engineering proceedings

MDPI

Proceeding Paper

Experts' Evaluation of Instructional Material in Fundamentals of Food Processing for Technology and Livelihood Education †

Julanie M. Limen *, Jayve G. Monton, Mary Grace C. Borja and Gladiole B. Morada

Department of Teacher Education, College of Industrial Technology and Teacher Education, Caraga State University Cabadbaran Campus, Cabadbaran City 8605, Philippines; jayvemonton@gmail.com (J.G.M.); marygracecorpuzborja25@gmail.com (M.G.C.B.); moradag153@gmail.com (G.B.M.)

* Correspondence: jmlimen@csucc.edu.ph

† Presented at the 8th International Global Conference Series on ICT Integration in Technical Education & Smart Society, Aizuwakamatsu City, Japan, 20–26 January 2026.

Abstract

This study focuses on the design and development of instructional materials tailored for the subject fundamentals of food processing, with the primary objective of equipping students with foundational knowledge and practical competencies essential to understanding core concepts and principles within the discipline. The instructional content was purposefully crafted to align with established course learning outcomes and the broader curricular framework. Drawing upon contemporary research and pedagogical best practices, the materials were customized to address the specific academic needs, interests, and learning preferences of students. Emphasis was placed on interactivity and inclusivity, with the integration of varied media formats to support diverse learning styles and enhance accessibility. The expert's evaluation of the instructional materials is based on the three criteria: content, organization and structure, and support for learning. Overall, the instructional material has a mean of 3.71, with a verbal interpretation of high evidence and a standard deviation of 0.11, indicating high reliability. The highest mean score is 3.79 for the content category. This indicates that the instructional material is highly effective in aligning with course requirements, currently accurate, and bias-free. The lowest mean score is 3.67 on organization structure and support for learning. These scores suggest that while these areas are well regarded, they have certain aspects that could be further improved. Moreover, the materials must exhibit flexibility and adaptability to accommodate various teaching methodologies. They should seamlessly integrate with various instructional strategies, including project-based learning, problem-based learning, and hands-on activities. This versatility ensures that educators can employ diverse approaches to cater to their students' needs and learning preferences.

Keywords: instructional material; industrial; technology; education; inclusive; Mindanao

Academic Editors: Debopriyo Roy, George Fragulis and Peter Ilic

Published: 12 June 2026

1. Introduction

Instructional materials for creating successful learning experiences in the ever-changing world of modern education cannot be emphasized. It is becoming increasingly necessary to have well-designed, engaging, and helpful teaching materials so researchers can explore the worlds of culinary arts and basic food processing. In the presented publication, an attempt was made to substantiate the unique aspects of a modern engineer-pedagogue's professional training when utilizing pedagogical design in professional activi-

ties. The article aims to substantiate the fundamentals of preparing upcoming engineers-pedagogues in food processing for pedagogical design in professional activities [1].

Food science, nutrition, and basic food processing are only a few fields of study represented in the domains of foods and fundamental processing. These fields also showcase the meeting point of traditional handicrafts and state-of-the-art advancements. A careful fusion of educational psychology, design thinking, and in-depth topic knowledge is needed to create educational resources that learners in these areas can relate to. This study aims to explore the complex process of creating educational resources that not only transmit information but also ignite a desire for learning and creativity.

In order to find chances for improvement, the researchers will assess the state of instructional materials in food and food processing education through the utilization of cutting-edge educational food processing and well-established instructional design theories. This study will provide helpful frameworks and insights for curriculum authors and educators in the food and basic food processing domains. It helps educators equip themselves with the knowledge and skills necessary to help students thrive in a rapidly changing global environment by thoroughly exploring effective instructional material design.

Food processing—which encompasses various engineering and scientific concepts—is essential to ensure food security, safety, and quality in the modern world [2]. In this regard, information and communication technologies (ICTs) are crucial because they make it easier to distribute safe and high-quality food [2]. To ensure the supply of safe and healthy products and understand food components, food science incorporates several scientific domains [3]. Moreover, food safety and quality are greatly impacted by the employment of modern food processing, such as food preservation and storage techniques [4]. In order to fulfill the growing demands for sustainable food production, these findings highlight the significance of high-quality educational materials in this area. The food sector has experienced a substantial impact from a variety of food processing [5], focusing on newly developed nonthermal food processing, including high hydrostatic pressure and cold plasma, whereas [6] examines the application of various food processing in food storage, preservation, and trading. Emphasizing the use of both conventional and contemporary technologies produces nutritious convenience foods while increasing their flavor and texture [6]. His historical analysis of the evolution of innovative food processing highlights how these technologies can guarantee food safety while cutting down on processing times and energy expenses [7]. This research highlights how food processing transforms food quality, safety, and health advantages. This study aims to create instructional materials for technology and livelihood education students that cover the fundamentals of food processing. Emphasizing real-world examples, this research offers a practical method for grasping essential concepts.

2. Methodology

ADDIE (Analysis, Design, Development, Implementation, and Evaluation is an ISD family (Instructional System Design) form. It has undergone several changes to become dynamic, iterative, and user-friendly. Other models, such as the Kemp Gustafson Branch and Dick and Carey models, are included in ISD (Instructional System Design).

Figure 1 shows the ADDIE model and the 4A format were combined when creating the instructional materials. The 4A's stand for Activity, Analysis, Abstraction and Application. Activity. Students recollect the topic's related experiences at this level, activating their past knowledge. This could be like brainstorming sessions, board games, etc. Analysis. The students will comprehend their instruction at this point. Students will learn more quickly if they have insights regarding the lessons. Instead of a pure lecture, the instructor will serve as a facilitator. Abstraction. At this point, the students are introduced to a new subject

and can draw connections between what they have learned in class and their personal experiences. Application. In the final section of the 4A's, students use practical exercises to apply what they have learned [8]. They can utilize this to prepare for the future and apply it to actual situations.

