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Scaffolding Techniques in Teaching TLE: Its Impact on Students' Performance and Knowledge Retention

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Abstract

This study investigated the impact of scaffolding techniques on student performance and knowledge retention in Technology and Livelihood Education (TLE), focusing on the lesson "Prepare and Cook Seafood Dishes." A mixed-methods approach was used at the Abra State Institute of Science and Technology – Laboratory School, combining assessments, observations, and interviews. Scaffolding strategies such as modeling, guided practice, visual aids, peer collaboration, and feedback were integrated into the lessons over several weeks. These techniques were tailored to learners' needs and supported hands-on seafood preparation activities. Findings revealed that scaffolding enhanced students' academic understanding, practical skills, and long-term retention. Learners became more engaged, confident, and independent. The study concludes that scaffolding is a practical approach in TLE, bridging theory and practice, and recommends its continued use across performance-based lessons.

Keywords: Scaffolding Techniques, TLE, Student Performance, Knowledge Retention, Seafood Preparation, Hands-on Learning, Constructivist Approach

1. Rationale

Education in the 21st century is no longer just about memorizing facts. Today's learners need to develop not only academic knowledge but also practical skills they can use in the real world. This is especially true for Technology and Livelihood Education (TLE), where students combine book smarts with hands-on tasks.

Despite how important it is, many students struggle to master tasks, remember what they've learned in the long run, and stay motivated in TLE classes. These problems show we need teaching methods that are more responsive and focused on the students. Scaffolding techniques, which come from Vygotsky's Zone of Proximal Development, are a great solution. By giving students step-by-step guidance—through things like modeling, guided practice, asking questions, and giving feedback—scaffolding slowly helps students become independent while making sure they truly understand and remember the material.

This study is important because it looks at scaffolding where it's most needed: in learning skills. By focusing on the "Prepare and Cook Seafood Dishes" lesson, the research aims to find out how scaffolding can boost performance and improve knowledge retention for Grade 10 students. The results could give teachers practical ideas for improving their TLE lessons and other skill-based subjects.

Background of the Study

Learning is a lifelong journey shaped by both our personal experiences and the quality of our education. Recently, educators have stressed the need for teaching strategies that encourage students to actively participate, think critically, and truly remember what they learn (Fatima, 2024; Gupta, 2022) [12, 15]. One of the most recognized methods is scaffolding, which gives learners temporary support to help them tackle tasks they would otherwise find difficult.

In the Philippines, TLE is a key part of the curriculum because it helps students bridge academic knowledge with practical, job-ready skills. It includes topics like home economics, agriculture, industrial arts, and business, all aimed at helping people become self-sufficient and productive. However, teaching TLE effectively can be a challenge. Students have different learning styles and levels of readiness, and hands-on tasks are complex, so traditional, lecture-based methods aren't enough (Gustems-Carnicer, Calderón, & Calderón-Garrido, 2019) [16].

The lesson "Prepare and Cook Seafood Dishes" is a perfect example of these challenges. It requires students to learn technical skills—like cleaning, preparing, cooking, and plating seafood—while also following food safety rules. Without proper guidance, students might forget or mess up key steps, which would hurt their learning and the quality of their work. Research confirms that scaffolding helps in these situations. Awidi, Paynter, and Evers (2020) [3] found that scaffolding improves both student performance and long-term memory. Similarly, Van de Pol, Volman, and Beishuizen (2020) [23] pointed out that it helps students become more independent and confident, which is crucial for mastering complex procedures. These findings show that scaffolding is highly relevant in TLE, where learning skills step-by-step and remembering them are essential for success.

2. Introduction

When teaching practical subjects like Technology and Livelihood Education (TLE), you need a strategy that helps students perform accurately and remember what they've learned. Traditional teaching methods often just expose students to content without ensuring they can apply that knowledge on their own or remember it later. This is why scaffolding is so important as a structured, student-focused approach.

This study, titled "Scaffolding Techniques in Teaching TLE: Its Impact on Students' Performance and Knowledge Retention," looks at how effective scaffolding is in a Grade 10 TLE classroom. Specifically, it explores how scaffolding techniques help students perform tasks in the "Prepare and Cook Seafood Dishes" lesson and remember the information for future use. By using strategies like teacher modeling, guided practice, questioning, and feedback, scaffolding is expected to bridge the gap between classroom knowledge and hands-on application. The goal is to provide solid evidence of scaffolding's benefits and give educators ideas for teaching practices that lead to meaningful and lasting learning.

Ultimately, this research aims to help improve TLE instruction and, more broadly, to help create lifelong learners who are prepared to contribute productively to society. Education has to keep up with modern learners, who need not only theoretical knowledge but also practical skills to succeed in the real world. In the Philippines, TLE gives students the technical skills they need for work, entrepreneurship, and sustainable living (Department of Education [DepEd], 2016) [11]. However, many students still find it difficult to connect what they learn in theory with practical applications. This shows the need for effective teaching strategies that help students master both knowledge and skills. Scaffolding is a promising approach because it's a teaching technique that gives temporary support until learners can do tasks on their own. Based on Vygotsky's (1978) [24] sociocultural theory, scaffolding lets teachers guide students within their Zone of Proximal Development (ZPD) and slowly remove assistance as they gain mastery. By adapting support to meet students' needs, scaffolding has been shown to improve comprehension, skill acquisition, and learner confidence (Van de Pol, Volman, & Beishuizen, 2010). In hands-on subjects like TLE, scaffolding makes sure students understand the procedures and can apply them effectively in practical tasks. For example, in cooking lessons, scaffolding allows students to watch demonstrations, practice with guided feedback, and eventually perform independently. This study, therefore, aims to see how scaffolding strategies improve both performance and knowledge retention among Grade 10 students, with a focus on preparing and cooking seafood dishes.

3. Theoretical Framework

This study is based on several well-known educational theories that explain how students learn and develop skills with structured guidance. These theories support why we used scaffolding techniques for teaching TLE, especially in hands-on lessons like "Prepare and Cook Seafood Dishes".

