



The Effect of ZEP Quiz on Critical Thinking Skills of Culinary Vocational School Students

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ABSTRACT

Keywords:

ZEP Quiz;
Critical Thinking Interactive;
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Mixed Methods.

Abstract: The integration of gamification-based interactive media into vocational education has become increasingly critical as conventional instructional approaches continue to fall short in fostering higher-order thinking skills among Generation Z learners. The study aims to examine the impact of ZEP Quiz interactive learning media on the critical thinking skills. A Mixed Methods approach with Sequential Explanatory design was employed. Mixed Methods integrating quantitative data from pre-tests, post-tests, and questionnaires with qualitative data from classroom observations and in-depth interviews. Respondents comprised 33 Grade X Culinary students in the Basic Culinary subject, Even Semester 2025/2026. Results showed a mean pretest score of 58.2 rising to 79.6 posttest, with an average N-Gain of 0.51 (moderate category). The critical thinking questionnaire yielded 81.2% and student response questionnaire 83.7%, both in the excellent category. Qualitative findings revealed that ZEP Quiz's immediate feedback and point-based competition features significantly enhanced students' analytical and evaluative capacities. ZEP Quiz is concluded to be an effective learning medium for improving critical thinking skills in culinary education.

Kata Kunci:

ZEP Quiz;
Berpikir Kritis;
Media Pembelajaran
Interaktif;
Mixed Methods.

Abstrak: Penelitian bertujuan mengkaji dampak penerapan media pembelajaran interaktif ZEP Quiz terhadap keterampilan berpikir kritis. Latar belakang penelitian didasari kondisi pembelajaran kuliner konvensional yang belum optimal dalam mendorong keterlibatan aktif dan pengembangan kemampuan kognitif tingkat tinggi siswa. Penelitian menggunakan pendekatan Mixed Methods dengan rancangan Sequential Explanatory. Mixed Methods mengintegrasikan data kuantitatif dari pretes, postes, dan kuesioner dengan data kualitatif dari observasi kelas dan wawancara mendalam. Responden 33 murid kelas X Program Keahlian Kuliner pada mata pelajaran Dasar-Dasar Kuliner, Semester Genap 2025/2026. Hasil rerata skor pretes 58,2 meningkat menjadi 79,6 pada postes, dengan rerata N-Gain 0,51 (sedang). Kuesioner keterampilan berpikir kritis menghasilkan persentase 81,2% dan kuesioner respons murid mencapai 83,7%, keduanya berkategori sangat baik. Temuan kualitatif mengungkap fitur umpan balik segera dan sistem kompetisi berbasis poin ZEP Quiz secara signifikan mendorong kapasitas analitis dan evaluatif siswa. Disimpulkan bahwa ZEP Quiz efektif dalam meningkatkan kemampuan berpikir kritis pada konteks pendidikan kuliner.

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A. INTRODUCTION

Vocational education in Indonesia is designed to equip graduates not only with technical competencies but also with higher-order cognitive skills, including critical thinking, that enable adaptation to the rapidly evolving demands of the culinary industry. Critical thinking encompasses the abilities to analyze information, evaluate arguments, synthesize evidence, and make sound decisions skills recognized as foundational for 21st-century learners (Widodo & Kadarwati, 2013; Redhana, 2019). Vocational High Schools (SMK) serve as the primary institutional contexts for

cultivating these competencies, as their graduates must be prepared not merely to execute cooking procedures but to reason critically about the rationale and science underlying culinary practice.

Gamification refers to the application of game design elements—such as point systems, leaderboards, badges, and immediate feedback—within non-game educational contexts to enhance engagement and motivation (Deterding et al., 2011). In educational settings, gamification has been increasingly recognized as a pedagogical strategy capable of stimulating intrinsic motivation and promoting active participation, especially among Generation Z learners who have grown up in digitally immersive environments (Mustakim, 2020). By transforming routine assessment activities into interactive, competitive experiences, gamification encourages students to invest greater cognitive effort in learning tasks.

ZEP Quiz is a gamification-based interactive learning platform that enables educators to design tiered quiz activities intended to stimulate higher-order cognitive processes. Its distinctive features include instant answer feedback, a real-time competitive point system, and visual result displays that create a dynamic and motivating learning atmosphere (Saputra & Muyaroah, 2022). These features are theoretically well-aligned with the requirements for developing critical thinking, as articulated by Facione (2020), who emphasizes that critical thinking capacities are cultivated through learning experiences that systematically demand analysis, synthesis, and evaluation rather than passive content reception.

