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Enhancing Primary Students' Critical Thinking through School Quality Management Practices and Deep Learning

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Abstract:

This study aims to explore how integrating school quality management principles with an immersive learning approach affects elementary school students' critical thinking skills. Using a quasi-experimental design, 80 fifth-grade students from a public elementary school were assigned to an experimental and a control group. The experimental group received instruction aligned with quality management principles and immersive learning, while the control group experienced conventional instruction. Validity and reliability tests confirmed the instrument's suitability (CVI = 0.93; α = 0.87). Results showed a significant improvement in the experimental group ($t = 10.518$, $p < 0.001$; N-gain = 0.56, moderate) compared to the control group (N-gain = 0.22, low). This study is innovative because previous research generally examines school quality management or immersive learning separately and at higher education levels, whereas this study integrates both in elementary education. Theoretically, this study extends the educational management literature by validating the pedagogical dimensions of quality management. Practically, this study provides guidelines for schools to align quality management practices with classroom-based immersive learning to develop students' critical thinking.

Keywords: *Critical Thinking, Quality Management, Deep Learning, Primary Education*

Abstrak:

Penelitian ini bertujuan untuk mengeksplorasi bagaimana integrasi prinsip manajemen kualitas sekolah dengan pendekatan pembelajaran mendalam memengaruhi keterampilan berpikir kritis siswa sekolah dasar. Menggunakan desain quasi-eksperimental, 80 siswa kelas lima dari sekolah dasar negeri, dibagi menjadi kelompok eksperimen dan kelompok kontrol. Kelompok eksperimen menerima pengajaran yang selaras dengan prinsip manajemen kualitas dan pembelajaran mendalam, sementara kelompok kontrol mengalami pengajaran konvensional. Uji validitas dan reliabilitas memastikan kesesuaian instrumen (CVI = 0.93; α = 0.87). Hasil menunjukkan peningkatan signifikan pada kelompok eksperimen ($t = 10.518$, $p < 0.001$; N-gain = 0.56, moderat) dibandingkan dengan kelompok kontrol (N-gain = 0.22, rendah). Studi ini bersifat inovatif karena penelitian sebelumnya umumnya mengkaji manajemen kualitas sekolah atau pembelajaran mendalam secara terpisah dan pada tingkat pendidikan yang lebih tinggi, sedangkan penelitian ini mengintegrasikan keduanya dalam pendidikan dasar. Secara teoritis, penelitian ini memperluas literatur manajemen pendidikan dengan memvalidasi dimensi pedagogis dari manajemen kualitas. Secara praktis, penelitian ini memberikan pedoman bagi sekolah untuk menyelaraskan praktik manajemen kualitas

dengan pembelajaran mendalam berbasis kelas guna mengembangkan pemikiran kritis siswa.
Kata Kunci: *Berpikir Kritis, Manajemen Kualitas, Pembelajaran Mendalam, Pendidikan Dasar*

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INTRODUCTION

Basic education is an essential foundation for the formation of character, skills, and higher-order thinking abilities that students need to face the challenges of the 21st century (Loyens et al., 2023). The Framework for 21st Century Learning document identifies critical thinking as one of the four core competencies (critical thinking, creativity, collaboration, communication) that should be developed from elementary school onward (Rapanta, 2019). Various studies have shown that elementary education focused on rote learning tends not to produce deep conceptual understanding and does not effectively train students to think critically (Khanal & Guha, 2023). This has resulted in lower-order thinking skills (HOTS) among students in developing countries, including Indonesia (Hardiansyah et al., 2022)

The Trends in International Mathematics and Science Study (TIMSS, 2019) revealed that only about 3% of Indonesian fourth graders reached the "high" level of analytical thinking—well below the international average of 10% (Martin & Mullis, 2017). This national trend, reflected in low PISA scores in higher grades, reflects the persistent weakness in cultivating critical thinking from the early years. Similar conditions are observed in local contexts, such as Sumenep, where classroom learning remains dominated by conventional, teacher-centered instruction that emphasizes factual recall rather than reflective inquiry and problem analysis.