One of the most important theories is Lev Vygotsky's Sociocultural Theory (1978) [24], which introduced the idea of the Zone of Proximal Development (ZPD). Vygotsky believed that learners can achieve more with the help of a teacher or a peer than they can on their own. In this sense, scaffolding is the temporary help that lets learners move from their current abilities to a higher level of competence. As they improve, the support is gradually taken away, helping them become more independent and skilled.

Another relevant theory is Jerome Bruner's Scaffolding Theory (1966) [6], which emphasizes that teachers should simplify difficult tasks and slowly hand over responsibility to the students. Bruner compared scaffolding to the temporary support used in construction that is removed once the building can stand on its own. In TLE, this works when teachers first model food preparation techniques and then let students do the tasks on their own.

The Cognitive Apprenticeship Theory by Collins, Brown, and Newman (1989) [9] is also important here. This theory highlights the value of modeling, coaching, and fading as students acquire skills. In TLE classrooms, teachers act as experts who show students how to do things (like cleaning seafood), coach them while they practice, and then gradually reduce their guidance as the students become more competent.

The Constructivist Learning Theory also supports this study by emphasizing that learners build their own knowledge through experience. In TLE, students learn best when they are involved in hands-on activities that connect new information to what they already know. Scaffolding fits this theory by helping learners build their understanding bit by bit and in a meaningful way (Boud & Molloy, 2018) [5].

In addition, John Sweller's Cognitive Load Theory (CLT) shows how scaffolding makes learning more efficient. According to CLT, students can get overwhelmed when faced with complex, multi-step tasks. Scaffolding helps by breaking down tasks into smaller, more manageable steps, so students can focus on important things like food safety, preparation, and cooking methods.

The Collaborative Learning Theory also backs the study, as it highlights that students learn well by working with their peers. In TLE group activities, collaborative scaffolding allows students to share ideas, support each other, and develop both technical and teamwork skills. Research by Gillies and Boyle (2022) [13] confirms that collaborative learning improves not only knowledge but also teamwork and communication.

Finally, Bloom's Revised Taxonomy (Anderson & Krathwohl, 2001) [2] gives a framework for how to structure scaffolded instruction. Teachers can guide students from basic skills like remembering and understanding to more

advanced tasks like analyzing, evaluating, and creating. This gradual process is just like scaffolding and helps students develop skills in a well-rounded way.

Combined, these theories show that scaffolding is more than just a teaching technique; it's a strategic, research-backed method that supports many different aspects of learning. In TLE, scaffolding makes sure students get knowledge and skills in a systematic way—starting with guidance and ending with independence. This framework confirms that scaffolding is relevant for improving both performance and knowledge retention in hands-on lessons like seafood preparation.

Conceptual Framework

The figure below is an illustration of the paradigm of the study.

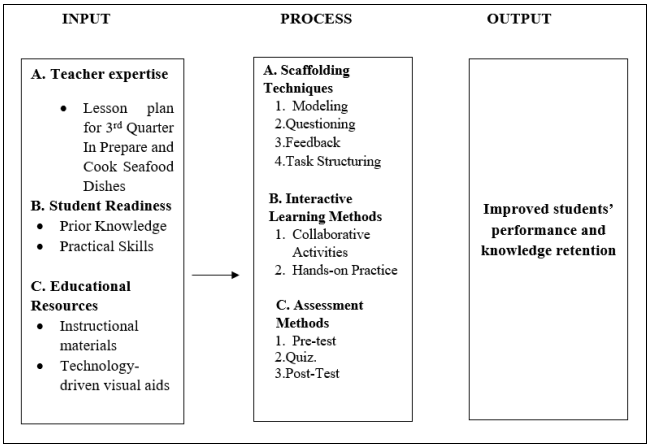

Fig 1: Research Paradigm

This study's model is based on three key things: teacher expertise, student readiness, and educational resources. These three elements work together to create the foundation for effective scaffolding. The process involved using scaffolding strategies like modeling, guided questioning, and constructive feedback, as well as interactive learning activities and assessments. These methods were designed to guide students step by step, improve their understanding, and boost their practical skills. As a result, the expected outcomes were improved student performance and stronger knowledge retention.

4. Objectives / Statement of the Problem

This study aimed to evaluate the impact of scaffolding techniques on academic performance regarding knowledge retention of Grade 10-B students in Technical and Livelihood Education (TLE).

Specifically, it aimed to address the following:

1. What is the influence of Scaffolding Techniques in Grade 10B students' performance and knowledge retention in TLE Subject?
2. Which Scaffolding Techniques are the most effective in improving students' performance and knowledge retention of Grade 10B students in TLE?
3. Is there a significant difference between the Pre-test and Post-test of the students in implementing Scaffolding Techniques?
4. Is there a significant difference between the students' performance and knowledge retention in the Scaffolding Techniques outputs?

5. Significance of the Study

This study is important because it explores how scaffolding can improve performance and knowledge retention in TLE, a subject that helps students gain practical life and work skills. By focusing on the "Prepare and Cook Seafood Dishes" lesson, the research addresses a specific challenge in TLE: making sure students not only master procedures but also remember them for future use.

The findings of this study could be helpful for the following people:

- **Students:** Learners will get structured support that helps them do tasks with confidence and accuracy, while also improving their ability to remember concepts and skills over time.
- **Teachers:** The study provides a clear model of effective scaffolding strategies that teachers can use to make their instruction more engaging and student-centered in hands-on subjects.
- **Curriculum Developers:** The research insights can help improve the curriculum, especially when designing guides and modules that emphasize scaffolding for skill-based learning.
- **School Administrators:** The results could be a basis for professional development programs that encourage teachers to adopt effective teaching methods to improve student outcomes.
- **Future Researchers:** The study adds to the existing knowledge about scaffolding and can be a reference for future research on teaching methods in TLE and other skill-based subjects.

Research Highlight

This study emphasizes how important it is to use scaffolding techniques as a teaching strategy in Technology and Livelihood Education (TLE). Through methods like modeling, guided practice, questioning, feedback, and interactive activities, scaffolding gives students step-by-step support that helps them do tasks with more confidence and independence.