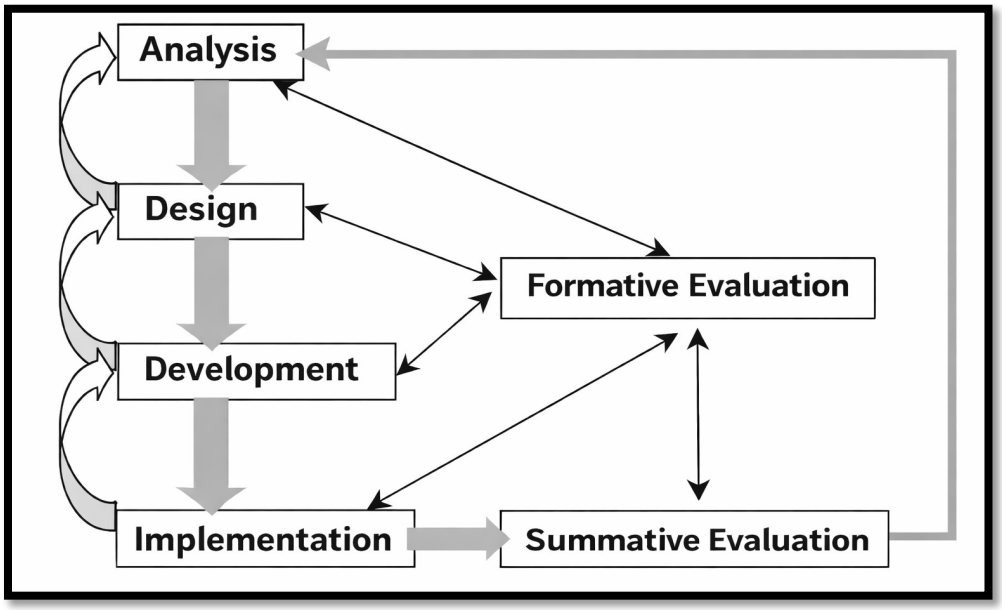


Figure 1. The systematic process of ADDIE instructional development, adapted from Steven J. McGriff [8].

3. Results and Discussion

The instructional development process follows the modified ADDE model—Analysis, Design, Develop, and Evaluate—to ensure a structured and effective approach. Once the learning materials were ready, the critiquing started. The critiquing included the participation of the experts in the field and the use of the Instructional Materials Evaluation Checklist (IMEC). The evaluators then described and commented on the instructional materials. The checklist contains parameters that the evaluator group can check. The following information shows the expert evaluation.

The Table 1 above shows the interpretation scale used in the study provides a clear and systematic approach to analyzing mean scores derived from Likert-scale survey responses. The scale is divided into four distinct ranges: 3.31 to 4.00, which indicates strong evidence, suggesting that respondents strongly agree with the presence, effectiveness, or relevance of a given factor. A mean score within this range reflects a high positive perception or affirmation level. The range of 2.51 to 3.30 is categorized as Enough Evidence, which signifies a moderate level of agreement, indicating that the factor is sufficiently evident but may require further enhancement or validation. Scores between 1.71 and 2.50 are interpreted as Little Evidence, revealing a low level of agreement and suggesting that the factor is weakly observed or inconsistently perceived among respondents. Lastly, the lowest range of 1.00 to 1.70 is classified as Very Little Evidence, indicating minimal support or recognition of the factor. This interpretation scale is a valuable tool for transforming quantitative data into qualitative insights, enhancing the clarity and depth of data analysis in research publications.

Table 1. Scoring and quantification of data for Instructional Materials Evaluation Checklist.

Scale	Interpretation
3.31–4.00	High Evidence
2.51–3.30	Enough Evidence
1.71–2.50	Little Evidence
1.00–1.70	Very Little Evidence

3.1. Analysis Phase

The analysis of instructional learning material starts with the selection of a course for lesson development that is based on the CHED Memorandum (CMO) No. 78, s. 2017, No. 72 series of 2012, otherwise known as "Policies, Standards, and Guidelines for the Bachelor of Technology and Livelihood Education (BTLED)."

Table 2 below shows the final course title, competencies, course lessons, and learning objectives of the web-based learning material.

Table 2. The final lesson content for instructional materials learning.

Chapter	Course Lessons	Intended Learning Outcomes/Learning Objectives (At the End of the Lesson, the Learners Will Be Able to:
I. Basic Concepts of Food Processing and Preservation	Lesson 1: Historical Origin of Food Preservation	• Understand the history and evolution of food industry in the Philippines and globally. • Identify current trends in the Philippines and globally. • Appreciate the historical origin food preservation.
	Lesson 2: Distinguish Food Processing Industries	• Identify the food processing methods. • Appreciate the Food Processing Uniforms & Safety. • Understand what Food Processing Means to the Economy.
	Lesson 3: Different Industrial Activities of Food Industries	• Identify the kinds of drying. • Differentiate the chilling and freezing. • Recognize the Different Industrial Activities of Food Industries. • Discuss the importance of pre-processing.
II. Heat Treatment	Lesson 1: Principles of Heat Preservation, Pasteurization, and Sterilization	• Acquire a deep understanding of the scientific principles underpinning heat transfer, preservation techniques, pasteurization methods, and sterilization processes. • Develop a positive attitude towards the importance of food safety and quality assurance in heat-based processes. • Demonstrate competence in the use of pasteurization, sterilization, preservation, and heat treatment techniques in a practical setting.
	Lesson 2: Canning Equipment	• Acquire comprehensive knowledge about various types of canning equipment, including their features, functions, and optimal usage. • Develop a positive attitude towards the importance of canning equipment in ensuring food safety and quality. • Demonstrate proficiency in operating canning equipment through hands-on practice and skill-building activities.