On the other hand, school quality management has long been recognized as a critical factor in determining the quality of primary education (Wijnen et al., 2023). School quality management refers to systematic efforts to ensure that all aspects of school operations—from planning and implementation of learning to evaluation—are oriented towards achieving optimal educational quality (Sølvik & Glenna, 2022). Schools with high-quality management practices generally have a clear vision, a strong culture of quality, effective teacher collaboration, and a commitment to continuous improvement. However, in practice, school quality management is often limited to administrative matters and does not truly affect classroom learning quality (Delle-Vergini et al., 2024).

To foster meaningful learning and enhance students' critical thinking skills, schools must establish a synergy between quality management practices and pedagogical approaches that promote deep cognitive engagement (Riwayatiningsih, 2019). While numerous studies have discussed school quality management as an administrative mechanism to improve overall school performance, few have linked it directly to pedagogical innovation and student thinking outcomes—particularly at the elementary level. Recently, the *deep learning* approach has gained attention as a pedagogical framework emphasizing deep conceptual understanding, reflective inquiry, active engagement, and the

application of knowledge to real-world contexts rather than the use of artificial intelligence algorithms (Frank, 2020). This approach nurtures higher-order thinking, including critical, analytical, and evaluative reasoning (Teng & Yue, 2023). However, empirical evidence connecting school quality management with deep learning-based instruction remains scarce, especially in Indonesian primary schools, where rote methods still dominate teaching practices. Integrating quality management principles that explicitly support deep learning offers a strategic pathway for improving students' critical thinking in contexts such as Sumenep. Schools that align institutional quality policies with innovative pedagogy are more likely to cultivate reflective and critical learners (H. Liu et al., 2022).

However, empirical research on the relationship between school quality management grounded in deep learning and the critical thinking skills of elementary school students remains relatively limited. Most previous studies focus on the impact of school quality management on overall academic performance (Caroti et al., 2022) or on the effectiveness of the deep learning approach in improving learning outcomes at the university level (Ho et al., 2023). Research explicitly examining the effect of integrating school quality management principles with deep learning approaches on elementary school students' critical thinking skills is rare.

The problem of low critical thinking skills among elementary school students is an urgent issue that needs to be addressed. The Programme for International Student Assessment (PISA, 2018) results also show that only 1% of Indonesian students aged 15 achieved the highest proficiency level in literacy-based critical thinking, while the majority were at lower levels. This indicates that the problem of low essential thinking skills is deeply rooted in elementary education (OECD, 2019). Therefore, it is necessary to undertake more targeted, evidence-based efforts to improve students' critical thinking skills from elementary school onward, through quality school management and appropriate learning strategies (Moghadam et al., 2023).

Based on the above description, this study focuses on the following question: Does applying school quality management principles using a deep learning approach significantly improve elementary school students' critical thinking skills? This study aims to 1) analyze the effect of implementing school quality management principles based on a deep learning approach on the critical thinking skills of elementary school students and 2) provide empirical evidence on the importance of integrating school quality management and innovative pedagogical approaches to improve critical thinking skills at the elementary education level.

Previous studies have examined the relationship between school quality management and learning outcomes. (Aston, 2024) found that schools with a strong quality culture achieved better academic outcomes. (M.Ed, 2020) reported that quality management practices in elementary schools in Taiwan were positively associated with student satisfaction and learning outcomes, although the impact on critical thinking skills was not specifically analyzed. Another study by Orhan & Çeviker Ay (2023) showed that a deep learning approach at the university level can improve students' conceptual understanding and reflective

thinking skills. However, it was conducted at the higher education level, not at the primary education level. In Indonesia, Hardiansyah & Zainuddin (2022) investigated the influence of school quality management on the academic performance of junior high school students and found significant results. However, the study did not measure critical thinking skills. A survey by Demircioglu et al. (2023) found that school quality management practices that involve teachers in decision-making positively impact learning quality. Meanwhile, research on the effectiveness of the deep learning approach in improving elementary school students' critical thinking remains limited to small-scale studies, such as a single-class experimental study by Rivas et al. (2023), which showed an increase in critical thinking after problem-based learning.

The existing literature reveals a clear gap: very few studies have examined how school quality management, when integrated with a deep learning approach, directly influences the development of elementary students' critical thinking skills. Prior research has essentially treated these constructs separately—school quality management as an administrative or managerial framework to improve institutional effectiveness, and deep learning as a pedagogical strategy to enhance cognitive engagement, mostly at secondary or tertiary levels. However, empirical evidence linking both within the context of primary education remains scarce. Synthesizing these strands, it becomes evident that managerial and pedagogical innovations must operate synergistically to produce sustainable learning improvement.