The results show that scaffolding not only improves students' performance in preparing and cooking seafood dishes but also strengthens their ability to remember and use that knowledge over time. By connecting what they learn in theory with practical application, scaffolding makes learning more engaging, meaningful, and long-lasting. Overall, the study proves that scaffolding is a practical and effective way to teach hands-on subjects, offering valuable ideas for teachers, curriculum planners, and future researchers who want to improve student outcomes in TLE and beyond.

Expected Output

This study is expected to produce a few important results. First, students who are taught using scaffolding strategies are expected to perform better on practical tasks, especially when preparing and cooking seafood dishes. Also, scaffolding should improve their knowledge retention, so they can remember and apply the skills and concepts they learned even after the lessons are over.

Another expected result is a practical teaching guide for TLE educators. By documenting the use of strategies like modeling, guided practice, questioning, and feedback, the study will provide teachers with approaches they can use to improve their classroom instruction. On a larger scale, the study is expected to add to the growing body of research on

how to teach skill-based subjects. The findings could be a valuable resource for curriculum developers, school leaders, and future researchers who are interested in strategies that improve both learning outcomes and long-term knowledge retention. In short, the study is expected to bridge the gap between theory and practice, making sure that students can not only do tasks accurately but are also equipped with knowledge and skills they can use in real-life situations.

6. Methodology / Procedures

Research Design

This study used a mixed-methods research design, which combined both descriptive and experimental approaches. The descriptive part was used to understand how ready the students were before the study began, giving us a clearer picture of their initial strengths and learning needs. The experimental part, on the other hand, focused on testing how effective scaffolding techniques and interactive learning strategies were at improving student performance. To evaluate these effects, we looked at factors like the teacher's expertise, student readiness, and the available learning resources. We measured learning through pre-tests and post-tests, which checked how much knowledge students had gained, and through their hands-on performance tasks during the third quarter, which showed their practical skills. By combining descriptive information with experimental validation, the study gave us a complete picture of how scaffolding can affect both knowledge and performance in TLE.

Population and Locale of the Study

The participants in this study were 53 Grade 10-B students who were officially enrolled in the Academic Year 2024–2025. The research took place at the Laboratory School of the Abra State Institute of Science and Technology (ASIST) in Lagangilang, Abra. This location was chosen because it gave us access to a group of students who were taking TLE as part of their curriculum, making them ideal for studying the effects of scaffolding on performance and knowledge retention.

Data Gathering Instrument

This study used several tools to collect both quantitative and qualitative data. To measure how much knowledge students gained, the researchers gave them pre-tests and post-tests that were closely related to the lesson objectives. The test had 25 multiple-choice questions, 10 classification tasks, 10 matching-type questions, and 5 open-ended questions to check students' understanding and critical thinking skills.

To assess students' practical skills, we used performance rubrics. These rubrics evaluated important things like how well students applied their skills, completed the tasks, solved problems, and the overall quality of their final work. Using these rubrics helped us to evaluate student performance in TLE classes consistently and objectively. We also used an observation checklist to record how scaffolding strategies were used during the lessons and how engaged the students were throughout the process. Additionally, we conducted semi-structured interviews to get deeper insights from both teachers and students. These interviews helped us understand their experiences and thoughts on using scaffolding techniques.

Data Gathering Procedure

The data was collected using a structured process. First, the researchers got permission to conduct the study from the Laboratory School chairperson, the Grade 10-B adviser, and the TLE teacher. We also coordinated with the TLE teacher to explain the research goals and figure out which specific lessons to cover. Before we started, we gave the students a 50-item pre-test to check their prior knowledge and readiness for the lessons. Based on those results, the researchers created detailed lesson plans that included scaffolding techniques—like modeling, questioning, feedback, and task structuring—and interactive strategies such as group activities and hands-on practice. The lessons were implemented over a six-week period, during which the researchers taught demonstration lessons and closely monitored how scaffolding and interactive methods were used. At the end of the intervention, we gave a 50-item post-test, similar to the pre-test, to see if student performance had changed. This systematic process was designed to evaluate how effective scaffolding and interactive strategies were at improving both the academic performance and attitudes of students. By combining quantitative data with qualitative observations, the study aimed to give a more complete understanding of how these teaching methods impact student learning outcomes.

Research Flowchart

This research employed a **Research Flowchart** as a guide in carrying out the lesson *Prepare and Cook Seafood Dishes*. The flowchart served as a step-by-step instrument that ensured the procedures were **systematic, organized, and consistent with the study's objectives**. It also provided the researchers with a clear sequence to follow, making the implementation of scaffolding techniques more efficient and reliable.