Table 2. *Cont.*

Chapter	Course Lessons	Intended Learning Outcomes/Learning Objectives (At the End of the Lesson, the Learners Will Be Able to:
II. Heat Treatment	Lesson 3: Containers for Canning	• Describe the types of containers commonly used for canning, including glass jars, metal cans, and plastic containers. • Demonstrate proper techniques for preparing containers for canning, including cleaning, sanitizing, and inspecting for damage. • Develop a sense of responsibility towards following recommended guidelines and procedures for selecting and using containers in canning practices.
	Lesson 4: Steps/Procedures in Canning	• Explain the sequential steps and procedures involved in the canning process, including preparation, processing, and storage. • Execute the correct procedures for processing canned goods using water bath or pressure canning methods, ensuring compliance with recommended processing times and pressures. • Develop a sense of confidence and competence in their ability to carry out the steps of the canning process effectively and efficiently.
III. Food Packaging and Labeling	Lesson 1: Principles of Food Packaging and Labeling	• Understand the Importance of Proper Food Packaging. • Explore International Standards and Regulations. • Appreciate the Role of Packaging in Consumer Education.
	Lesson 2: Types and Properties of Packaging Materials	• Identify the Different Packaging Materials. • Understand the Role of Packaging in Food Preservation. • Evaluate the Environmental Impact of Packaging Materials.
	Lesson 3: Methods of Food Packaging	• Explore Different Food Packaging Techniques. • Understand Modified Atmosphere Packaging (MAP). • Analyze the importance of selecting the right packaging technique and material.
	Lesson 4: Elements of Nutrition label	• Understand the Importance of Nutrition Labels. • Explore Different Types of Labels. • Appreciate the Role of Labels in Consumer Education.
	Lesson 5: Requirements for Labeling a Product	• Understand Regulatory Requirements. • Appreciate Consumer Safety and Transparency. • Promote Consumer Awareness.
	Lesson 6: Laws and Regulations	• Understand Regulatory Framework. • Analyze Labeling Standards. • Apply Knowledge to Real-World Scenarios.

3.2. Design Phase

Lesson Plan. The design of the instructional material was done through lesson planning. The lesson plan provides the necessary outline for the logical arrangement of the lessons in the web-based learning material. The lesson format uses different terminologies, and the sequence of the different sections in the lesson proper is correspondingly equivalent to the Activity, Analysis, Abstraction, and Application used by the Department of Education. Each section in the lesson is further explained as follows:

The Table 3 above shows the design of each lesson follows the 4A's format. The lesson format uses different terminologies, and the sequence of the different sections in the lesson proper is correspondingly equivalent to the Activity, Analysis, Abstraction, and

Application used by the Department of Education. Each section in the lesson is further explained as follows:

Table 3. Lesson format (4A's).

Lesson Format	
Front Page	
Preliminary	4A's
Visualization of Concept	
Lesson Proper	
Intended Learning Outcome	
Pre-Test Activity	Activity
Discussion	Analysis
Check your Progress	Abstraction
Performance Task	Application
Post Test	Assessment

Figure 2 shows the instructional material front page designed with specific elements to boost readability and visual appeal. It utilized a 12-point font size for optimal legibility and chose Times New Roman for its formal and clear appearance. The cover, in a soothing blue color, is visually appealing and likely to attract readers. Each chapter includes pre-tests and post-tests to assess students' prior knowledge and measure their learning progress, ensuring the material is both informative and evaluative.

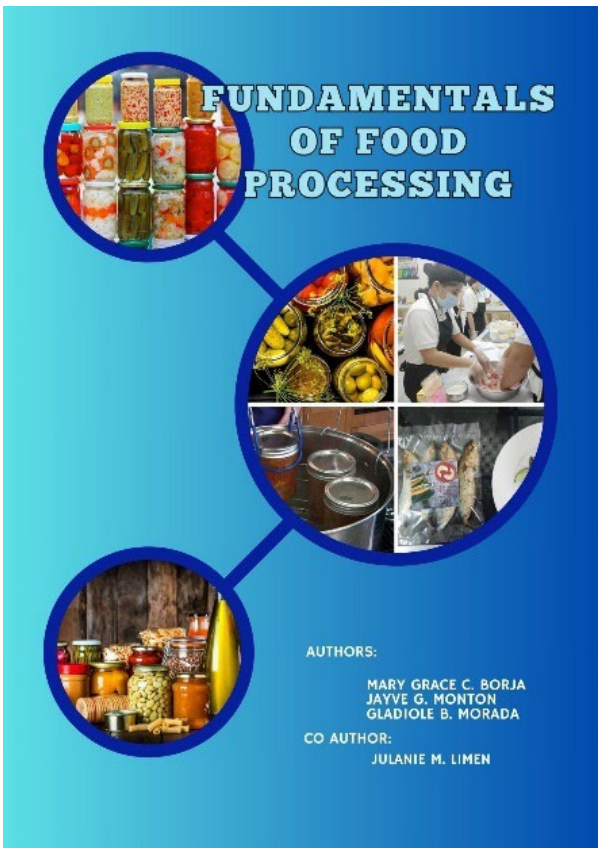


Figure 2. Front page.

