International Journal of Pedagogy and Teacher Education

Journal Homepage: jurnal.uns.ac.id/ijpte

Learning from CLT-Informed Interactive Video: Cognitive Performance and Learning Motivation in Culinary Education

Mauren Gita Miranti[1]*, Nona Rachel Putri Taperu[1], Lucia Tri Pangesthi[1], Hanif Naufal Ahmi[1], Anderson Ngelambong[2]

[1]Culinary Education Study Program, Engineering Faculty, Universitas Negeri Surabaya, Surabaya, Indonesia
[2]Department of Hotel Management, Universiti Teknologi MARA, Selangor, Malaysia

ARTICLE INFO

Article History
Received: December 12, 2025
1st Revision: March 10, 2026
Accepted: April 22, 2026
Available Online: April 30, 2026

Keywords:
Culinary Education; Cognitive Ability; Interactive Video; Learning Motivation; Vocational Education.

****Corresponding Author***
Email address:
maurenmiranti@unesa.ac.id

ABSTRACT

Grounded in Cognitive Load Theory (CLT), this study examined whether CLT-informed interactive video instruction was associated with improvements in students' cognitive performance and learning motivation in vocational culinary education. A one-group pretest–posttest design was employed involving 41 eleventh-grade culinary arts students at a public vocational high school in East Java, Indonesia. Data were collected using a 30-item cognitive test and a 35-item learning motivation questionnaire, both of which demonstrated acceptable content validity and high internal consistency (α = 0.914 and α = 0.866, respectively). Because some variables did not meet normality assumptions, non-parametric analyses were used. Wilcoxon signed-rank tests were conducted to examine pre–post changes in cognitive performance and learning motivation, while Spearman's rho was used to examine the relationship between post-intervention learning motivation and cognitive performance gain. The results showed statistically significant improvements in both cognitive performance ($Z = -3.650$, $p < .001$) and learning motivation ($Z = -2.130$, $p = .033$) following the intervention. However, no statistically significant relationship was found between learning motivation and cognitive performance ($r_s = -.188$, $p = .319$). These findings suggest that CLT-informed interactive video may serve as a promising instructional medium for improving topic-specific cognitive performance and supporting learning motivation in vocational culinary education.

How to cite: Miranti, M. G., Taperu, N. R. P., Pangesthi, L. T., Ahmi, H. N., & Ngelambong, A. (2026). Learning from CLT-Informed Interactive Video: Cognitive Performance and Learning Motivation in Culinary Education. *International Journal of Pedagogy and Teacher Education, 10*(1), 158–168. https://doi.org/10.20961/ijpte.v10i1.113058

1. INTRODUCTION

The integration of digital technology into education has fundamentally reshaped how knowledge is delivered, processed, and retained across disciplines and educational levels (Luo et al., 2025; Oudat & Othman, 2024; Raffi et al., 2025; Perry-Kates et al., 2025). Among the media that have emerged from this transformation, interactive video—where learners respond to embedded questions, make navigational decisions, and receive immediate feedback—has attracted growing scholarly interest for its capacity to promote active cognitive engagement rather than passive observation (Luo et al., 2025; Suen & Hung, 2025). In vocational culinary education, where learning objectives are inherently procedural, sequential, and skill-intensive, such media holds particular promise because it enables students to observe multi-step cooking techniques in ways that text-based or verbal instruction cannot fully replicate (Deng & Gao, 2023). However, the mere inclusion of interactive features does not guarantee learning effectiveness. When instructional media is not designed with careful attention to how the human cognitive system processes information, it risks undermining the very outcomes it is intended to support, including comprehension, procedural retention, and learning motivation.

This concern is grounded in Cognitive Load Theory (CLT), which serves as the primary theoretical framework of the present study (Sweller, 2011). CLT is particularly relevant in vocational culinary learning because procedural content is often dense, sequential, and cognitively demanding for novice learners. The theory holds that working memory the cognitive workspace through which new information is actively processed is limited in both capacity and duration (Sweller, 2024; Almarzouki, 2024; Mayer, 2024). Poorly structured instructional media generates extraneous cognitive load, consuming working-memory resources without contributing to learning. Conversely, CLT-informed design manages this load by organizing content coherently, aligning visual and auditory channels, and eliminating redundant elements, thereby freeing cognitive resources

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v10i1.113058

for germane processing and schema construction that support long-term knowledge retention (Mayer, 2024; Ljubojević et al., 2025). In the context of interactive video, design features can either support or overload learners' cognitive processing. Well-calibrated interactive elements may foster engagement by creating a sense of manageable challenge and competence, whereas poorly designed elements may fragment attention and impede comprehension (Liu et al., 2024; Timileyin, 2024). Cognitive performance and learning motivation should therefore be understood as related but conceptually distinct outcomes: CLT primarily explains the efficiency of information processing, whereas motivation reflects learners' willingness to engage, persist, and invest effort when instructional demands are perceived as manageable and meaningful (Fan et al., 2025; Perry-Kates et al., 2025).