A. Research Flowchart in Prepare and Cook Seafood Dishes

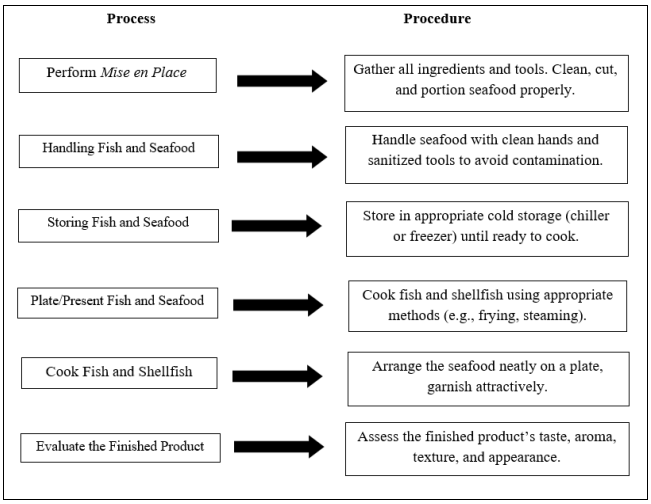

Fig 2: Flowchart of Lesson in Prepare and Cook Seafood Dishes

B. Research Flowchart in Perform *Mise en Place*

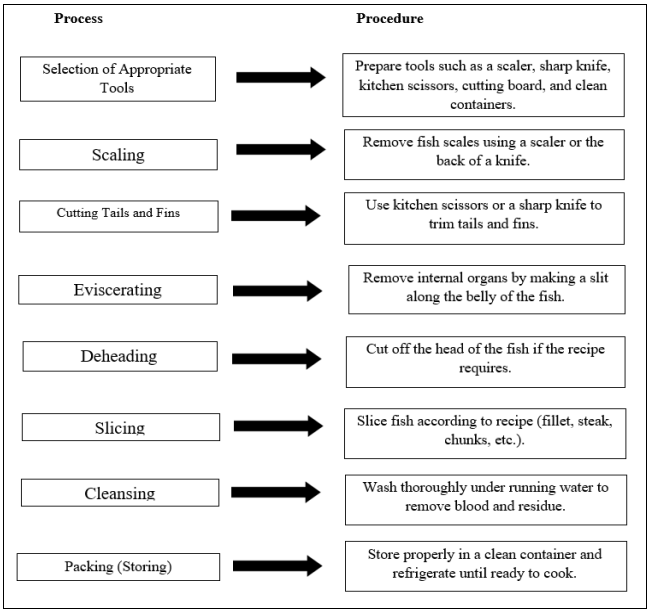

Fig 3a: Flowchart of Steps in Processing a Fish

C. Research Flowchart in Perform *Mise en Place*

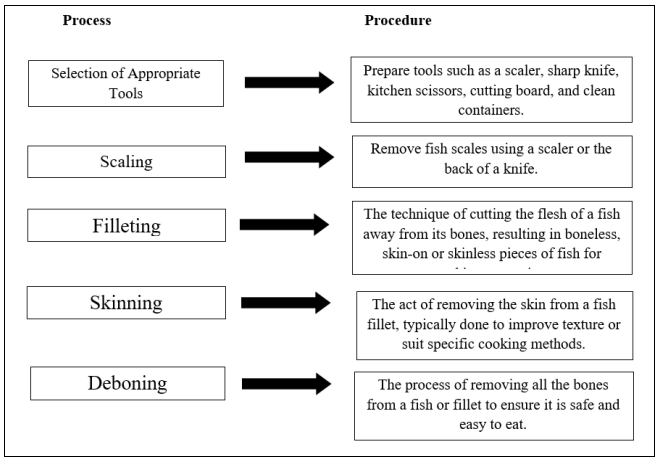

Fig 3b: Flowchart of Steps in Processing a Fish

D. Research Flowchart in Perform *Mise en Place*

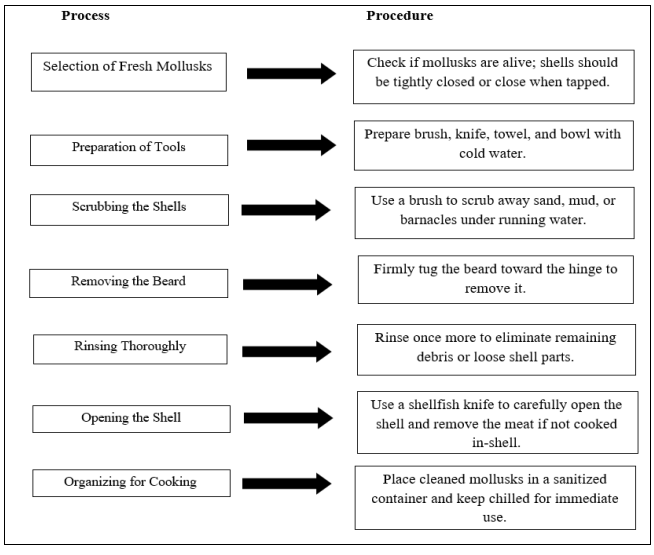

Fig 4: Flowchart of Cleaning and Opening Mollusks

E. Research Flowchart in Perform *Mise en Place*

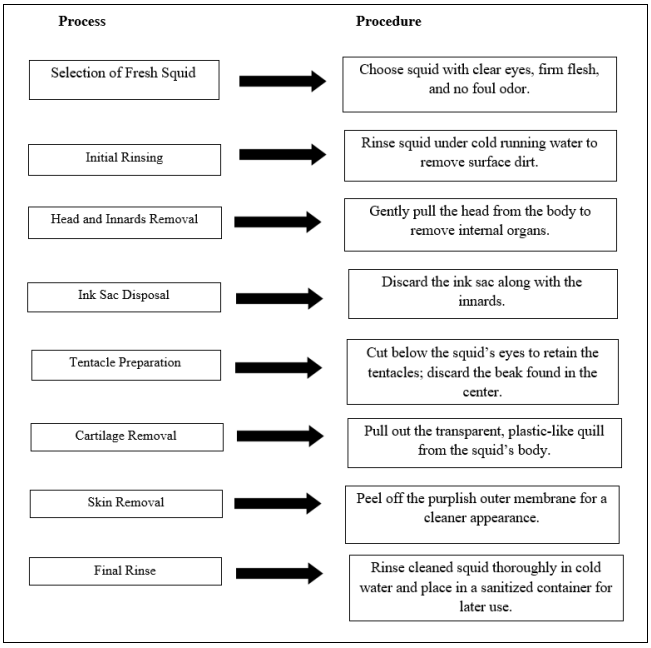

Fig 5: Flowchart of Steps in Cleaning Squid

F. Research Flowchart in Perform *Mise en Place*

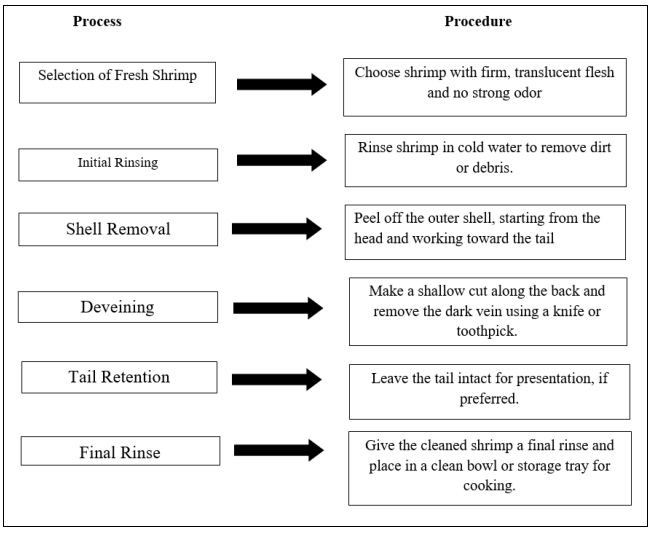

Fig 6: Flowchart of Steps in Cleaning Shrimp