3.3. Preliminary

It represents the visual representation of concepts early in the instructional design process to capture and motivate learners to continue with the material.

Figure 3 above shows the Visualization of Concept that includes images familiar to learners that demonstrate the practical applications of the concept within society. This section provides an overview of the concept and acts as the motivational segment of the lesson, engaging students by connecting the material to real-world scenarios.

Figure 3. Visualization of Concept.

3.4. Lesson Proper

It refers to the main part of a lesson where the core content is delivered and the primary instructional activities take place. It is distinct from the preliminary activities such as warm-ups, introductions, or reviews of previous material.

As shown in Figure 4, the **Intended Learning Outcome (ILO)** represents the desired end result that learners are expected to achieve, ideally encompassing the cognitive, affective, and psychomotor learning domains. ILOs begin with the phrase, "At the end of the lesson, 75% of the students shall be able to".

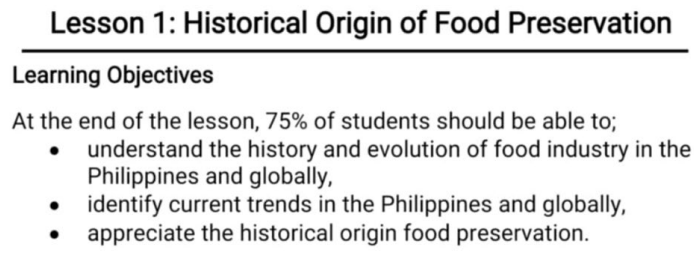
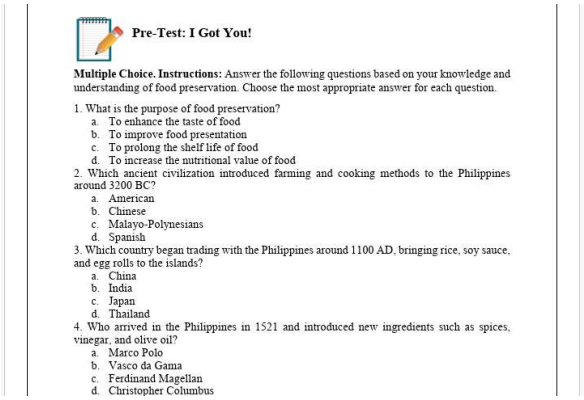


Figure 4. Intended Learning Outcome (ILO).

As shown in Figure 5, Pre-Test is intended to assess learners' existing knowledge and skills before instruction begins. This helps identify their strengths and areas for improvement, allowing instructors to tailor their teaching strategies to meet the learners' needs more effectively.



Pre-Test: I Got You!

Multiple Choice. Instructions: Answer the following questions based on your knowledge and understanding of food preservation. Choose the most appropriate answer for each question.

1. What is the purpose of food preservation?
   a. To enhance the taste of food
   b. To improve food presentation
   c. To prolong the shelf life of food
   d. To increase the nutritional value of food
2. Which ancient civilization introduced farming and cooking methods to the Philippines around 3200 BC?
   a. American
   b. Chinese
   c. Malayo-Polynesians
   d. Spanish
3. Which country began trading with the Philippines around 1100 AD, bringing rice, soy sauce, and egg rolls to the islands?
   a. China
   b. India
   c. Japan
   d. Thailand
4. Who arrived in the Philippines in 1521 and introduced new ingredients such as spices, vinegar, and olive oil?
   a. Marco Polo
   b. Vasco da Gama
   c. Ferdinand Magellan
   d. Christopher Columbus

Figure 5. Pre-Test.

Figure 6 above shows the Discussion (Analysis) that is intended to deepen understanding, encourage critical thinking, and promote active engagement among students. Discussions provide an opportunity for learners to articulate their thoughts, ask questions, and interact with different perspectives, thereby enhancing their comprehension of the subject matter [8].

DISCUSSION

The astonishing fact about food preservation is that it permeated every culture at nearly every moment in time. To survive ancient man had to harness nature. In frozen climates, he froze seal meat on the ice. In tropical climates, he dried foods in the sun. Food by its nature begins to spoil the moment it is harvested. Food preservation enabled ancient man to make roots live in one place and form a community. He no longer had to consume the kill or harvest immediately but could preserve some for later use. Each culture preserved its local food sources using the same basic methods of food preservation.

Drying

Ancient foods were naturally dried by the sun and breeze. There is proof that meals were intentionally dried by Middle Eastern and Eastern societies as early as 12,000 B.C. under the sweltering sun. Subsequent societies produced more artifacts and materials that reflected their respective food sources, which included fish, wild game, domestic animals. Dried fruits and vegetables date back to ancient times. Anything that could be made into dried fruit was especially beloved by the Romans.