A growing body of research has examined the effectiveness of gamification-based media in improving student learning outcomes and critical thinking. Saputra and Muyaroah (2022) reported a moderate N-Gain of 0.58 following gamification interventions in high school Biology, while Wardani and Suparman (2020) recorded an N-Gain of 0.43 in junior high Social Studies, both confirming the positive influence of interactive quiz media on cognitive achievement. Mustakim (2020) further demonstrated that digital learning platforms adapted to the technological preferences of Generation Z learners significantly enhanced academic engagement and performance outcomes.

Research by Putri et al. (2021) on interactive media development for culinary education confirmed that students responded positively to contextually relevant digital media, yielding a student response rate of 82.3% in the excellent category. Similarly, Nurhidayah (2021) documented that the use of interactive quiz applications as formative assessment tools significantly improved student engagement and learning outcomes in online instructional settings. Listiana et al. (2020) provided additional empirical support by demonstrating that structured, inquiry-driven learning activities are effective in developing critical thinking among vocational students when accompanied by meaningful feedback mechanisms.

Yuliana et al. (2022) also established that interactive quiz platforms positively influenced student responses and science learning outcomes, reinforcing the growing consensus that technology-mediated gamification constitutes a promising instructional strategy. Despite this accumulating evidence, the existing literature remains predominantly focused on general science subjects and does not adequately address the specific cognitive and contextual demands of culinary vocational education, where students must integrate procedural knowledge with analytical and evaluative reasoning grounded in practical cooking contexts.

A notable research gap exists in that no prior study has specifically investigated the effect of ZEP Quiz on critical thinking skills within a culinary vocational school context using a Mixed Methods approach that combines quantitative outcome measurement with qualitative exploration of the underlying cognitive mechanisms. This gap is particularly significant given the unique epistemological character of culinary education, which demands simultaneous development of procedural fluency and higher-order reasoning. Accordingly, this study aims to: (1) describe the improvement in students' critical thinking skills through N-Gain analysis; (2) analyze students' responses to the use of ZEP Quiz as an interactive learning medium; and (3) explore the mechanisms

through which ZEP Quiz stimulates critical thinking processes, based on qualitative evidence from classroom observations and in-depth interviews.

B. METHODS

The study employed a Mixed Methods approach with a Sequential Explanatory Design. In the first phase, quantitative data were collected and analyzed; the results were then used as the basis for qualitative data collection in the second phase (Creswell, 2014). The integration of both types of data aimed to produce a more comprehensive understanding than either approach could achieve individually (Sugiyono, 2017). Quantitative data were analyzed using descriptive statistics, while qualitative data were analyzed narratively using the Miles and Huberman interactive model.

The study was conducted at SMKN 3 Malang during the Even Semester of 2025/2026, specifically in April 2026. The respondents were all 33 Grade X Culinary Expertise Program students (31 female, 2 male, aged 15–16 years), who served as the experimental group. The sampling technique employed was total sampling, in which all members of the available population were included as research participants. This technique was selected because the total population size was small and manageable ($n = 33$), allowing for comprehensive data collection without the risk of sampling bias, and because the homogeneous characteristics of the population made complete enumeration the most appropriate strategy (Sugiyono, 2017). The research location was selected based on the suitability of the population's characteristics with the research focus and the accessibility of data collection.

The independent variable was the implementation of ZEP Quiz in Basic Culinary learning. The dependent variables included critical thinking skills (measured through pretest–posttest N-Gain and questionnaires) and student responses. Control variables encompassed instructional materials, learning instruments, time allocation, teachers, and physical facilities, all of which were kept consistent throughout the study. The research instruments consisted of: (1) multiple-choice items based on Bloom's Taxonomy cognitive indicators C4–C6 to measure learning outcomes; (2) a critical thinking skills questionnaire using a Guttman scale (Yes/No); and (3) a student response questionnaire using a five-point Likert scale. All instruments were validated by three expert validators, comprising one lecturer in culinary education (serving as content expert) and two culinary arts subject teachers (serving as practitioner validators), with validity scores exceeding 80%. Data collection was carried out in a single session of 6×40 minutes: pretest (30 minutes); ZEP Quiz-assisted learning (150 minutes); posttest (30 minutes); and questionnaire completion (30 minutes). The data collection procedure is illustrated in Figure 1.

