences existed among the respondents' evaluations.

This finding suggests a high level of agreement among evaluators regarding the quality and effectiveness of the enhanced toolkit. According to Aiken, strong agreement among evaluators strengthens the validity and reliability of instructional materials [2]. Similarly, Pascual emphasized that consistent evaluations across stakeholder groups indicate the quality, usability, and effectiveness of educational resources [42]. Atchison, Garet, and Song likewise stressed that instructional materials demonstrating alignment with educational standards tend to receive consistent ratings from evaluators [5].

The result also supports UNESCO-UNEVOC, which emphasized that successful TVET instructional materials should be acceptable to both experts and learners while addressing educational and industry needs [55]. Furthermore, OECD noted that educational resources demonstrating consistency across user groups are more likely to be effective in vocational education settings and competency-based learning environments [38]. Ozturk and Cecen similarly reported that participatory evaluation processes often result in shared perceptions regarding the usefulness and effectiveness of instructional tools [40].

The absence of significant differences further demonstrates that the enhancement process successfully addressed the needs of various stakeholders involved in food safety education. The findings support the suitability of the enhanced flowchart-based learning toolkit for use in TVL Cookery instruction and confirm its potential as a valuable resource for improving food safety learning outcomes [40], [42], [55].

IV. Conclusion

The study evaluated and iteratively improved a flowchart-based learning toolkit on food safety for TVL Cookery students, identifying strengths in content relevance, clarity, and practical application while highlighting areas for improvement in content accuracy, procedural sequencing, and independent usability. Guided by these findings, the enhancement process significantly improved the toolkit's content, visual presentation, procedural organization, and durability. The enhanced toolkit was rated Very Strong by both experts and students for validity, acceptability, and usefulness, indicating alignment with educational standards and learner needs. Furthermore, the field try-out revealed a significant improvement in students' posttest performance, confirming the toolkit's effectiveness as a reliable instructional resource for strengthening food safety competencies among TVL Cookery students.

V. Recommendations

Based on the study's findings, it is recommended that the enhanced flowchart-based learning toolkit be adopted and integrated into TVL Cookery classroom and laboratory instruction to strengthen students' understanding and application of food safety concepts and procedures through clear, sequential, and visually guided learning. Teachers should be encouraged and provided with appropriate orientation and training to ensure the effective and consistent use of the toolkit, particularly in competency-based instruction in sanitation, food handling, and practical cookery. School administrators, curriculum implementers, and technical-vocational education stakeholders should support its dissemination and implementation to improve instructional delivery and learner performance. Furthermore, the toolkit should be regularly reviewed and enhanced to ensure its continued relevance, accuracy, and alignment with current industry standards and educational requirements. Future studies involving larger populations and diverse educational settings are recommended to further validate its effectiveness and applicability across other technical-vocational specializations.

Acknowledgment

The authors would like to express their sincere gratitude to the administrators, teachers, experts, and students who participated in this study. Special appreciation is extended to North Eastern Mindanao State University for its academic support and guidance throughout the research. The authors also thank their families and colleagues for their encouragement and assistance in completing this study.