This study offers originality by positioning the intersection of school management and pedagogy as a unified framework for cultivating critical thinking at the foundational education stage. Unlike previous research on organizational performance or classroom methods in isolation, this study empirically validates their integration through a quasi-experimental design in an Indonesian elementary school context. Theoretically, it extends educational management literature by demonstrating how quality assurance mechanisms can enable deep, reflective learning. Practically, it provides a strategic model for school leaders and teachers to embed quality management principles into daily instructional practice. Through this dual focus, the study seeks to advance conceptual understanding and generate actionable insights to improve educational quality from the ground up.

RESEARCH METHODS

This study employed a quantitative approach with a quasi-experimental, non-equivalent control group design. The quantitative method was chosen to objectively assess the effect of implementing school quality management principles integrated with a deep learning approach on elementary students' critical thinking skills, using numerical data analysis. A quasi-experimental design was appropriate because the researcher could not fully randomize participants into treatment and control groups, but could control most external variables influencing the outcomes.

The study involved two fifth-grade classes from a public elementary school in Sumenep, Indonesia, with 80 students (40 in the experimental group

and 40 in the control group). The sampling technique was cluster random sampling, with intact classes as the units of selection rather than individual students. The experimental class received instruction based on school-quality management principles, combined with a deep learning approach, while the control class followed conventional learning practices. This design was chosen because it enabled pre-test and post-test comparisons between groups to determine treatment effects, even without complete individual randomization. While this approach ensured reasonable internal validity and practical feasibility within the school setting, the study's single-institution design may limit the generalizability of its findings to broader educational contexts.

The research instrument used to measure students' critical thinking skills was an essay test with 30 questions developed based on critical thinking skill indicators. The questions were designed to address the taxonomy of critical thinking, which includes skills in analysis, evaluation, inference, explanation, and self-regulation. This instrument was validated through content validity testing involving three elementary education experts to ensure the questions were consistent with the critical thinking ability indicators. The instrument's reliability was also assessed using Cronbach's alpha to ensure internal consistency. The following table shows the indicators of the critical thinking ability test instrument:

Table 1. Critical Thinking Ability Test Instrument Indicators

Critical Thinking Aspect	Detailed Indicators
Problem Identification	a) Identifying which statement represents the problem in a given learning situation. b) Identifying the main issue from a text or word problem.
Information Analysis	a) Breaking down key information from a text, image, or graph. b) Connecting relevant information to understand the problem situation.
Argument Evaluation	a) Assessing whether the reasons provided support the conclusion. b) Distinguishing between facts and opinions in a statement.
Inference Making	a) Drawing logical conclusions based on available evidence. b) Predicting outcomes of an action based on given patterns.
Explanation	a) Providing logical reasons for the chosen answer. b) Clearly and systematically communicating the thinking process.
Self-Regulation	a) Re-evaluating answers to ensure their accuracy. b) Demonstrating awareness of the weaknesses/strengths of one's own arguments.
Problem Solving	a) Formulating an appropriate problem-solving strategy. b) Choosing the most effective solution among several alternatives.
Creative Critical Thinking	a) Generating alternative, reasonable ideas to solve a problem. b) Providing different yet logical answers from common responses.

Before being used in the main study, the critical thinking test instrument was validated to ensure that the items truly measured the intended

competencies. Validation was conducted through content validity and empirical validity tests. Assessment was performed using a scale of 1–4 for indicator representativeness, instruction clarity, and material relevance to critical thinking skills. The average content validity index (CVI) for all items reached 0.93, which is classified as very high validity. Subsequently, empirical validity testing was conducted on a pilot sample of 40 fifth-grade students outside the research sample. The results of the Pearson product-moment correlation test between the scores of each question and the total test scores showed a correlation coefficient (r) ranging from 0.41 to 0.78, with a significant value at the $p < 0.05$ level. All 30 questions showed a correlation coefficient above the minimum limit of 0.30, so all were declared empirically valid.