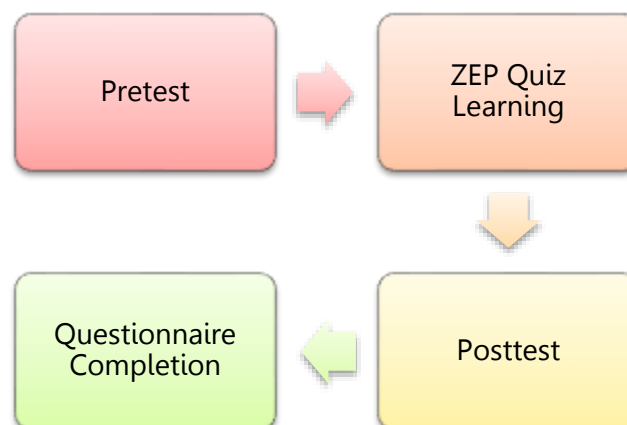


Figure 1. Data Collection Procedure

Improvement in critical thinking skills was measured using the N-Gain formula from Hake (1998) with the following criteria: > 0.7 (high); 0.3–0.7 (moderate); < 0.3 (low).

$$N - Gain = \frac{Skor\ Posttest - Skor\ Pretest}{Skor\ Maksimal - Skor\ Pretest} \quad (1)$$

Questionnaire data were analyzed using the percentage formula with the following categories: 81–100% (excellent); 61–80% (good); 41–60% (adequate).

$$P\ obs = \frac{f}{N} \times 100\% \quad (2)$$

C. RESULTS AND DISCUSSION

1. Instrument Validation Analysis

Prior to use, all instruments were validated by three expert judgement validators: one culinary education lecturer (content expert) and two culinary arts subject teachers (practitioner validators). Validity testing was conducted to determine whether the research instruments were valid and suitable for data collection. Validation result presented in Table 1.

Table 1. Instrument Validation Results

Instrument	Mean (%)	Category
Pretest and Posttest items	87.5	Excellent
Critical Thinking Questionnaire	85.0	Excellent
Student Response Questionnaire	87.5	Excellent
Learning Instruments	83.3	Excellent

Table 1 shows that all instruments received validation scores above 80%, placing them in the excellent category and indicating that they are suitable for use without substantial modification. Pretest and posttest items received a mean validity score of 87.5 from the three validators, placing them in the excellent category and confirming their suitability for use in learning activities and data collection. The Critical Thinking Questionnaire received a mean validity score of 85.0 from the three validators, placing it in the excellent category and confirming its suitability for use in learning activities and data collection. The Student Response Questionnaire received a mean validity score of 87.5 from the three validators, placing it in the excellent category and confirming its suitability for use in learning activities and data collection. The learning instruments received a mean validity score of 83.3 from the three validators, placing them in the excellent category and confirming their suitability for use in learning activities.

2. Cognitive Learning Outcomes Analysis: Pretest and Posttest

Cognitive learning outcomes were obtained from a posttest administered to all 33 students in the Grade X Culinary Academic 2 class, who received the intervention in the form of ZEP Quiz interactive learning media. A comparison of pretest and posttest data reveals a highly significant improvement in learning outcomes, as shown in Table 2.

Table 2. Descriptive Statistics of Pretest and Posttest Scores

Statistic	Pretest	Posttest	Difference
Highest Score	76	96	+20
Lowest Score	36	60	+24
Mean Score	58.2	79.6	+21.4
Standard Deviation	9.84	8.76	–1.08
Learning Mastery (≥ 75)	12.1% (4 students)	84.8% (28 students)	+24 students

The mean score increased from 58.2 to 79.6 (an increase of 21.4 points, or approximately 36.8%). The proportion of students achieving learning mastery (score ≥ 75) rose dramatically from an initial rate of 12.1% to 84.8%. The decline in standard deviation from 9.84 to 8.76 indicates a more even distribution of scores following the intervention, suggesting that ZEP Quiz provided relatively equal and consistent benefits for students with varying levels of initial ability and understanding.

3. Critical Thinking Skills Questionnaire Analysis

The overall mean percentage of the critical thinking questionnaire reached 81.2% (excellent category), as shown in Table 3.

Table 3. Critical Thinking Skills Questionnaire Results by Indicator

Critical Thinking Indicator	Score	Max.	%	Category
Ability to Analyze Information	158	198	79.8	Good
Ability to Identify Problems	162	198	81.8	Excellent
Ability to Evaluate Solutions	155	198	78.3	Good
Ability to Draw Conclusions	163	198	82.3	Excellent
Ability to Make Decisions	167	198	84.3	Excellent
Openness to Alternative Perspectives	152	198	76.8	Good
Total / Mean	957	1188	81.2	Excellent

The decision-making indicator received the highest score (84.3%), followed by the ability to draw conclusions (82.3%) and to identify problems (81.8%). Openness to alternative perspectives received the lowest percentage (76.8%, good category), which is understandable given that the multiple-choice format is inherently less optimal for developing multiperspective thinking compared with discussion-based methods.