References

[1] Abdullah, N., & Rahman, S. (2022). Dual-coding visuals for culinary procedures: Effects on recall and task execution. *Journal of Technical and Vocational Education, 14*(3), 112–129.
[2] Aiken, L. R. (1985). Three coefficients for analyzing the reliability and validity of ratings. *Educational and Psychological Measurement, 45*(1), 131–142.
[3] Al-Jubair, M., Al-Obaidi, F., & Hassan, S. (2022). Enhancing food-safety education through visual instructional materials. *Journal of Food Hygiene, 34*(2), 101–112.
[4] Alon, M. R., & Dela Cruz, J. P. (2021). Localizing SHS cookery content to TESDA NC II standards: Effects on performance. *Philippine Journal of TVET Research, 7*(1), 33–47.
[5] Atchison, D., Garet, M., & Song, M. (2022). The validity of measures of instructional alignment with state standards based on surveyed enacted curriculum.
[6] Bacia, M. (2024). Role of instructional materials in students' academic performance.
[7] Balaba, R. A. (2022). Challenges in implementing TESDA modules in Senior High School cookery. *Philippine Journal of Technical Education, 28*(1), 45–59.
[8] Castillo, J. M. (2021). Contextualized visual aids in Senior High School cookery classes: Effects on clarity and task sequencing. *Philippine Journal of Home Economics, 15*(2), 67–78.
[9] Castro-Alonso, J., Koning, B., Fiorella, L., & Paas, F. (2021). Five strategies for optimizing instructional materials: Instructor- and learner-managed cognitive load.
[10] Clark, C., & Kimmons, R. (2023). Cognitive Load Theory.
[11] Dela Cruz, M. A., & Santos, P. B. (2022). Evaluating TESDA-developed toolkits: Implications for SHS food-safety instruction. *Asian Journal of Vocational Studies, 9*(1), 88–99.
[12] Department of Education. (2012). *DepEd Order No. 31, s. 2012: Policy guidelines on the implementation of Grades 1 to 10 of the K to 12 Basic Education Curriculum.*
[13] Department of Education. (2015). *DepEd Order No. 8, s. 2015: Policy guidelines on classroom assessment for the K to 12 Basic Education Program.*
[14] Department of Education. (2017). *DepEd Order No. 42, s. 2017: National adoption and implementation of the Philippine Professional Standards for Teachers (PPST).*
[15] Department of Education. (2022). *DepEd Order No. 54, s. 2022.*
[16] Domingo, A. L., & Estrella, C. R. (2021). Reducing food-safety errors through simplified visual flowcharts in school laboratories. *Philippine Educational Research Review, 13*(1), 120–134.
[17] Dunn, O. J. (1964). Multiple comparisons using rank sums. *Technometrics, 6*(3), 241–252.
[18] Fiorella, L., & Mayer, R. (2015). *Learning as a Generative Activity: Eight Learning Strategies that Promote Understanding.*
[19] Food and Agriculture Organization. (2021). *The Future of Food Safety: Transforming Knowledge into Action.*
[20] Food and Agriculture Organization. (2022). *Food Safety and Quality.*
[21] Games, P. A., & Howell, J. F. (1976). Pairwise multiple comparison procedures with unequal Ns and/or variances. *Journal of Educational Statistics, 1*(2), 113–125.
[22] Handepi, N., Ambiyar, & Maksum, H. (2026). Kurikulum berbasis kompetensi pada TVET: Tinjauan sistematis tentang desain, implementasi, dan evaluasi CBE/OBE.
[23] Inarda, A. (2023). Promoting outcomes-based instructional materials: Testing the effectiveness of print modules for business students.
[24] Kabilito, J., & Extension, K. (2024). The influence of instructional materials on students' academic achievement.
[25] Kim, S., Park, J., & Lee, H. (2021). Revising food-safety training materials: Effects on sanitation compliance and learner outcomes. *International Journal of Hospitality Management, 94*, 102813.
[26] Kirschner, P. A., & van Merriënboer, J. J. G. (2020). *Ten Steps to Complex Learning: A Systematic Approach to Four-Component Instructional Design* (3rd ed.).
[27] Li, Y., Leong, W., & Zhang, H. (2025). Innovative teaching practice in vocational education using smart technology.
[28] Mañanita, M. C. (2021). Adequacy and utilization of tools and equipment and students' performance in technical vocational and livelihood education.
[29] Mayer, R. E. (2021). *Multimedia Learning* (3rd ed.).
[30] Mayer, R. E., & Fiorella, L. (2021). *Learning as a Generative Activity: Eight Learning Strategies that Promote Understanding* (2nd ed.).
[31] Navarro, F. J., & Ocampo, R. V. (2023). Teacher and student perceptions of contextualized instructional materials in SHS cookery. *Philippine Journal of Educational Development, 21*(2), 55–70.
[32] Nonato, M. C. M. (2024). Redesigned learning material model in TLE.
[33] Nguyen, T. T., & Ha, L. P. (2022). User feedback and iterative refinement in vocational education materials. *International Review of Vocational Education, 17*(4), 233–248.
[34] Nikolopoulou, K. (2023). What is purposive sampling?
[35] Nuryakin, N., Rakotoarizaka, N., & Musa, H. (2023). The effect of perceived usefulness and perceived ease of use on student satisfaction.
[36] Ocampo, R. S., & Gamboa, K. L. (2022). Laminated charts and workflow signage in SHS cookery labs: A cost–benefit view. *Journal of Philippine Home Economics Education, 10*(1), 41–53.
[37] Odiame, I. (2025). Development and curricular validity evaluation of a contextualized instructional module in food processing, packaging and labeling.
[38] OECD. (2021). Directorate for Education and Skills.
[39] Organisation for Economic Co-operation and Development. (2020). *Building Future-Ready Vocational Education and Training Systems.*
[40] Ozturk, A., & Cecen, A. (2023). Participatory evaluation of instructional tools in technical and vocational education. *Journal of Educational Improvement, 29*(1), 78–96.
[41] Paivio, A. (1986). *Mental Representations: A Dual Coding Approach.*
[42] Pascual, J. R. (2024). Validating culinary learning aids: Content validity indices and usability evidence. *Asian Journal of Home Economics, 2*(1), 25–39.
[43] Pharmer, R., Wickens, C., Plabst, L., Clegg, B., Hirshfield, L., Lewis, J., Nicoly, J., Spencer, C., & Ortega, F. (2025). *The impact of simple, brief,*