Prior research has examined components of this relationship selectively. Studies on interactive video and cognitive outcomes have consistently shown that segmented, feedback-rich instruction can improve recall, comprehension, and knowledge transfer compared with passive video-based learning (Chen et al., 2024; Fan et al., 2024; Mayer, 2024). Separately, investigations into interactive video and motivation have suggested that embedded quizzing, immediate feedback, and branched navigation may increase learner engagement, persistence, and self-efficacy (Liu et al., 2024; Zhang, H., 2024). A smaller body of work has grounded interactive video design explicitly in CLT principles, indicating that adherence to segmenting, coherence, and modality principles can reduce unnecessary processing demands and support more efficient schema formation (Ljubojević et al., 2025; Baxter et al., 2025). At the same time, the educational value of interactivity should not be assumed to be uniform across contexts. Interactivity may support learning when it directs attention and regulates processing, but it may also become counterproductive when it introduces excessive navigational demands, split attention, or superficial engagement. This issue is particularly important in vocational learning contexts, where procedural complexity may already impose substantial intrinsic cognitive load (Sweller, 2011).

A critical gap therefore remains. Empirical studies applying CLT principles to interactive video in vocational culinary education are notably absent, and research that examines cognitive performance and learning motivation within the same instructional intervention remains limited. More importantly, it remains unclear whether CLT-informed interactivity functions similarly in procedurally intensive vocational learning, where intrinsic load may be greater than in more declarative academic content (Mayer, 2024). The topic of Indonesian Cakes from Tubers, a mandatory competency in vocational culinary curricula, exemplifies precisely this type of learning content. It requires students to understand multi-step procedural sequencing, ingredient preparation, production techniques, and quality-evaluation decisions, making it a pedagogically relevant case for examining the potential of CLT-informed interactive video design (Baxter et al., 2025). The present study addresses this gap by investigating the use of CLT-informed interactive video instruction in teaching Indonesian Cakes from Tubers in a vocational high school setting. Its novelty lies in three main aspects: first, it applies CLT principles systematically to the design of interactive video in vocational culinary education; second, it examines cognitive performance and learning motivation within the same intervention context rather than as isolated outcomes; and third, it explores the relationship between these two variables, thereby contributing to a more integrated understanding of how instructional design may shape cognitive and motivational processes in procedurally intensive vocational learning. This study is guided by three research questions: (1) To what extent is CLT-informed interactive video associated with changes in students' cognitive performance? (2) To what extent is it associated with changes in students' learning motivation? (3) What is the relationship between cognitive performance and learning motivation following CLT-informed interactive video instruction?

2. MATERIAL AND METHOD

Research Design

This study employed a one-group pretest–posttest design to examine whether CLT-informed interactive video instruction was associated with changes in students' cognitive performance and learning motivation in vocational culinary education. The study involved 41 eleventh-grade students enrolled in a vocational culinary arts program at a public vocational secondary school in East Java, Indonesia. This design was selected because the intervention was implemented in an intact classroom setting and aimed to evaluate learning changes before and after the use of interactive video instruction within a limited educational context. Before the instructional intervention began, students completed a pre-test to assess their initial cognitive performance and learning motivation. The intervention was then conducted using interactive video delivered

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v10i1.113058

through EdPuzzle. The instructional videos were designed in accordance with Cognitive Load Theory (CLT) principles, including segmentation of content into shorter procedural units, removal of non-essential elements to reduce extraneous load, provision of pre-training on key concepts, and the use of embedded multiple-choice questions with immediate feedback. The intervention was delivered over four weeks across eight sessions of 90 minutes each. At the end of the intervention, students completed a post-test to assess their final cognitive performance and learning motivation.

Instruments

Two instruments were used for data collection. First, a cognitive performance test consisting of 30 multiple-choice items on the topic of Indonesian Cakes from Tubers was used. Each item had four answer choices and was designed to cover cognitive levels C1 through C6. An initial pool of 35 items was subjected to expert content validation by three validators (two university lecturers and one vocational culinary teacher) using Aiken's V, yielding a content validity index of V = 0.699, which was considered acceptable for use after revision (Aiken, 1985). Statistical item analysis (Sig. < α = 0.05) identified five invalid items, which were removed. The final 30-item instrument demonstrated very high internal consistency reliability (Cronbach's α = 0.914). Scores were converted to a 0–100 scale. Second, a learning motivation questionnaire comprising 35 items was administered. The questionnaire covered intrinsic and extrinsic motivation indicators and used a four-point Likert scale (1 = strongly disagree to 4 = strongly agree), with both favourable and unfavourable statements. Content validation yielded a high validity index (V = 0.895), and all 35 items were statistically valid (Sig. < 0.05). Internal consistency reliability was also high (α = 0.866). In the present study, the motivation questionnaire was analysed as a total score representing overall learning motivation. The research variables, indicators, and measurement approaches are summarised in Table 1.