Table 2. Summary of Empirical Validity Results of Critical Thinking Skills Test Instrument

Item No.	Correlation (r)	Validity Category
1–5	0.41–0.52	Moderate
6–15	0.53–0.67	High
16–25	0.61–0.74	High
26–30	0.65–0.78	High

The results of the content validity analysis indicate that all items are highly consistent with the critical thinking ability indicators formulated in the indicator table. A CVI value of 0.93 means that the instrument comprehensively covers the dimensions of critical thinking skills and is suitable for use in research. Therefore, based on both content and empirical validity tests, all 30 items are deemed valid and can be used in research to measure critical thinking skills among elementary school students in the context of implementing school-based quality management through deep learning.

Table 3. Reliability Test Result of Critical Thinking Skills Test Instrument

Instrument	Number of Items	Cronbach's Alpha	Reliability Category
Critical Thinking Skills Test	30	0.87	High Reliability

The reliability test results show that Cronbach's Alpha for the critical thinking ability test instrument is 0.87, exceeding the 0.80 threshold for high reliability, indicating excellent internal consistency. This indicates that all items in the instrument are consistently related to measuring the same construct: the critical thinking ability of elementary school students.

Before testing the hypotheses, the data were examined to ensure compliance with statistical assumptions and research ethics. The critical thinking test used in this study was a researcher-developed instrument, constructed based on key indicators of critical thinking proposed by Ennis (2011) and the Watson–Glaser Critical Thinking Appraisal framework, covering aspects of analysis, inference, evaluation, explanation, and self-regulation. The initial pool of 30 essay-type items was reviewed by three experts: a psychometrician, a primary education curriculum expert, and a senior elementary teacher experienced in competency-based assessment. The Content Validity Index (CVI) reached 0.93, indicating excellent representativeness, and empirical validity testing in a pilot group ($n = 40$) yielded item–total correlations ranging from 0.41 to 0.78. The

instrument demonstrated high internal consistency (Cronbach's α = 0.87).

All statistical analyses were conducted using SPSS version 26. Before hypothesis testing, data normality was examined using the Kolmogorov–Smirnov test, and homogeneity of variance was assessed via Levene's test. Normalized Gain (N-gain) scores were calculated to assess the treatment's effectiveness, indicating the relative increase in students' critical thinking performance compared to the maximum achievable score. For hypothesis testing, a parametric independent-samples t-test was used when the assumptions of normality and homogeneity were met, given its higher statistical power for moderate sample sizes. If assumptions were violated, the nonparametric Mann–Whitney U test was employed as a robustness check.

According to conventional power analysis benchmarks, the sample size of 80 students (40 per group) met the minimum requirements for detecting a moderate effect (Cohen's d = 0.5, α = 0.05, power = 0.80). Research procedures adhered to ethical standards, including approval from the participating school, informed parental consent, and assurances of student anonymity and data confidentiality. This adaptive analytical and ethical framework ensured the reliability, validity, and credibility of the study's findings.

RESULTS AND DISCUSSION

Results

Data Assumptions and Preliminary Equivalence

This study presents key findings on implementing school quality management principles, integrated with a deep learning approach, to enhance elementary students' critical thinking skills. Before hypothesis testing, preliminary analyses were conducted to ensure the data met the required statistical assumptions. The Kolmogorov–Smirnov test confirmed that both pre-test and post-test scores in the experimental and control groups were normally distributed ($p > 0.05$). Likewise, Levene's test for equality of variances indicated homogeneity between the two groups ($p = 0.227$). These results validate the use of parametric testing procedures.

Table 4. Normality Test Results of Pre-Test and Post-Test Scores

Group	Test Type	N	Sig. (Kolmogorov–Smirnov)	Decision
Experimental Group	Pre-Test	40	0.142	Normal
Experimental Group	Post-Test	40	0.087	Normal
Control Group	Pre-Test	40	0.198	Normal
Control Group	Post-Test	40	0.061	Normal

Based on the Kolmogorov–Smirnov test results in Table 4, the significance value for the pre-test score of the experimental group was 0.142, and the post-test score was 0.087. Meanwhile, the significance values for the pre-test score of the control group were 0.198, and for the post-test, 0.061. All significance values are above the 0.05 significance level, so it can be concluded that the data distributions in both groups, before and after treatment, are normal. The data distribution is normal, indicating that the basic assumptions for parametric tests (e.g., the independent-samples t-test) are met. Therefore, a test of homogeneity of variance

and a parametric hypothesis test were conducted to determine whether there was a significant difference in the mean post-test scores between the experimental and control groups.