Freezing

In the right temperatures, freezing was an obvious preservation technique. Any region with freezing temperatures for even a small portion of the year used those conditions to its advantage to preserve food. The storage periods were extended by using temperatures below freezing. For that reason, chilly streams, tunnels, and cellars were all quite useful.

https://images.app.goo.gl/9es37LhpTQ3YC

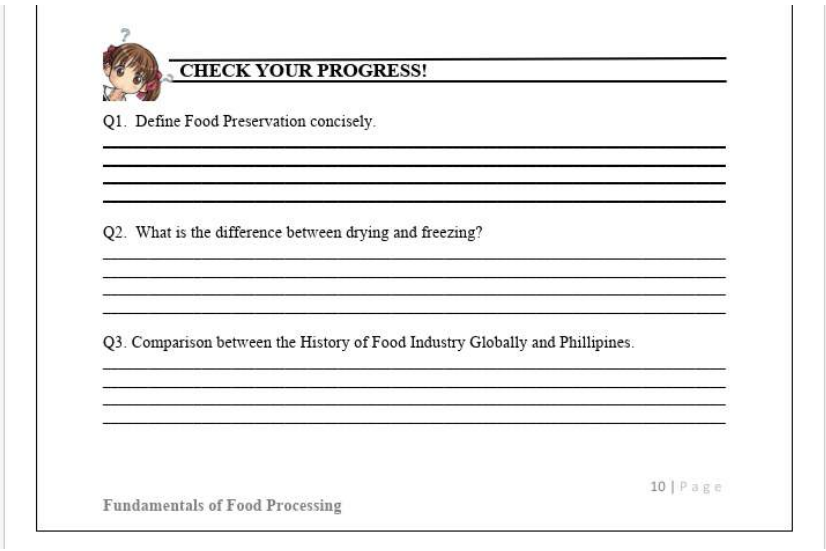
Fermenting

Rather than being created, fermentation was discovered. No doubt finding a few barley grains left in the rain led to the discovery of the first beer. The sugars produced from starch were fermented into alcohol by opportunistic bacteria. The same is true for fruits that are fermented into wine, cabbage that is turned into sauerkraut or Kimchi, and so forth. One important technique for preserving food was fermentation.

Figure 6. Discussion (Analysis).

Figure 7 shows the Check your Progress (Abstraction) consists of posing questions designed to elicit learners' general ideas, descriptions, or statements about the primary concepts of the lesson. This component evaluates how well students grasp the material covered during the discussion.

Figure 8 above shows the Performance Task (Application) is an activity (preferably individual or group work) that is essential for learners to showcase their comprehension and skills effectively, aligning with the intended learning outcomes (ILO). These tasks should encourage creativity and enable students to apply concepts concretely [9].



CHECK YOUR PROGRESS!

Q1. Define Food Preservation concisely.

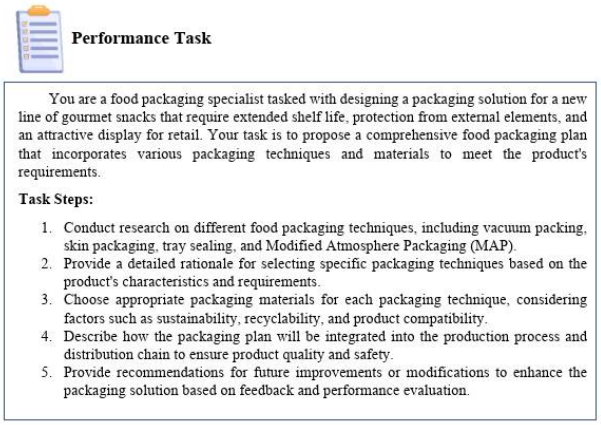
Q2. What is the difference between drying and freezing?

Q3. Comparison between the History of Food Industry Globally and Phillipines.

10 | Page

Fundamentals of Food Processing

Figure 7. Check your Progress (Abstraction).



Performance Task

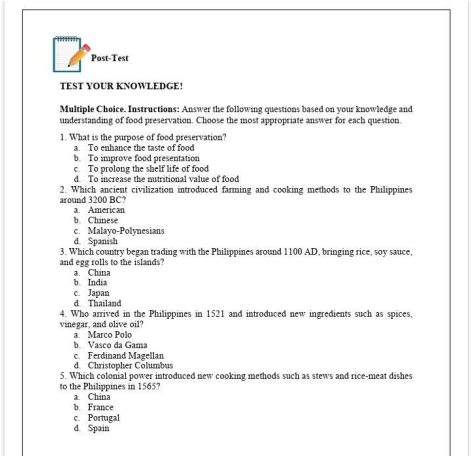
You are a food packaging specialist tasked with designing a packaging solution for a new line of gourmet snacks that require extended shelf life, protection from external elements, and an attractive display for retail. Your task is to propose a comprehensive food packaging plan that incorporates various packaging techniques and materials to meet the product's requirements.

Task Steps:

1. Conduct research on different food packaging techniques, including vacuum packing, skin packaging, tray sealing, and Modified Atmosphere Packaging (MAP).
2. Provide a detailed rationale for selecting specific packaging techniques based on the product's characteristics and requirements.
3. Choose appropriate packaging materials for each packaging technique, considering factors such as sustainability, recyclability, and product compatibility.
4. Describe how the packaging plan will be integrated into the production process and distribution chain to ensure product quality and safety.
5. Provide recommendations for future improvements or modifications to enhance the packaging solution based on feedback and performance evaluation.

Figure 8. Performance Task (Application).

Figure 9 above shows the Post Test (Assessment). This is intended to evaluate the effectiveness of learning and assess the extent to which learners have achieved the intended learning outcomes. According to Chand [10], post-tests provide valuable feedback to both educators and learners, helping to identify areas of strength and areas needing improvement.



Post-Test

TEST YOUR KNOWLEDGE!

Multiple Choice. Instructions: Answer the following questions based on your knowledge and understanding of food preservation. Choose the most appropriate answer for each question.