Table 1. Research Variables, Indicators, and Measurement Instruments

No	Variable	Indicator	Measurement
1	Cognitive performance	1. Explain the meaning of Indonesian cakes from tubers 2. Determine the tools used to make Indonesian cakes from tubers 3. Calculate the ingredients used to make Indonesian cakes from various tubers 4. Determine the procedure for making Indonesian cakes from tubers 5. Determine the criteria for the results of Indonesian cakes from tubers 6. Analyze problems in making Indonesian cakes from tubers	Multiple-choice test (C1–C6), 30 items, 4 answer choices
2	Learning motivation	1. Intrinsic motivation 2. Extrinsic motivation	Likert-scale questionnaire (1–4), 35 items, favorable and unfavorable statements

Data Collection

The CLT-informed interactive video intervention was implemented over four weeks, comprising eight instructional sessions, each lasting 90 minutes. Delivered via the EdPuzzle platform, the videos were designed

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v10i1.113058

based on key principles of Cognitive Load Theory (CLT) to optimize learning by managing cognitive load. The videos incorporated multimodal presentation, combining visual imagery, diagrams, and narration to engage both auditory and visual channels, thus supporting dual-channel processing and reducing cognitive overload, in line with CLT's multimodal principle. The coherence principle was also followed by ensuring that only essential content related to culinary procedures was included, eliminating unnecessary details to prevent extraneous cognitive load. Furthermore, adhering to the pre-training principle, foundational concepts and terminology related to culinary techniques were introduced before more complex procedural content, allowing students to build the necessary prior knowledge to effectively process advanced material.

Embedded multiple-choice questions (MCQs) were strategically placed throughout the videos to promote active engagement and reinforce learning. These MCQs encouraged students to process the content actively, deepening their understanding and enhancing retention. Immediate corrective feedback was provided after each response, helping students to correct misunderstandings and refine their knowledge in real-time. This approach followed the active learning principle, ensuring continuous engagement with the content and real-time cognitive processing. By integrating these CLT principles, the intervention created an immersive learning environment that helped manage cognitive load while fostering both cognitive performance and learning motivation. The interactive video format, combined with continuous feedback, guided students through the learning process, supporting both procedural understanding and engagement with the content.

Hypotheses and Statistical Analysis Plan

Based on the theoretical framework and research design, three hypotheses were formulated, each directly matched to a corresponding statistical test, as presented in Table 2. To examine H1 and H2, pre-test and post-test scores were compared within the same class for each variable. Because the study used a one-group pretest–posttest design, no between-group comparison was conducted. The Wilcoxon signed-rank test was selected as the appropriate non-parametric procedure for assessing within-group changes when normality assumptions were violated (Kok et al., 2024; Chicco et al., 2025). This approach allowed the study to evaluate whether students' scores after the intervention were significantly different from their scores before the intervention. For H3, Spearman's rho correlation was used to examine the association between students' post-intervention learning motivation and cognitive performance gain (post-test score minus pre-test score), consistent with its application to non-normally distributed interval data (Efendi, 2025). This analysis was intended to explore whether students with stronger post-intervention motivation also tended to show greater improvement in cognitive performance

Table 2. Percentage of Learning Implementation

H	Hypothesis	Statistical Test
H1	The implementation of interactive video is associated with changes in students' cognitive performance	Wilcoxon signed-rank test
H2	The implementation of interactive video is associated with changes in students' learning motivation	Wilcoxon signed-rank test
H3	There is a significant relationship between students' cognitive performance and learning motivation following CLT-informed interactive video instruction	Spearman's rho correlation

Assumption Testing

Prior to hypothesis testing, distributional normality was assessed for each variable and measurement point using the Shapiro–Wilk test. The results are presented in Table 3, the post-test cognitive performance scores (Sig. = 0.000) and the post-questionnaire motivation scores (Sig. = 0.001) were non-normally distributed,

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v10i1.113058

whereas the corresponding pre-measurement scores were normally distributed. Because at least one measurement point for each variable violated the normality assumption, the decision was made to employ non-parametric tests across the analyses to ensure consistency and appropriateness of inference. Accordingly, the Wilcoxon signed-rank test was used to examine pre–post changes in cognitive performance and learning motivation, and Spearman's rho was applied to the correlation analysis. This approach was considered more suitable for the distributional characteristics of the data.