Table 5. Homogeneity Test of Post-Test Scores Variance

Dependent Variable	Levene Statistic	df1	df2	Sig. (p)	Decision
Critical Thinking Post-Test Score	1.482	1	78	0.227	Homogeneous

The homogeneity test results in Table 5 show that the Levene Statistic value is 1.482 with a significance value (p) of 0.227, which is greater than $\alpha = 0.05$. This means there is no significant difference in the variance of the post-test scores for critical thinking ability between the experimental and control groups. Thus, the data can be declared homogeneous. This conclusion supports using a parametric test (an independent-samples t-test) to test the hypothesis of a difference in the mean post-test scores between the two groups. The assumption of homogeneity of variance strengthens the validity of statistical inference, as the t-test requires equal population variances across the groups being compared.

Table 6. Distribution of Pre-Test and Post-Test Scores of Critical Thinking Skills

Group	N	Test Type	Mean	SD	Minimum	Maximum
Experimental Group	40	Pre-Test	52.30	6.42	40	64
	40	Post-Test	78.85	7.12	65	90
Control Group	40	Pre-Test	51.90	6.15	42	62
	40	Post-Test	62.45	6.89	50	74

Based on Table 6, the pre-test scores showed that the experimental group had an average critical thinking ability of 52.30 (SD = 6.42), while the control group averaged 51.90 (SD = 6.15). The average pre-test scores of the two groups were relatively equivalent, with a minimal difference (0.4 points), indicating that the initial conditions of the two groups were homogeneous and comparable. After the treatment, the experimental group showed a significant increase in the average post-test score to 78.85 (SD = 7.12), while the control group showed a more minor increase, with an average post-test score of 62.45 (SD = 6.89). The average score increase in the experimental group was 26.55 points, much higher than the 10.55-point increase in the control group. This shows that applying school quality management principles, combined with a deep learning approach, positively impacted students' critical thinking skills in the experimental group. The distribution of minimum and maximum scores also increased: in the experimental group, the minimum score increased from 40 to 65, and the maximum score increased from 64 to 90. Conversely, in the control group, the minimum score rose only from 42 to 50, and the maximum from 62 to 74. Thus, descriptively, these results indicate that the treatment given to the experimental group was more effective in improving critical thinking skills than conventional learning in the control group.

To determine the level of effectiveness of the improvement in students' critical thinking skills after treatment, the Normalized Gain (N-Gain) index was calculated for each group. N-Gain was calculated to measure the magnitude of the increase in students' scores relative to the maximum possible score. The

interpretation of N-Gain effectiveness categories is as follows: high (≥ 0.7), moderate (0.3 ≤ g < 0.7), and low (g < 0.3).

Table 7. N-Gain Scores of Critical Thinking Skills Improvement

Group	Pre-Test Mean	Post-Test Mean	N-Gain	Category
Experimental Group	52.30	78.85	0.56	Moderate
Control Group	51.90	62.45	0.22	Low

Based on Table 7, the experimental group showed an N-Gain of 0.56, which falls within the moderate range. This indicates that implementing school quality management principles with a deep learning approach effectively improved students' critical thinking skills to a higher level than before, with moderate effectiveness. Meanwhile, the control group only showed an N-Gain of 0.22, which is classified as low. This means that conventional learning given to the control group was less effective in improving students' critical thinking skills. The significant difference in effectiveness between the two groups shows that school quality management-based intervention with a deep learning approach is superior to conventional learning. These results are consistent with previous descriptive findings showing a greater increase in the average post-test scores in the experimental group. Thus, the intervention in the experimental group was shown to contribute significantly to the development of elementary school students' critical thinking skills, in line with the objectives of this study.

Table 8. Independent Samples t-Test of Post-Test Scores

Group	N	Mean	SD					
Experimental Group	40	78.85	7.12					
Control Group	40	62.45	6.89					
Levene's Test for Equality of Variances				F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed				1.482	0.227	10.518	78	0.000

Based on the t-test results in Table 8, the average post-test score for critical thinking skills in the experimental group was 78.85, while in the control group, it was 62.45. The Levene's Test showed a p-value of 0.227 (> 0.05), indicating that the assumption of homogeneity of variance was met, and the t-test was conducted under the assumption of equal variance. The t-value obtained was 10.518 with degrees of freedom (df) = 78, and the significance value (2-tailed) was 0.000 (< 0.05). This indicates a statistically significant difference in the average critical thinking scores between the experimental and control groups after the treatment. These results suggest that applying school-quality management principles using a deep learning approach is significantly more effective at improving elementary school students' critical thinking skills than conventional instruction. Thus, the research hypothesis stating that "there is a significant effect of the application of school quality management principles using a deep learning approach on the critical thinking skills of elementary school students" is accepted.