1. What is the purpose of food preservation?
   a. To enhance the taste of food
   b. To improve food presentation
   c. To prolong the shelf life of food
   d. To increase the nutritional value of food
2. Which ancient civilization introduced farming and cooking methods to the Philippines around 3200 BC?
   a. American
   b. Chinese
   c. Malayo-Polynesians
   d. Spanish
3. Which country began trading with the Philippines around 1100 AD, bringing rice, soy sauce, and egg rolls to the islands?
   a. China
   b. India
   c. Japan
   d. Thailand
4. Who arrived in the Philippines in 1521 and introduced new ingredients such as spices, vinegar, and olive oil?
   a. Marco Polo
   b. Vasco da Gama
   c. Ferdinand Magellan
   d. Christopher Columbus
5. Which colonial power introduced new cooking methods such as stews and rice-meat dishes to the Philippines in 1565?
   a. China
   b. France
   c. Portugal
   d. Spain

Figure 9. Post Test (Assessment).

3.5. Development Phase

The instructional material in the fundamentals of food processing underwent a thorough critique and review, incorporating feedback gathered from stakeholders. Experts in the field meticulously evaluated the lesson, offering insights to improve content, design, organization, and technical aspects of the web-based learning material. Subsequent revisions were implemented in response to these valuable comments and suggestions, ensuring the material's efficacy and quality.

3.6. Evaluation Phase

In this stage, the results and discussion were illustrated in the data representation using the tables, and the interpretation of the gathered inputs from the said participants was evaluated.

The total population of this study is composed of (11) experts in making instructional materials and food technology specialization.

Table 4 shows the expert's evaluation of the instructional materials in terms of their content, with an overall mean of 3.79 with a verbal interpretation of high evidence and a standard deviation of 0.21, which indicates high reliability. Parameters 2 and 5 indicate the highest mean score of 3.91; the criteria regarding the currency, relevance, completeness, and accuracy of content, as well as freedom from gender, social, and cultural bias, received the highest ratings. This suggests that the instructional material is up-to-date and inclusive, reflecting a high standard of educational content. The criterion also concerning the appropriateness of the content difficulty level received the lowest mean of 3.55, although it still falls within the strong evidence category. It might indicate that the student has varying learning paces, and some might find the material too challenging or too easy. A statement aligns with [11] that this variation can be attributed to the Zone of Proximal Development (ZPD) concept, which suggests that learners progress at different rates based on their current capabilities and the support they receive. Differentiation in instruction, as [12] emphasized, is crucial to address these individual differences by providing varied difficulty levels within the instructional materials to meet diverse learning needs. Additionally, it highlights that effective teaching involves understanding and addressing the different stages of learner readiness to optimize educational outcomes.

Table 4. Expert validation of the instructional materials in terms of content.

Content	Standard Deviation	Mean	Verbal Interpretation
1. Does the Content of the instructional material align with the course requirements?	0.40	3.82	High Evidence
2. Is the Content current, up-to-date, relevant, complete, and accurate?	0.30	3.91	High Evidence
3. Is the level of difficulty of Content appropriate for the target end-user in terms of age, abilities, and time/period for teaching?	0.52	3.55	High Evidence
4. Does the Content involve connections to other disciplines and real-life situations or students' socio-cultural environments to promote the deeper meaning of concepts?	0.47	3.73	High Evidence
5. Is IM free of gender, social, and cultural biases?	0.30	3.91	High Evidence
6. Are the ideas expressed in unifying themes?	0.40	3.82	High Evidence
Overall Mean	0.21	3.79	High Evidence

Table 5 shows the experts' evaluation of the instructional material in terms of its organization and structure, with an overall mean of 3.67 with a verbal interpretation of substantial evidence and a standard deviation of 0.43, which indicates high reliability. The highest score regarding ease of use and clarity of instructions is 3.73, suggesting that the instructional material is well designed for students' comprehension and engagement. The slightly low score is 3.64, still within the strong evidence category, about the clarity and appropriateness of lesson objectives, the appeal of the layout and visuals, the logical organization of components, and the integration of ICT opportunities. These areas, while strong, indicate room for improvement to reach higher levels of excellence. According to the study of [13], the effectiveness of instructional materials can be significantly enhanced by focusing on multimedia principles that improve cognitive load management. Additionally, a statement from [14] highlights the importance of integrating technology pedagogically to enrich the learning experience. Improving these aspects can lead to more engaging and effective instructional materials that better meet the diverse needs of learners.

Table 5. Experts' evaluation of the instructional material in terms of organization and structure.

Organization and Structure	Standard Deviation	Mean	Verbal Interpretation
1. Is the material easy for students to use and understand?	0.47	3.73	High Evidence
2. Are the instructions/directions in IM clear and concise?	0.47	3.73	High Evidence
3. Are lesson objectives/outcomes clear and appropriate?	0.67	3.64	High Evidence
4. Is the layout/format, narrative, and visuals of IM interesting and appealing?	0.67	3.64	High Evidence
5. Are the components of IM logically organized, untitled, and consistent?	0.50	3.64	High Evidence
6. Does the IM provide opportunities for students to use ICT?	0.50	3.64	High Evidence
Overall Mean	0.43	3.67	High Evidence

Table 6 shows the expert's evaluation of the instructional materials in terms of their support for learning, with an overall mean of 3.67, a verbal interpretation of substantial evidence, and a standard deviation of 0.32, indicating high reliability. The highest score is the provision of rubrics and opportunities for task-based learning, which is 3.91, suggesting that the instructional materials are well designed to provide precise assessment criteria and practical, hands-on learning experiences; the criterion for promoting collaborative learning received the lowest score, which is 3.36, although it still falls within the high evidence category. This indicates that while collaborative learning is supported, there might be fewer opportunities for group work or cooperative activities compared to other areas. Collaborative learning fosters essential skills such as communication, problem-solving, and critical thinking, which are crucial for student development [15]. The lower score suggests incorporating more structured group activities and cooperative learning strategies within the instructional materials. Enhancing these opportunities can better support student interaction and teamwork, providing more comprehensive learning outcomes.