Table 3. Shapiro–Wilk Normality Test Results

Variable	Measurement Point	Sig. (Shapiro–Wilk)	Distribution
Cognitive ability	Pre-test	0.587	Normal
Cognitive ability	Post-test	0.000	Non-normal
Learning motivation	Pre-questionnaire	0.403	Normal
Learning motivation	Post-questionnaire	0.001	Non-normal

3. RESULTS

Effect of Interactive Video on Cognitive Performance (H1)

Table 4. Wilcoxon Signed-Rank Test: Cognitive Ability

	Post-test – Pre-test
Z	−3.650
Asymp. Sig. (2-tailed)	< .001
Effect size (r)	0.57

The effect of the CLT-informed interactive video intervention on students' cognitive performance was examined using a Wilcoxon signed-rank test to assess within-group changes in scores from pre-test to post-test. This non-parametric test is ideal for comparing paired data when the assumptions of normality are not met, making it particularly suitable for assessing changes in performance within a single group. The goal of this analysis was to determine whether the intervention led to a statistically significant improvement in students' cognitive abilities, as measured by the difference in their scores before and after the intervention. A significant result would suggest that the interactive video, based on Cognitive Load Theory (CLT) principles, effectively enhanced students' cognitive performance, which is a key outcome of the study (Sweller, 2011; Baxter et al., 2025).

As shown in Table 4, the Wilcoxon signed-rank test yielded a Z-value of −3.650 with a p-value of < .001, indicating a statistically significant improvement in students' cognitive performance following the intervention. This result demonstrates that, after engaging with the CLT-informed interactive video instruction, students showed a meaningful enhancement in their cognitive abilities, as evidenced by the significant change in their post-test scores compared to the pre-test scores. The effect size (r) = 0.57, which indicates a large effect, further supports the magnitude of this improvement. An effect size of 0.57 means that the intervention had a substantial and practical impact on cognitive performance, demonstrating that the improvement in post-test scores was not only statistically significant but also educationally meaningful. These findings indicate that the CLT-based interactive video was highly effective in enhancing students' cognitive abilities, confirming that the intervention significantly contributed to learning outcomes (Sweller, 2011). The large effect size suggests that the interactive video instruction had a robust and sustained impact on students' ability to retain and process the content, further emphasizing the value of using CLT principles in instructional design. In practical terms, this means that incorporating interactive video lessons based on CLT can be an effective approach to improving students' cognitive performance, particularly in fields that require complex procedural understanding, such as culinary education. The significant improvement in cognitive ability also highlights the effectiveness of active learning and

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v10i1.113058

feedback mechanisms embedded in the video content, which reinforced students' engagement and understanding throughout the learning process (Baxter et al., 2025; Liu et al., 2024).

Effect of Interactive Video on Learning Motivation (H2)

The impact of the CLT-informed interactive video intervention on students' learning motivation was assessed using a Wilcoxon signed-rank test to examine changes from the pre-questionnaire to the post-questionnaire. This test was chosen due to the nature of the data, which was paired and non-normally distributed. The goal of this analysis was to determine whether the interactive video instruction had a statistically significant effect on students' motivation to learn, an important outcome that complements the cognitive performance improvements observed in the study. Increased learning motivation is a crucial factor in promoting sustained engagement and better retention, particularly in complex subjects like culinary education (Baxter et al., 2025; Mayer, 2024).

Table 5. Wilcoxon Signed-Rank Test: Learning Motivation

	Post-questionnaire – Pre-questionnaire
Z	−2.130
Asymp. Sig. (2-tailed)	.033
Effect size (r)	0.33

Table 6. Summary of Within-Group Improvement: H1 and H2

Variable	Test	Z	Sig.	Effect size (r)	Decision
Cognitive performance	Wilcoxon signed-rank	−3.650	< .001	0.57	H1 supported
Learning motivation	Wilcoxon signed-rank	−2.130	.033	0.33	H2 supported

As shown in Table 5, the Wilcoxon signed-rank test yielded a Z-value of −2.130 with a p-value of 0.033, indicating a statistically significant increase in learning motivation from pre-test to post-test. The p-value of 0.033 is less than the threshold of 0.05, suggesting that the observed increase in motivation was unlikely to have occurred by chance. The effect size was calculated to be r = 0.33, indicating a moderate effect. According to Cohen's (1988) guidelines, an effect size of 0.33 suggests that the intervention had a meaningful but moderate impact on students' motivation. This result demonstrates that the interactive video intervention not only improved cognitive performance but also contributed to increased motivation, making learning more engaging and stimulating for the students (Liu et al., 2024). As shown in Table 5, the Wilcoxon signed-rank test yielded a Z-value of −2.130 with a p-value of 0.033, indicating a statistically significant increase in learning motivation from pre-test to post-test. The p-value of 0.033 is less than the threshold of 0.05, suggesting that the observed increase in motivation was unlikely to have occurred by chance. The effect size was calculated to be r = 0.33, indicating a moderate effect. According to Cohen's (1988) guidelines, an effect size of 0.33 suggests that the intervention had a meaningful but moderate impact on students' motivation. This result demonstrates that the interactive video intervention not only improved cognitive performance but also contributed to increased motivation, making learning more engaging and stimulating for the students (Liu et al., 2024).