4. N-Gain Analysis: Improvement in Critical Thinking Skills

The N-Gain analysis results are presented in Table 4. The majority of students (63.6%) fell into the moderate category, followed by the high (21.2%) and low (15.2%) categories, with a mean N-Gain of 0.51 (moderate category, approaching the upper boundary of the range). These results are consistent with the findings of Saputra & Muyaroah (2022), who obtained an N-Gain of 0.58 in high school Biology, and exceed those of Wardani & Suparman (2020), who recorded 0.43 in junior high Social Studies. These differences may be attributed to variations in subject characteristics and students' digital readiness across different contexts.

Table 4. Distribution of Student N-Gain Scores

N-Gain Category	Criterion	Number of Students	Percentage (%)
High	$N\text{-Gain} > 0.7$	7	21.2
Moderate	$0.3 \leq N\text{-Gain} \leq 0.7$	21	63.6
Low	$N\text{-Gain} < 0.3$	5	15.2
Total/Mean	$N\text{-Gain} = 0.51$ (Moderate)	33	100

The five students in the low category reported technical obstacles, including unstable internet connectivity and unfamiliarity with the platform's interface, causing their cognitive capacity to be largely expended on resolving technical issues rather than processing learning content. This underscores the critical importance of ensuring digital readiness prior to the implementation of technology-based media. The proportion of 15.2% is lower than the 20–25% reported in similar studies (Mustakim, 2020; Nurhidayah, 2021), likely due to the relatively adequate infrastructure preparation at SMKN 3 Malang. The distribution of N-Gain scores is displayed in Figure 2.

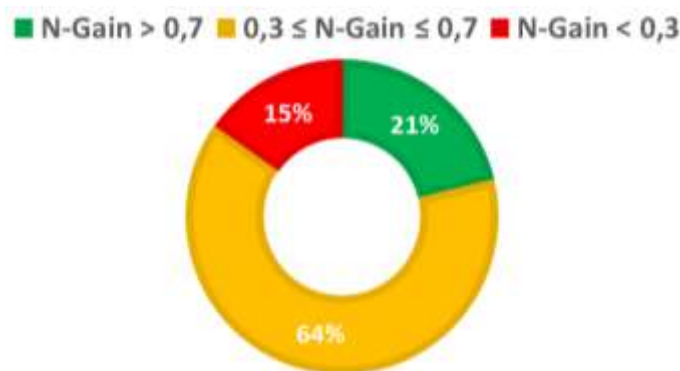


Figure 2. Distribution of Student N-Gain Scores

5. Student Response Questionnaire Analysis

Overall, the student response questionnaire yielded a percentage of 83.7% (excellent), indicating a highly positive reception of ZEP Quiz as a learning medium. The learning motivation aspect received the highest rating (87.9%), demonstrating that the interactive gamification elements within ZEP Quiz successfully created an enjoyable learning experience while simultaneously motivating students to engage in learning activities. Content relevance to the material also received a high rating (86.7%), reflecting the success of the quiz question design in creating meaningful connections to real-world culinary contexts. The interface usability (80.0%) and clarity of instructions (78.8%) aspects received relatively lower scores, indicating the need for improvements in user experience design, in accordance with the recommendations of Yuliana et al. (2022) for the simplification of digital quiz platforms.

Table 5. Student Response Questionnaire Results for ZEP Quiz

Assessment Aspect	Score	Max.	%	Category
Ease of Interface Use	132	165	80.0	Good
Visual Appeal and Design	141	165	85.5	Excellent
Content Relevance to Material	143	165	86.7	Excellent
Effectiveness of Immediate Feedback	139	165	84.2	Excellent
Learning Motivation Generated	145	165	87.9	Excellent
Critical Thinking Stimulation Capacity	136	165	82.4	Excellent
Clarity of Instructions and Directions	130	165	78.8	Good
Total / Mean	966	1155	83.7	Excellent

The implementation of ZEP Quiz in a culinary learning context generated more positive responses on the content relevance aspect (86.7%) compared with those reported by Putri et al. (2021) for Science subjects (82.3%). This suggests that questions rooted in concrete and practical culinary contexts resonate strongly with students' everyday experiences, thereby enhancing their sense of meaningfulness and level of cognitive engagement. The technical obstacles experienced by 15.2% of students represent a proportion that is relatively lower than the 20–25% reported in similar studies (Mustakim, 2020; Nurhidayah, 2021), which is likely attributable to the relatively adequate infrastructure preparation at SMKN 3 Malang prior to data collection.