G. Research Flowchart in Handling Fish and Seafood

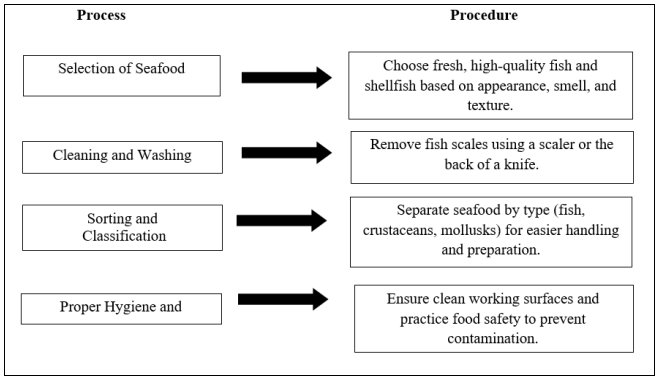

Fig 7: Flowchart of Proper Handling Fish and Seafoods

H. Research Flowchart in Storing Fish and Seafood

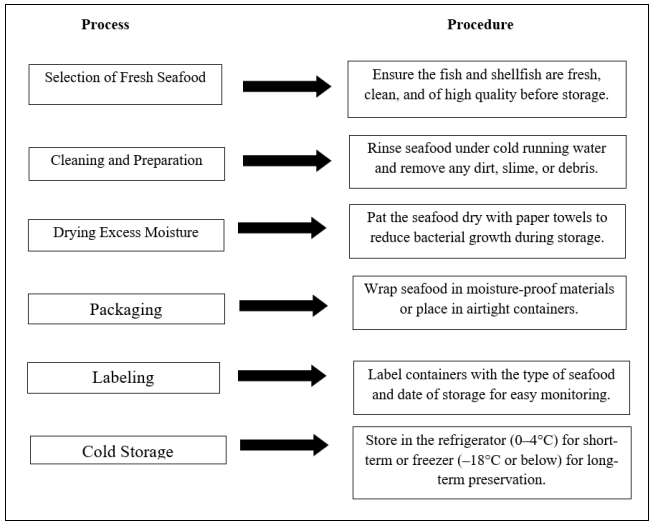

Fig 8: Flowchart of Storing of Fish and Seafoods

I. Research Flowchart in Cook Fish and Shellfish

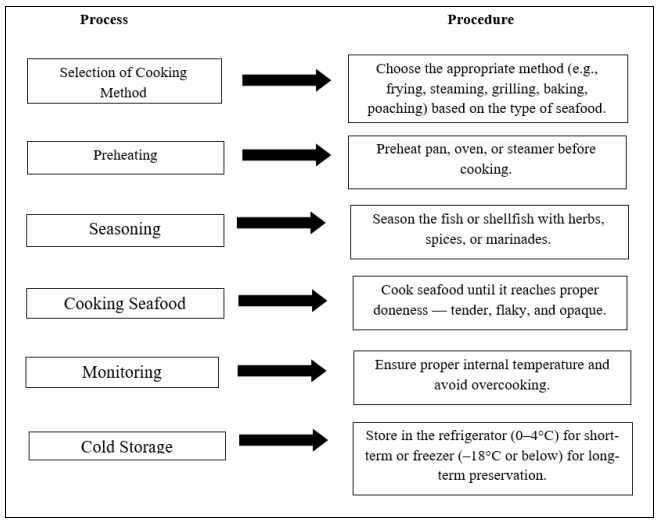

Fig 9: Flowchart of Steps in Cooking Fish and Shellfish

J. Research Flowchart in Plate/Present Fish and Shellfish

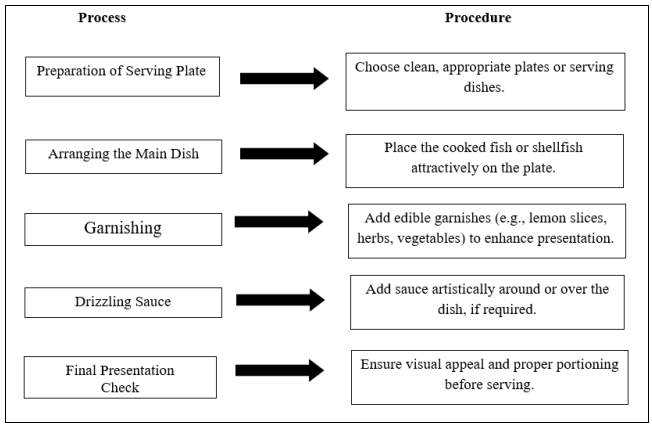

Fig 10: Flowchart of Steps in Plating Fish and Shellfish

K. Research Flowchart in Evaluate Finish Product

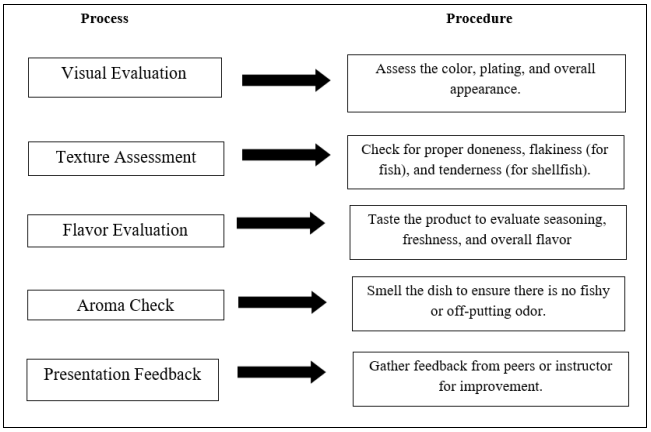

Fig 11: Flowchart of Evaluation of Finished Product

Statistical Treatment of Data

The researchers used the following statistical data treatments:

1. **Mean:** Used to calculate the average scores from the pre-tests and post-tests to determine the overall performance level of the students.
2. **T-test for correlated samples:** Used to find any significant differences between the pre-test and post-test scores, which would indicate if the scaffolding strategies were effective.
3. **T-test for independent samples:** Used to compare the effectiveness of different scaffolding techniques and interactive learning strategies to see if one method was significantly better than another.
4. **Analysis of Variance (ANOVA):** Used to identify any significant differences in performance and knowledge retention among students who were exposed to different scaffolding strategies, which helped determine which strategy was most effective.

7. Results and Discussion

This chapter focuses on the presentation, analysis, and interpretation of the data gathered from the respondents that answered the questions raised in this study.

1. What is Scaffolding Techniques' influence on Grade 10B students' performance and knowledge retention in TLE Subjects?

Table 1A: Influence of Scaffolding Techniques in Grade 10B Knowledge Retention in TLE Subject

Indicator	Mean	Indicator
Q1: I can recall the steps in seafood preparation better when my teacher models them.	4.57	**Strongly Agree**
Q2: Answering questions during the lesson helps me remember the topic.	3.34	**Neutral**
Q3: My teacher's feedback helps me improve and remember my mistakes.	3.91	**Agree**
Q4: Breaking tasks into steps helps me understand and remember the lesson better.	4.40	**Strongly Agree**
Q5: Group activities and hands-on learning help me retain information longer.	4.45	**Strongly Agree**
Q6: Taking quizzes and tests after lessons helps me recall information better.	4.19	**Agree**
Overall Mean:	**4.14**	**agree**

Legend:

Relative Value	Range	DR
5	4.21-5.00	Strongly Agree (SA)
4	3.41-4.20	Agree (A)
3	2.61-3.40	Neutral (N)
2	1.81-2.60	Disagree (DA)
1	1.00-1.80	Strongly Disagree (DA)

Based on the data in Table 1a, students generally agreed that scaffolding techniques helped improve their performance and memory retention in their TLE class, specifically for the seafood preparation lesson. The overall average score of 4.14 supports this finding. The most notable result, however, is which specific techniques students found most effective.

The approach rated most highly was teacher modeling, which received the highest mean score of 4.57 ("Strongly Agree"). Students found that watching their teacher demonstrate the step-by-step process made it easier to follow, understand, and remember the lesson. This is consistent with Zhou *et al*. (2022) [28], who emphasized that modeling provides students with clear and concrete examples, especially in hands-on subjects like TLE.

Another technique that students rated highly was the use of group activities and hands-on learning (Q5), which obtained a mean score of 4.45 ("Strongly Agree"). This suggests that students prefer to be actively involved in their learning rather than just listening. According to Kang and Tan (2018) [18], collaborative and experiential tasks significantly improve retention because learners are more likely to remember concepts when they actively apply them with their peers.

The practice of breaking lessons into smaller, manageable steps (Q4) also received a high score of 4.40 ("Strongly Agree"). This finding aligns with Vygotsky's scaffolding principle, which focuses on simplifying tasks so learners don't feel overwhelmed. Beck and Gottschalk (2019) [4] further explain that when instruction is organized into smaller chunks, students feel more confident, which in turn leads to deeper learning.

Interestingly, the item on answering questions during lessons (Q2) recorded the lowest mean score of 3.34 ("Neutral"). While questioning is a valuable tool, this result suggests that for these students, it may not have been the most effective way to remember information. Glogger-Frey *et al*. (2020) [14] noted that questioning is more effective when paired with visuals, demonstrations, or feedback—all of which are crucial in technical and skill-based subjects.

Students also acknowledged the importance of feedback (Q3) and quizzes (Q6), with mean scores of 3.91 and 4.19, respectively. Feedback was seen as a useful way to identify mistakes and make improvements, which aligns with Shute's (2019) [21] research that effective, timely, and specific feedback is one of the strongest drivers of student growth. Meanwhile, quizzes helped reinforce learning by encouraging students to revisit and strengthen their understanding of the material.

Overall, the data shows that scaffolding techniques such as teacher modeling, collaborative hands-on activities, and step-by-step instruction are especially effective in helping Grade 10 students learn seafood preparation. These strategies not only guided learners in completing their tasks but also helped them develop a lasting understanding, improved retention, and the ability to apply their knowledge in practical settings.

Table 1B: Influence of Scaffolding Techniques in Grade 10B Students' Performance in TLE Subject

Indicator	Mean	Indicator
Q1: I can perform seafood preparation more accurately when my teacher models the steps.	4.55	**Strongly Agree**
Q2: Answering my teacher's guided questions improves my performance in TLE activities.	3.32	**Neutral**
Q3: The feedback I receive from my teacher helps me correct mistakes and improve my skills.	3.42	**Agree**
Q4: Step-by-step instructions help me complete seafood preparation tasks correctly.	4.57	**Strongly Agree**
Q5: Working with classmates in group activities improves my ability to perform TLE tasks.	4.30	**Strongly Agree**
Q6: Taking quizzes and tests helps me evaluate my performance and improve.	4.40	**Strongly Agree**
Overall Mean:	**4.09**	**Agree**

Legend:

Relative Value	Range	DR
5	4.21-5.00	Strongly Agree (SA)
4	3.41-4.20	Agree (A)
3	2.61-3.40	Neutral (N)
2	1.81-2.60	Disagree (DA)
1	1.00-1.80	Strongly Disagree (DA)

Based on the data in Table 1b, students generally agreed that scaffolding techniques had a positive influence on their performance in TLE. The overall average score of 4.09 suggests that scaffolding not only helps students remember content but also enhances their ability to perform practical tasks effectively.