The findings, as summarized in Table 6, show that both cognitive performance (H1) and learning motivation (H2) experienced significant within-group improvements following the intervention. The moderate effect size (r = 0.33) for learning motivation indicates that the intervention successfully fostered a positive shift in how students engaged with and approached the learning material. The statistical significance of this change suggests that the CLT-informed interactive video instruction had a beneficial effect on students' enthusiasm and drive to learn, which is an important factor in the success of educational interventions (Mayer, 2024; Baxter et al., 2025). Taken together, the results suggest that the CLT-informed interactive video instruction led to significant improvements in both cognitive performance and learning motivation within the same group of students. These findings are important because they demonstrate that the intervention not only enhanced students' ability to understand and apply the course material but also made them more motivated to engage with it. It is worth noting that, since H1 and H2 were tested separately using within-group analysis, these results should be interpreted as evidence of improvement over time within the same class rather than as a comparison

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v10i1.113058

across different groups. This highlights the potential of using CLT principles in interactive video to support both cognitive and motivational outcomes in vocational education (Sweller, 2011).

Relationship between Learning Motivation and Cognitive Performance (H3)

Further examination of whether students with stronger post-intervention learning motivation also tended to achieve greater improvement in cognitive performance was conducted using a Spearman's rho correlation analysis between post-intervention learning motivation and cognitive performance gain. This analysis was selected because the data did not fully meet normality assumptions, making a non-parametric correlation test more appropriate. The purpose of this test was not merely to determine whether both variables changed over time, but to investigate whether they changed in a related manner within the same group of students. In other words, the analysis was intended to assess whether students with higher motivation scores after engaging with the CLT-informed interactive video were also the ones who experienced larger gains in cognitive performance. The results of this analysis are presented in Table 7.

Table 7. Learning Implementation Results

Variables	Correlation Coefficient (r)	Sig. (2-tailed)	N
Learning Motivation × Cognitive Performance	−0.188	0.319	41

As shown in Table 7, the Spearman's rho correlation coefficient was $r_s = -.188$ with a p-value of .319 and a sample size of 41, indicating a weak negative and statistically non-significant association between post-intervention learning motivation and cognitive performance gain. Although the coefficient was negative, its magnitude was very small, and the p-value was considerably higher than the conventional significance threshold of 0.05, meaning that the observed association was not statistically meaningful. Therefore, H3 was not supported. These results suggest that, within this study, students who reported higher motivation after the intervention did not necessarily show greater improvement in cognitive performance (Fan et al., 2024; Mayer, 2024). Put differently, the increase in learning motivation observed after the CLT-informed interactive video instruction did not translate into a directly corresponding increase in cognitive gain at the individual level. This finding implies that motivation and cognitive improvement, although both positively influenced by the intervention in separate analyses, may operate through more complex and partially independent pathways. It is possible that students' cognitive gains were influenced more strongly by factors such as prior knowledge, attention during instruction, or the structured support embedded in the video design, whereas motivational responses may have reflected students' affective engagement with the learning experience rather than their measurable performance gains (Ljubojević et al., 2025; Fan et al., 2024). Thus, the data in Table 7 indicate that the intervention may have improved both outcomes overall, but not in a way that produced a statistically reliable correlation between them within the sample.

4. DISCUSSION

Interpretation of the Cognitive Performance Findings

The significant pre–post improvement in cognitive performance observed in this study ($Z = -3.650$, $p < .001$; Table 6) is consistent with prior literature suggesting that CLT-informed interactive video may support knowledge acquisition in instructional settings that require structured information processing (Chen et al., 2024; Fan et al., 2024; Mayer, 2024). Interpreted through a CLT lens, the three-segment structure of the videos may have helped reduce unnecessary processing demands by presenting information incrementally rather than all at once. Likewise, the coherence principle, implemented through the reduction of redundant visual and textual elements, may have supported more efficient use of working-memory resources. The pre-training principle may also have helped students enter each procedural segment with sufficient conceptual scaffolding, thereby reducing the difficulty of processing unfamiliar terminology during the main instructional sequence (Mayer, 2024; Ljubojević et al., 2025).