Table 6. Experts' validation of the instructional material in terms of support to learning.

Support to Learning	Standard Deviation	Mean	Verbal Interpretation
1. Does IM promote collaborative learning?	0.67	3.36	High Evidence
2. Are the learning tasks motivating and engaging to students?	0.69	3.55	High Evidence
3. Does the material involve varied teaching strategies?	0.69	3.55	High Evidence
4. Are assessments of learning appropriate to achieve the intended learning outcome?	0.47	3.73	High Evidence
5. Are rubrics to assess learning provided?	0.30	3.91	High Evidence
6. Does the material present opportunities for task-based learning	0.30	3.91	High Evidence
7. Does the material support self-directed learning?	0.40	3.82	High Evidence
8. Does the IM promote students' critical thinking, creativity, and problem-solving skills?	0.50	3.64	High Evidence
9. Is the IM free from any form of plagiarism? (Sources are appropriately cited)	0.52	3.55	High Evidence
Overall Mean	0.32	3.67	High Evidence

Table 7 summarizes the expert's evaluation of the instructional materials based on the three criteria: content, organization, and structure; support to learning; with an overall mean of 3.71 with a verbal interpretation of high evidence and a standard deviation of 0.11, indicating high reliability. The highest mean score is 3.79 for the content category. This indicates that the instructional material is highly effective in aligning with course requirements, currently accurate, and bias-free. The lowest score is 3.67, shared by the categories of organization and structure and support to learning. These scores suggest that while these areas are well regarded, they might have certain aspects that could be further improved. Research studies from [16,17] state that effective instructional design should not only present accurate and relevant content but also ensure that the organization and structure of the material facilitate easy comprehension and engagement. Improving these aspects could involve refining the layout, enhancing the clarity of objectives, and better integrating opportunities for student interaction and self-directed learning. Such improvements can make instructional materials more user-friendly and supportive. Of diverse learning needs, thereby enhancing overall educational effectiveness.

Table 7. Overall experts' evaluation of the instructional material.

Support to Learning	Standard Deviation	Mean	Verbal Interpretation
Content	0.21	3.79	High Evidence
Organization and Structure	0.43	3.67	High Evidence
Support to Learning	0.32	3.67	High Evidence
Overall Mean	0.11	3.71	High Evidence

Table 8 highlights key feedback on improving instructional materials and the actions taken. The researcher made learning objectives more specific and tasks more engaging, adjusted performance tasks to suit various learner levels, ensured originality through a plagiarism check, and included reliable instructional videos to support teaching. Overall, the researcher responded effectively to enhance the quality and relevance of the materials.

Table 8. Comments and recommendations of the evaluators.

Comments and Recommendations	Actions Taken
Some learning objectives must be specific. Varied activities/tasks must be done to enhance the learners' interest.	The researchers reviewed each learning objective and enhanced the task to be more engaging for students.
The performance tasks are too easy for higher levels but manageable for lower levels.	The researcher created a performance task that is engaging and manageable at different levels.
The instructional material must undergo a plagiarism check.	The researcher already used a plagiarism checker.
Provide instructional videos that one teacher could use during the teaching-learning process.	The researcher added reliable video sites aligned with the topic so teachers could use them during learning.

4. Conclusions

The evaluation of the instructional material in fundamentals of food processing demonstrates that the developed resource meets high standards across content, organization, and support to learning, as confirmed by expert feedback using the Instructional Materials Evaluation Checklist (IMEC). The overall mean score of 3.71 with a low standard deviation of 0.11 indicates strong consistency and reliability in expert responses, classifying the instructional material under the "High Evidence" category. Notably, the content category scored the highest with a mean of 3.79, reflecting its strong alignment with course requirements, accuracy, and inclusivity. However, a notable gap lies in organization structure and support to learning, scoring slightly lower at 3.67. While still within the "High Evidence" range, these aspects require targeted enhancement to maximize the instructional material's impact. Specific concerns were raised about the clarity of objectives, diversity of tasks, and opportunities for collaborative learning. The gap analysis revealed that while the content is comprehensive and current, there is a need for better instructional scaffolding, improved layout design, more specific and varied learning objectives, and the integration of collaborative and technology-enhanced learning activities. These findings align with educational frameworks such as Vygotsky's Zone of Proximal Development and Mayer's Multimedia Learning Theory, emphasizing the importance of learner readiness and cognitive load.

The developed instructional materials demonstrate strong potential to support the teaching of the fundamentals of food processing within a blended learning environment. While the present study primarily focused on the systematic design, development, and expert evaluation of the instructional materials, their applicability in actual classroom settings remains an important consideration for strengthening practical implementation. Preliminary use of the materials in instructional planning indicates that they can facilitate structured lesson delivery, promote learner engagement, and support the achievement of intended learning outcomes. Nevertheless, further classroom-based pilot testing is recommended to examine how the instructional materials function in real teaching and learning contexts. Future implementation involving students and instructors will provide additional evidence regarding their effectiveness, usability, and impact on students' learning experiences in food processing education.