6. Interview Results Analysis: ZEP Quiz in Stimulating Critical Thinking

In-depth interviews with eight selected students (representing the high, moderate, and low N-Gain categories) revealed four main mechanisms through which the ZEP Quiz fosters the development of critical thinking, as follows:

- a. Immediate feedback as a catalyst for cognitive reflection. The instant feedback feature, which displays an explanation of the correct answer immediately after a student responds, proved

to be the most effective mechanism. Students were able to identify the source of their errors and the rationale behind them in real time. Classroom observations revealed that after receiving feedback, the majority of students engaged in brief discussions with their seatmates to review the correct answers. This behavior reflects the activation of analytical and evaluative processes as the core of critical thinking (Facione, 2020), and was observed in 26 of the 33 students.

- b. Point-based competition as a cognitive motivator. The point system and real-time leaderboard encouraged students to process information more carefully before answering. Unlike conventional tests, which tend to promote guessing, ZEP Quiz's structured competition promotes deeper cognitive elaboration, consistent with the findings of Wardani & Suparman (2020). This mechanism was observed in 24 of the 33 students.
- c. Content visualization as a conceptual bridge. Questions incorporating images of ingredients, cooking technique diagrams, and nutritional value comparison tables prompted more active discussions and longer response times, indicating genuine visual analysis. This feature helped students connect abstract concepts with the practical realities of cooking (Listiana et al., 2020) and was observed in 18 of the 33 students.
- d. Technical barriers and their implications. The five students in the low N-Gain category experienced connectivity disruptions and difficulty adapting to the platform's interface, causing their cognitive capacity to be largely diverted toward technical issues rather than content processing. These findings underscore the necessity for teachers to ensure technical readiness devices, connectivity, and digital literacy prior to implementing technology based media.

7. Data Triangulation

The convergence of quantitative and qualitative data yields a comprehensive picture of ZEP Quiz's effectiveness. The high scores on the decision-making indicator (84.3%) and learning motivation (87.9%) align with qualitative findings regarding the effectiveness of immediate feedback and point-based competition as the primary drivers of critical thinking. Conversely, the relatively lower score on interface usability (80.0%) and the low N-Gain of five students are consistently corroborated by qualitative evidence concerning technical barriers. This triangulation not only strengthens the validity of the findings but also generates more operationally applicable implementation recommendations for practitioners.

D. CONCLUSION AND SUGGESTIONS

Based on a comprehensive analysis of the data, three primary conclusions were drawn. First, the implementation of ZEP Quiz as an interactive learning medium was proven effective in improving the critical thinking skills of Grade X Culinary Expertise Program students at SMKN 3 Malang. This is evidenced by an improvement in the mean cognitive score of 21.4 points (58.2 to 79.6), a mean N-Gain of 0.51 (moderate category), a critical thinking questionnaire percentage of 81.2% (excellent), and 84.8% of students achieving learning mastery. Second, students' responses to ZEP Quiz were highly positive, with a percentage of 83.7% (excellent). Learning motivation and content relevance received the highest ratings, while interface usability and clarity of instructions still require further improvement. Third, this study contributes to the literature by providing the first empirical evidence, using a Mixed Methods Sequential Explanatory design, of ZEP Quiz's effectiveness in simultaneously advancing gamification-based learning and critical thinking skills within the specific context of culinary vocational education, thereby extending the theoretical and practical knowledge base for technology-enhanced pedagogy in vocational schooling. The primary mechanisms through which ZEP Quiz promotes critical thinking are: (1) immediate feedback that triggers reflection and

metacognition; (2) a point-based competition system that encourages deeper cognitive elaboration; and (3) content visualization that bridges abstract concepts with real culinary practice.

Based on these conclusions, the following recommendations are put forward: (1) teachers should conduct a platform orientation session prior to implementation and ensure the readiness of devices and connectivity; (2) school administrators should make sustained investments in digital infrastructure; (3) platform developers should simplify the ZEP Quiz interface; and (4) future researchers should examine the effects of ZEP Quiz over longer periods with a robust control group in order to obtain more compelling evidence of causality, including its adaptation for students with limited access to technology.

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