The embedded multiple-choice questions may likewise have served an additional cognitive function beyond assessment. By requiring students to pause, retrieve, and apply information before proceeding, these questions likely supported elaborative processing and schema construction—processes that are theoretically consistent with what CLT describes as germane cognitive load (Weinert et al., 2024; Wong et al., 2025). In the context of culinary education, where procedural knowledge can easily be misunderstood if instructional steps

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v10i1.113058

are absorbed passively, such design features may be particularly valuable. At the same time, these interpretations should remain cautious. Because cognitive load was not directly measured in the present study, the explanation offered here should be understood as theoretically plausible rather than empirically demonstrated. Other factors, such as increased attention, novelty of the medium, or test familiarity, may also have contributed to the observed improvement. Even so, the finding provides preliminary support for extending CLT-informed design principles from general academic settings to vocational procedural learning contexts (Sweller, 2011).

Interpretation of the Learning Motivation Findings

The statistically significant improvement in learning motivation ($Z = -2.130$, $p = .033$; Table 6) is also consistent with theoretical accounts linking interactive video features to learner engagement. In interpretive terms, Keller's ARCS model offers a useful lens for understanding this pattern (Keller, 1987). The visual and auditory richness of the videos may have supported Attention; the culinary-specific procedural demonstrations may have supported Relevance; the opportunity to replay segments may have strengthened Confidence; and the immediate corrective feedback embedded in the interactive sequence may have contributed to Satisfaction (Zhang, H., 2024; Perry-Kates et al., 2025). Together, these features may have created a learning environment that was more responsive and engaging for students.

The motivational gain, however, appeared less pronounced than the cognitive improvement (Ryan et al., 2020). This is not surprising, given that motivation is a multifactorial construct shaped not only by instructional media, but also by personal dispositions, perceived task relevance, prior interest, and broader classroom context (Diseth, 2025; Fan et al., 2025). In this sense, the present finding should not be interpreted as evidence that interactive video alone determines motivation, but rather as an indication that CLT-informed interactive video may support motivational engagement alongside cognitive processing. Because the motivation instrument in this study was analysed as an overall score rather than as separate ARCS dimensions, the ARCS framework is best understood here as an interpretive lens rather than as a directly measured structure (Fiorella & Mayer 2018).

Why Learning Motivation and Cognitive Performance Were Not Significantly Related

The non-significant correlation between post-intervention learning motivation and cognitive performance gain ($r_s = -.188$, $p = .319$; Table 7) warrants careful interpretation. Contrary to the common assumption that motivation and achievement should always move together, the present finding suggests that the relationship may be more complex in this instructional context (Mayer, 2024). Several plausible explanations may account for the absence of a significant association. First, the type of motivation—intrinsic versus extrinsic—may shape its relationship with cognitive outcomes in ways that a total motivation score cannot fully differentiate. Students who are motivated primarily by external rewards or evaluation demands may report relatively high motivation without necessarily engaging in the deeper cognitive processing required for stronger learning performance (Xu et al., 2025). Second, prior knowledge and baseline cognitive capacity may have exerted a stronger influence on post-test performance than short-term motivational change. This possibility is theoretically relevant in a CLT-informed study because learners' existing schemas and processing capacity may shape how efficiently they benefit from instructional design (Fan et al., 2024; Sweller, 2011). Third, the four-week duration of the intervention may have been insufficient for motivational changes to translate into measurable cognitive gains, particularly for procedurally complex culinary content. These explanations should be treated as tentative rather than conclusive, because the present study did not directly measure motivation type, prior knowledge, or learning strategies (Liu et al., 2024; Baxter et al., 2025). Future research incorporating these variables as covariates would provide a more definitive account of the motivation–cognition relationship in vocational culinary learning.

Implications of CLT-Informed Interactive Video for Vocational Culinary Education

Taken together, the observed improvements in cognitive performance and learning motivation suggest several practical implications for instructional design in vocational culinary education. First, the findings suggest that CLT-based design principles—particularly segmentation, coherence, and pre-training—may be promising for procedural and craft-based content, not only for declarative or conceptual subject matter (Ljubojević et al., 2025;

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v10i1.113058

Fan et al., 2024). Practitioners designing instructional videos for culinary topics should therefore prioritise structural clarity over visual richness, ensuring that multimedia elements actively support comprehension rather than merely decorating content (Mayer, 2024; Fan et al., 2024). Second, the use of embedded mandatory questions at strategic instructional points appears to be a productive scaffolding mechanism in this context. Such questions may help regulate attention, encourage retrieval, and support active engagement with procedural material. This interpretation is consistent with recommendations from Weinert et al. (2024) and Hong & Guo (2025) regarding the role of mid-video interactivity in supporting attention regulation and retrieval practice. From a practical perspective, platforms such as EdPuzzle, which allow educators to insert question checkpoints without requiring advanced video-production expertise, may offer a feasible way to implement CLT-aligned interactive video in school settings.