and adaptive instructions within virtual reality training: Components of cognitive load theory in an assembly task. arXiv.
[44] Rabanes, L., & Paglinawan, J. (2025). *Instructional materials availability and learner engagement in science.*
[45] Ramos, J. D., & Dizon, K. L. (2020). Compliance with sanitation protocols among Senior High School cookery students. *Philippine Journal of Technical and Vocational Research, 12*(2), 102–115.
[46] Ryan, R., & Deci, E. (2020). *Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions.*
[47] Sweller, J. (1994). Cognitive load theory, learning difficulty, and instructional design. *Learning and Instruction, 4*(4), 295–312. https://doi.org/10.1016/0959-4752(94)90003-5
[48] Sweller, J., van Merriënboer, J. J. G., & Paas, F. (2019). Cognitive architecture and instructional design: 20 years later. *Educational Psychology Review, 31*(2), 261–292.
[49] Technical Education and Skills Development Authority. (2019). *Cookery NC II: Training regulations*. TESDA.
[50] UNESCO. (2021). *Reimagining our futures together: A new social contract for education*. UNESCO.
[51] UNESCO. (2023a). *Designing effective learning materials for competency-based education and training*. UNESCO.
[52] UNESCO. (2023b). *Global Education Monitoring Report 2023: Technology in education—A tool on whose terms?* UNESCO.
[53] UNESCO. (2024). *What you need to know about digital learning and transformation of education*. UNESCO.
[54] UNESCO-UNEVOC. (2021). *Guidelines for sustainable and inclusive TVET resources*. UNESCO-UNEVOC.
[55] UNESCO-UNEVOC. (2023). *UNESCO-UNEVOC International Centre for TVET*. UNESCO-UNEVOC.
[56] Valerio, E., & Accad, A. (2025). *Assessing the influence of the Technical Vocational Livelihood (TVL) program on student academic success, career opportunities, and vocational competency.*
[57] Villagracia, M. F. G., Aninion, M. C., & Nepales, R. A. L. (2024). Utilization of instructional materials in enhancing midterm performance of first-year BEED students. *International Journal on Management Education and Emerging Technology, 2*(4), 12–21.
[58] World Health Organization. (2021). *Five keys to safer food manual* (3rd ed.). World Health Organization.
[59] World Health Organization. (2022). *Food safety*. World Health Organization.
[60] World Health Organization. (2023). *Food safety*. World Health Organization.