The highest-rated item was "Step-by-step instructions help me complete seafood preparation tasks correctly," which received a mean of 4.57 ("Strongly Agree"). This result highlights the importance of breaking down complex procedures into simpler, more manageable steps. Van de Pol, Volman, and Beishuizen (2019) [22] emphasized that this task decomposition is a key component of effective scaffolding, as it allows students to gradually build competence until they can work independently. The students' responses confirm that clear, sequential guidance directly improves their performance.

Similarly, students gave high ratings to teacher modeling (Q1), with a mean of 4.55 ("Strongly Agree"), and assessments such as quizzes and tests (Q6), with a mean of 4.40 ("Strongly Agree"). These findings suggest that modeling and assessments are crucial for helping learners visualize how tasks should be performed, reflect on their learning, and monitor their progress. Hammond and Gibbons (2017) [17] explain that scaffolding works most effectively when demonstration and feedback are combined, both of which are essential for building student competence in performance-based subjects like TLE.

Peer collaboration was also highlighted in Q5, which received a mean of 4.30 ("Strongly Agree"). Students recognized the value of working with classmates, which reflects the idea that collaborative learning can also serve as a form of scaffolding. Chen and Looi (2017) [8] argue that peer interaction enhances critical thinking and supports skill development, especially when it is guided by the teacher.

On the other hand, "Answering guided questions" (Q2) received the lowest mean of 3.32 ("Neutral"). While questioning is a valid teaching strategy, this result suggests that it may not have had a strong impact on students' performance in this specific context. Rezat and Dreher

(2020) [20] noted that questioning is only effective when students clearly understand its purpose and when it is paired with other strategies that actively engage them.

Receiving teacher feedback (Q3) earned a mean of 3.42 ("Agree"). Although not rated as highly as other techniques, feedback still contributed positively to learning. This suggests that students value feedback but might benefit more when it is combined with hands-on guidance or demonstrations.

Overall, the results confirm that scaffolding techniques like step-by-step instructions, teacher demonstrations, quizzes, and collaborative activities are highly effective in improving student performance in TLE. These strategies reduce confusion, improve accuracy, and build student confidence in practical tasks such as seafood preparation.

2. Which Scaffolding Techniques are the most effective in improving student performance and knowledge retention of Grade 10B students in TLE?

Table 2: The Most Effective Scaffolding Techniques in Improving Student Performance and Knowledge Retention of Grade 10B Students in TLE

Indicator	Mean	Indicator
Q1: Modeling (Teacher demonstrates the skill before students perform it)	4.34	**Highly Effective**
Q2: Questioning (Teacher asks questions to guide understanding)	3.40	**Moderately Effective**
Q3: Feedback (Teacher provides corrections, guidance, and encouragement)	3.36	**Moderately Effective**
Q4: Task Structuring (Breaking lessons into step-by-step tasks)	4.30	**Highly Effective**
Q5: Interactive Learning (Collaborative group work, hands-on practice and integration of technology)	4.40	**Highly Effective**
Q6: Assessment Methods (Pre-tests, post-tests, and quizzes)	4.09	**Effective**
Overall Mean:	**3.98**	**Effective**

Legend:

Relative Value	Range	DR
5	4.21 – 5.00	Highly Effective (HE)
4	3.41 – 4.20	Effective (E)
3	2.61 – 3.40	Moderately Effective (MoE)
2	1.81 – 2.60	Less Effective (LE)
1	1.00 – 1.80	Ineffective (IE)

A descriptive analysis was conducted using six indicators to figure out which scaffolding techniques were most effective at improving both the performance and memory retention of Grade 10-B students in TLE.

The results showed that Interactive Learning (Q5), which involves collaborative group work and hands-on practice, received the highest mean score of 4.40, which is interpreted as "Highly Effective." This was followed by Modeling (Q1), where the teacher demonstrates the task before the students perform it, with a mean of 4.34, and Task Structuring (Q4), which involves breaking down lessons into smaller, sequential steps, with a mean of 4.30. Both of these were also rated as "Highly Effective." These findings suggest that students find strategies that require active involvement and provide clear, step-by-step guidance to be the most beneficial to their learning.

In contrast, Questioning (Q2) and Feedback (Q3) were rated as only "Moderately Effective," with mean scores of 3.40 and 3.36, respectively. This indicates that while students recognize their value, these strategies may depend heavily on how consistently and constructively they are implemented. Meanwhile, Assessment Methods (Q6), such as pre-tests and quizzes, achieved a mean of 4.09, which is interpreted as "Effective," showing that assessments play an important role in reinforcing knowledge and monitoring progress.

With an overall mean of 3.98, the findings indicate that scaffolding techniques are generally perceived as "Effective," though some strategies are more impactful than others. These results align with Alibudbud (2021) [1], who noted that interactive and participatory approaches—especially those involving peer collaboration and hands-on learning—significantly enhance retention and skill development. Similarly, Zhao *et al*. (2021) [27] emphasized that modeling and task breakdown are vital in helping learners master procedural skills. Puntambekar and Hübscher (2019) [19] further highlighted that scaffolding is most effective when it is tailored to learners' immediate needs, which may explain why questioning and feedback require refinement to maximize their benefits.

Overall, the analysis indicates that Interactive Learning, Modeling, and Task Structuring are the most effective scaffolding strategies for improving performance and retention in TLE. These methods promote engagement, clarity, and mastery of skills, which are essential in performance-based subjects like seafood preparation. While feedback and questioning remain valuable, their effectiveness appears to be strongly influenced by the timing and manner in which they are applied.

3. Is there a significant difference between the Pre-test and Post-test of Grade 10-B students who implement scaffolding techniques?

Table 3: Significant Difference Matrix Between Pre-Test and Post-Test of Grade10-B in Implementing Scaffolding Techniques

Variables	Mean	Mean Difference	t-value	prob	Sig (2-tailed)
Pre-Test	28.6604	10.28302	15.553	0.000	.000
Post-Test	38.9434				

Legend:
**Difference is significant at 0.01 level
*Difference is significant at 0.05 level

To assess how scaffolding techniques affect students' academic performance in TLE, a statistical comparison was made between the pre-test and post-test scores of Grade 10-B students.