Limitations and Directions for Future Research

Several limitations of the present study should be acknowledged. First, the study employed a one-group pretest–posttest design, which means that the observed improvements in cognitive performance and learning motivation were identified through within-group change only. Although this design is useful for detecting measurable pre–post differences in an authentic classroom setting, it does not provide the same level of inferential strength as a controlled comparison design. Accordingly, the findings should be interpreted as evidence of significant improvement within the studied class rather than as definitive proof of comparative treatment effectiveness. Second, the study did not employ random assignment, and the intervention was conducted in a single classroom context. Third, the scope of the study was limited to one topic within one school, which constrains the generalisability of the findings to other culinary competencies or institutional settings. Even so, the topic-specific focus also gives the study exploratory value, because Indonesian Cakes from Tubers represents the kind of procedurally dense content for which CLT-informed video design is pedagogically relevant. Future research should examine CLT-informed interactive video over longer instructional periods, with more fine-grained measures of intrinsic and extrinsic motivation, and with designs that allow stronger causal inference (Liu et al., 2024; Ljubojević et al., 2025). Studies that directly measure cognitive load would also strengthen claims about the mechanisms through which CLT-informed video supports learning. Comparative studies across different vocational domains—such as cooking, fashion, and automotive education—would further help establish the boundary conditions of CLT-based interactive video as a pedagogical strategy and clarify the extent to which these design principles transfer across forms of procedural learning (Fan et al., 2024; Baxter et al., 2025).

5. CONCLUSION

The findings of this study indicate that CLT-informed interactive video instruction was associated with statistically significant pre–post improvement in students' cognitive performance and learning motivation in vocational culinary education. First, the Wilcoxon signed-rank test showed a statistically significant improvement in cognitive performance following the intervention ($Z = -3.650$, $p < .001$). Second, the Wilcoxon signed-rank test also indicated a statistically significant improvement in learning motivation ($Z = -2.130$, $p = .033$). These two outcomes were assessed independently; therefore, the findings suggest that both cognitive performance and learning motivation improved significantly following the intervention based on separate analyses. Third, no statistically significant relationship was found between post-intervention learning motivation and cognitive performance gain ($r_s = -.188$, $p = .319$). Future research should address these methodological limitations more directly. In particular, studies using quasi-experimental or controlled comparison designs would provide stronger evidence for the instructional contribution of CLT-informed interactive video. Direct measurement of cognitive load, rather than inferring it from performance outcomes, would also provide more precise evidence regarding the operation of CLT principles in vocational learning. A longer intervention period may further help clarify how changes in learning motivation develop over time and how they relate to cognitive performance. Overall, this study suggests that interactive video designed in line with Cognitive Load Theory principles holds promising potential as an instructional medium in vocational culinary education, particularly for supporting topic-specific cognitive performance and learning motivation.

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v10i1.113058

6. REFERENCES

Aiken, L. R. (1985). Three coefficients for analyzing the reliability and validity of ratings. Educational and Psychological Measurement, 45(1), 131–142. https://doi.org/10.1177/0013164485451012

Almarzouki, A. F. (2024). Stress, working memory, and academic performance: A neuroscience perspective. Stress, 27(1). https://doi.org/10.1080/10253890.2024.2364333

Baxter, K. A., Sachdeva, N., & [rekan]. (2025). The application of cognitive load theory to the design of health and behavior change programs: Principles and recommendations. Health Education & Behavior, 52(4), 469–477. https://doi.org/10.1177/10901981251327185.

Chen, Z., Qian, W., & Zhang, C. (2024). The effect of digital technology usage on higher vocational student satisfaction: The mediating role of learning experience and learning engagement. Frontiers in Education, 9, 1508119. https://doi.org/10.3389/feduc.2024.1508119

Chicco, D., Sichenze, A., & Jurman, G. (2025). A simple guide to the use of Student's t-test, Mann–Whitney U test, Chi-squared test, and Kruskal–Wallis test in biostatistics. BioData Mining, 18, Article 56. https://doi.org/10.1186/s13040-025-00465-6

Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Deng, R., & Gao, Y. (2023). Effects of embedded questions in pre-class videos on learner perceptions, video engagement, and learning performance in flipped classrooms. Active Learning in Higher Education, 25(1). https://doi.org/10.1177/14697874231167098

Diseth, Å. (2025). Motivation and learning strategies among students in upper secondary education: Grade level differences and academic outcomes. Frontiers in Education, 10, 1679954. https://doi.org/10.3389/feduc.2025.1679954

Efendi, D. (2025). The relationship between training satisfaction and work motivation of employees in the emergency department unit of Ciputra Hospital Surabaya. International Journal of Administration, Business & Organization, 6(2), 66–78. https://doi.org/10.61242/ijabo.25.486

Fan, E., Bower, M., & Siemon, J. (2024). Video tutorials in the traditional classroom: The effects on different types of cognitive load. Technology, Knowledge and Learning, 29, 2017–2036. https://doi.org/10.1007/s10758-024-09754-1

Fiorella, L., & Mayer, R. E. (2018). What works and doesn't work with instructional video [Editorial]. *Computers in Human Behavior, 89,* 465–470. https://doi.org/10.1016/j.chb.2018.07.015.