5. Recommendations

The researchers recommend that the developed instructional material for the fundamentals of food processing be utilized by educators as a supportive resource in delivering instruction within a blended learning environment to achieve satisfactory learning out-

comes. Teachers are also encouraged to continuously enhance and refine the material by integrating additional learning activities, appropriate teaching strategies, and relevant real-world contexts to ensure that the intended learning outcomes remain effective and responsive to contemporary developments. Furthermore, educational institutions may adopt the developed and evaluated instructional material as a reference tool to support teaching and learning processes, helping both teachers and students move beyond excessive reliance on recitation and rote memorization toward more meaningful and engaging learning experiences. Finally, future researchers may use the study as a basis for further investigation in the development and design of instructional materials by conducting comprehensive formative and summative evaluations and by collaborating with experts from academic institutions and the food processing industry to further improve and strengthen instructional material development practices.

Author Contributions: Conceptualization, J.M.L., J.G.M., M.G.C.B. and G.B.M.; methodology, J.M.L. and J.G.M.; validation, formal analysis, investigation, resources, writing, J.M.L., J.G.M., M.G.C.B. and G.B.M.; original draft preparation, J.M.L.; writing—review and editing, J.M.L. and J.G.M.; visualization, J.M.L. and J.G.M.; supervision, J.M.L. and J.G.M.; project administration, J.M.L., J.G.M., M.G.C.B. and G.B.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author at jmlimen@csucc.edu.ph.

Acknowledgments: The researchers would like to thank the Research Development and Innovation and Extension Office for its financial support and application of its scholarly works.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Agafonova, S. Features of the approximate basic educational program of higher education in food biotechnology in connection with the updating of the FGOS 3++. In Proceedings of the International Conference SCIENCE ONLINE XXIII: Information Resources, Services and Analytical Systems for Science and Education, Sochi, Russia, 26 September–3 October 2020; pp. 446–448. [CrossRef]
2. Gupta, R. Food Security And Safety Using Advanced Information And Communication Technologies (ICTs). In Proceedings of the Second International Conference on Information and Communication Technology for Competitive Strategies, Udaipur, India, 4–5 March 2016. [CrossRef]
3. Titus, D.; Samuel, E.J.J.; Roopan, S.M. Importance Of Food Science And Technology- Way To Future. In *Bioorganic Phase in Natural Food: An Overview*; Springer International Publishing: Cham, Switzerland, 2018; pp. 11–23. [CrossRef]
4. Lupien, J.R.; Lin, D.X. Contemporary Food Technology and Its Impact on Cuisine. *Asia Pac. J. Clin. Nutr.* **2004**, *13*, 156–161. [PubMed]
5. Knorr, D.; Froehling, A.; Jaeger, H.; Reineke, K.; Schlueter, O.; Schoessler, K. Emerging Technologies in Food Processing. *Annu. Food Sci. Technol. Rev.* **2011**, *2*, 203–235. [CrossRef]
6. Hsieh, Y.H.; Ofori, J.A. Innovations in Food Technology for Health. *Asia Pac. J. Clin. Nutr.* **2007**, *16*, 65–73. [PubMed]
7. Misra, N.; Koubàa, M.; Roohinejad, S.; Juliano, P.; Alpas, H.; Inácio, R.S.; Saraiva, J.A.; Barba, F.J. Landmarks in the Historical Development of Twenty-First Century Food Processing Technologies. *Food Res. Int.* **2017**, *97*, 318–339. [CrossRef] [PubMed]
8. McGriff, S.J. Instructional System Design (ISD): Using the ADDIE Model. Available online: https://snazlan.wordpress.com/wp-content/uploads/2017/03/instructional-system-design-isd-using-the-addie-model.pdf (accessed on 12 June 2026).
9. Abdulbaki, K.; Suhaimi, M.; Alsaqqaf, A.; Jawad, W. The Use of the Discussion Method at University: Enhancement of Teaching and Learning. Available online: https://eric.ed.gov/?id=EJ1200403 (accessed on 20 November 2025).
10. Chand, S.P. Exploring teachers' perceptions, practices, and attitudes towards the use of intended learning outcomes in the classroom. *SAGE Open* **2025**, *15*, 21582440251365751. [CrossRef]

11. Shabani, K.; Khatib, M.; Ebadi, S. Vygotsky's Zone of Proximal Development: Instructional implications and teachers' professional development. *Engl. Lang. Teach.* **2010**, *3*, 237–248. [CrossRef]
12. Langelaan, B.N.; Gaikhorst, L.; Smets, W.; Oostdam, R.J. Differentiating instruction: Understanding the key elements for successful teacher preparation and development. *Teach. Teach. Educ.* **2024**, *140*, 104464. [CrossRef]
13. Ljubojević, M.; Savić, M.; Mijić, D.; Vico, G. Improving the efficiency of multimedia learning and the quality of experience by reducing cognitive load. *Appl. Sci.* **2025**, *15*, 1054. [CrossRef]
14. Kalyani, L.K. The role of Technology in Education: Enhancing learning outcomes and 21st century skills. *Int. J. Sci. Res. Mod. Sci. Technol.* **2024**, *3*, 5–10. [CrossRef]
15. Kausar, F.N. Effect of collaborative learning on students' communication skills and reasoning skills. *Soc. Sci. Rev. Arch.* **2025**, *3*, 2228–2244. [CrossRef]
16. Taskiran, A. Effective, efficient, and attractive instructional design for online learning. In *Handbook of Research on Managing and Designing Online Courses in Synchronous and Asynchronous Environments*; Advances in Mobile and Distance Learning Book Series; IGI Global Scientific Publishing: Palmdale, PA, USA, 2021; pp. 140–158. [CrossRef]
17. Reigeluth, C.M. *Instructional-Design Theories and Models*, 1st ed.; Routledge: New York, NY, USA, 1999.