As shown in Table 3, the average pre-test score was 28.66, while the average post-test score increased to 38.94, which is a gain of 10.28. The calculated t-value was 15.553 with a p-value of 0.000, which indicates that the difference between the two sets of scores was highly significant at both the 0.01 and 0.05 levels.

This significant improvement suggests that using scaffolding strategies had a substantial and positive influence on student performance in TLE. Techniques such as teacher modeling, step-by-step instruction, constructive feedback, and guided questioning likely contributed to students' deeper understanding, better retention, and more accurate application of skills.

These findings are consistent with Hammond and Gibbons (2017) [17], who noted that scaffolding promotes learner

independence and supports comprehension through structured guidance. Similarly, Van de Pol, Volman, and Beishuizen (2019) [22] reported that scaffolding significantly enhances learning outcomes when instruction is interactive and responsive to students' needs. Zhao *et al*. (2021) [27] further affirmed that task-specific scaffolding in skill-based lessons improves both knowledge retention and learner confidence.

The statistical evidence from this study mirrors these global findings. The significant difference between the pre-test and post-test scores shows that scaffolding is not only effective in theory but also practical and impactful in a Filipino classroom setting. Overall, the results confirm that scaffolding is a powerful instructional approach for improving student performance in hands-on subjects like TLE.

4. Is there a significant difference between the students' performance and knowledge retention in the Scaffolding Techniques outputs?

Table 4: Significant Difference Matrix Between Students' Performance and Knowledge Retention of Grade10-B in the Scaffolding Techniques Outputs

Variables	Mean	Mean Difference	t-value	prob	Sig (2-tailed)
Student's Performance	98.0343	4.99132	10.768	0.000	.000
Knowledge Retention	93.0430				

Legend:
**Difference is significant at 0.01 level
*Difference is significant at 0.05 level

This study also looked at the relationship between students' performance and knowledge retention to further evaluate how effective scaffolding techniques are in teaching TLE.

As shown in Table 4, the students had an average performance score of 98.03 and an average knowledge retention score of 93.04. The calculated average difference was 4.99, with a t-value of 10.768 and a p-value of 0.000, which indicates that the difference is statistically significant at both the 0.01 and 0.05 levels.

The results show that although students performed exceptionally well during the demonstrations and tasks, their ability to remember the skills and knowledge they had acquired was slightly lower, though still at a high level. This suggests that scaffolding is highly effective at boosting immediate performance, but long-term retention may need extra reinforcement after the guided instruction phase.

These findings are consistent with Wibowo, Handhika, and Hidayat (2020) [26], who noted that student performance tends to peak during guided learning activities, while retention relies on continued practice and review. Chai *et al*. (2019) [7] also highlighted that scaffolding contributes to both short-term performance and long-term retention but stressed the importance of reinforcement strategies like spaced repetition and active recall to sustain mastery.

Therefore, while the high average scores for both performance and knowledge retention confirm that scaffolding was effective, the statistical difference emphasizes the importance of including follow-up activities, review sessions, or practice tasks to maintain learning gains. In this context, scaffolding can be seen not only as a tool for improving immediate outcomes but also as a foundation that should be paired with other strategies to ensure students retain knowledge over time in TLE.

8. Findings, Conclusions and Recommendations

Findings

1. Before the intervention, the Grade 10-B students had a limited understanding of seafood preparation, as shown by their average pre-test score of 28.66. After the scaffolding techniques were used, their average post-test score increased to 38.94, a gain of 10.28. A statistical test confirmed that this improvement was significant, providing strong evidence that scaffolding strategies had a positive impact on student performance.
2. Students rated Interactive Learning (mean: 4.40), Modeling (mean: 4.34), and Task Structuring (mean: 4.30) as "Highly Effective." These are methods that provide hands-on experiences, clear demonstrations, and step-by-step guidance. In contrast, Questioning (mean: 3.40) and Feedback (mean: 3.36) were rated as "Moderately Effective," suggesting that while they are useful, their benefits depend heavily on how they are implemented. Overall, scaffolding strategies were considered "Effective" with an overall average score of 3.98.
3. A comparison of the students' performance scores (average: 98.03) and knowledge retention scores (average: 93.04) showed that while both were high, there was a small but significant difference. This suggests that while scaffolding is excellent for immediate performance gains, long-term retention may require additional review and reinforcement activities.

Conclusions

Based on the findings, the following conclusions were drawn:

1. Scaffolding techniques significantly improved the academic performance of Grade 10-B students in TLE, specifically in seafood preparation. The substantial increase in post-test scores confirms that scaffolding is an effective strategy for helping students master concepts and develop skills.
2. Among the techniques examined, interactive learning, teacher modeling, and task structuring were found to be the most effective. These strategies gave learners opportunities for active participation, provided them with clear demonstrations, and offered step-by-step guidance, which enhanced their engagement and deepened their understanding.
3. Scaffolding is a vital support mechanism that not only helps students during instruction but also encourages independence, confidence, and accountability in their learning journey. When applied effectively, scaffolding bridges the gap between what learners can achieve on their own and what they can achieve with guided support.

Recommendations

Considering the conclusions, the following recommendations are proposed:

1. TLE teachers consistently use scaffolding strategies like modeling, task structuring, and interactive learning in their classes. These approaches don't just improve student performance but also help them develop the

practical, higher-level thinking skills they'll need in real life.
2. To help students remember what they've learned, teachers should design and use follow-up activities. Things like spiraled review sessions, refresher quizzes, return demonstrations, and reinforcement discussions will help solidify learning and ensure students can retain and apply their skills over time.
3. Future studies look at the long-term effects of scaffolding in different subjects and at different grade levels. Future research could also explore how individual factors—like learning styles, motivation, or prior knowledge—affect how well specific scaffolding strategies work. These investigations can offer deeper insights that will help improve lesson planning and teaching practices.

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