Hong, J. C., & Guo, M. (2025). Improving the effectiveness of video-based flipped classrooms with question-embedding. Education and Information Technologies. https://doi.org/10.1007/s10639-023-12303-5

Keller, J. M. (1987). Development and Use of the ARCS Model of Instructional Design. Journal of Instructional Development, 10, 2-10. http://dx.doi.org/10.1007/BF02905780.

Kok, X. F. K., Wang, P. C., Avnit, K., & Shukla, M. (2024). User engagement with interactive educational videos: Relations with task value, cognitive load, and learning satisfaction. International Journal of Instruction, 17(4), 459–482. https://doi.org/10.29333/iji.2024.17426a

Liu, Y., Ma, S., & Chen, Y. (2024). The impacts of learning motivation, emotional engagement and psychological capital on academic performance in a blended learning university course. Frontiers in Psychology, 15, 1357936. https://doi.org/10.3389/fpsyg.2024.1357936

Ljubojević, M., Vujičić, V., Stanković, M., & Đorđević, D. (2025). Improving the efficiency of multimedia learning and the quality of experience by reducing cognitive load. Applied Sciences, 15(3), 1054. https://doi.org/10.3390/app15031054

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v10i1.113058

Luo, J., Boland, R., & Chan, C. (2025). How to use technology in educational innovation. In *Advances in educational technologies* (pp. xx–xx). Springer. https://doi.org/10.1007/978-3-031-91745-5_17

Mayer, R. E. (2024). The past, present, and future of the cognitive theory of multimedia learning. Educational Psychology Review, 36, Article 8. https://doi.org/10.1007/s10648-023-09842-1

Oudat, Q., & Othman, M. (2024). Embracing digital learning: Benefits and challenges of using Canvas in education. Journal of Nursing Education and Practice, 14, 39. https://doi.org/10.5430/jnep.v14n2p39

Perry-Kates, A., & Cohen, A. (2025). From viewers to participants: The evolution of learning through interactive video. Journal of Computer Assisted Learning, 41(3), e70061. https://doi.org/10.1111/jcal.70061

Raffi, M., Salo, M., Familoni, B., & Onyebuchi, C. (2025). Digital learning in the 21st century: Trends, challenges, and innovations in technology integration. Frontiers in Education, 10, 1562391. https://doi.org/10.3389/feduc.2025.1562391

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology, 61,* Article 101860. https://doi.org/10.1016/j.cedpsych.2020.101860

Suen, H. Y., & Hung, K. E. (2025). Enhancing learner affective engagement: The impact of instructor emotional expressions and vocal charisma in asynchronous video-based online learning. Education and Information Technologies, 30, 4033–4060. https://doi.org/10.1007/s10639-024-12956-w

Sweller, J. (2024). Cognitive load theory and individual differences. Learning and Individual Differences, 110, Article 102423. https://doi.org/10.1016/j.lindif.2024.102423

Sweller, J. (2011). Cognitive load theory. In J. P. Mestre & B. H. Ross (Eds.), The psychology of learning and motivation: Cognition in education (pp. 37–76). Elsevier Academic Press. https://doi.org/10.1016/B978-0-12-387691-1.00002-8

Timileyin, A. (2024). The role of cognitive load in shaping web usability requirements. SSRN. https://doi.org/10.2139/ssrn.5247018

Weinert, T., Benner, D., Dickhaut, E., Janson, A., Schöbel, S., & Leimeister, J. M. (2024). Engaging students through interactive learning videos in higher education: Developing a creation process and design patterns for interactive learning videos. Communications of the Association for Information Systems, 55, 475–506. https://doi.org/10.17705/1CAIS.05519

Wong, J. T., Richland, L. E., & Hughes, B. S. (2025). Immediate versus delayed low-stakes questioning. Technology, Knowledge and Learning, 30, 1421–1456. https://doi.org/10.1007/s10758-024-09746-1

Xu, Z. (2025). The predictive effect of extrinsic motivation on English online learning engagement. Frontiers in Psychology, 16, 1612002. https://doi.org/10.3389/fpsyg.2025.1612002

Zhang, H. (2024). Cognitive load as a mediator in self-efficacy and English learning motivation among vocational college students. PLOS ONE. https://doi.org/10.1371/journal.pone.0314088

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v10i1.113058