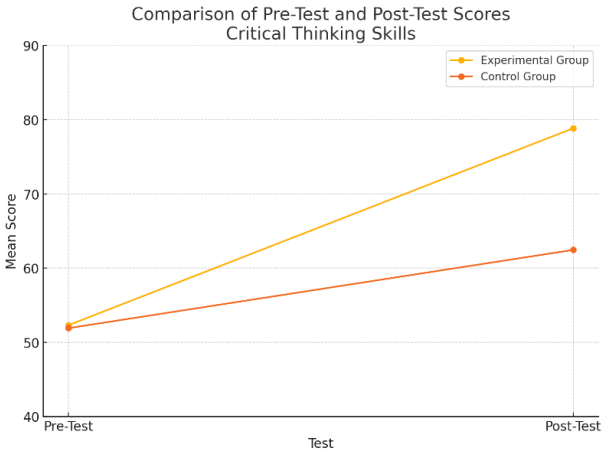

Figure 1. Line Chart of Pre-Test and Post-Test Scores of Critical Thinking Skills

The diagram shows that both groups started with almost identical pre-test scores (52.30 for the experiment and 51.90 for the control), indicating equal initial conditions. After the treatment, the experimental group showed a much greater increase in post-test scores (78.85), while the control group showed only a moderate increase (62.45). The upward slope for the experimental group is steeper, indicating that implementing school quality management with a deep learning approach effectively improves students' critical thinking skills. The increase in the experimental group's scores is significantly higher than that of the control group, supporting the hypothesis that the treatment positively impacts critical thinking skills.

Discussion

The findings of this study provide strong evidence for the effectiveness of implementing integrated school quality management principles, combined with a deep learning approach, in improving elementary school students' critical thinking skills. The significant improvement in critical thinking skills in the experimental group is consistent with the theoretical framework of this study, particularly constructivist learning theory, which states that students actively construct knowledge through meaningful engagement (X. Liu et al., 2023). The deep learning approach encouraged students to go beyond mere memorization, engaging higher-order cognitive processes such as analysis, evaluation, and synthesis, which are at the core of critical thinking skills (van Peppen et al., 2021). Furthermore, implementing school quality management practices was essential in creating a learning environment that supported such pedagogical innovation (Min et al., 2023).

These results align with previous research showing that when implemented beyond mere administrative compliance, school quality management can positively impact student learning outcomes (Xu et al., 2023). Setting clear learning objectives, involving teachers in collaborative planning, monitoring learning implementation, and providing feedback, creates a structured and conducive framework for implementing deep learning in the classroom (Weng et al., 2023). In contrast, the control group that followed only

conventional learning showed only minor improvements in critical thinking skills. This highlights the limitations of traditional pedagogy, which remains focused on mastering facts and memorization, rather than on developing the competencies needed in the 21st century, such as problem-solving and reflective thinking (Jaffe et al., 2019). This study also strengthens empirical evidence for integrating managerial and pedagogical aspects to improve student learning outcomes. While previous studies (Hardiansyah et al., 2022; Hsu, 2021) generally tested the effects of school quality management or the effectiveness of deep learning separately, this study shows that combining both produces a greater impact, particularly in developing critical thinking skills at the elementary school level.

Theoretically, the results of this study expand the discussion on school quality management by highlighting its pedagogical dimension. Until now, quality management has been viewed more as an administrative function to improve efficiency and meet performance indicators. This study shows that quality management can also serve as a lever for learning innovation when directed to support constructivist teaching practices that encourage deep learning and critical thinking. From a pedagogical perspective, these results reinforce the evidence that deep learning approaches are relevant in higher education and can be effectively adapted to elementary education. These results refute the assumption that elementary school students cannot engage in higher-order thinking. With proper guidance and learning strategies, elementary school students can engage in reflective, analytical, and evaluative thinking.

The practical implications of this study for school principals, teachers, and policymakers are clear. First, training programs for school principals and teachers need to integrate instructional leadership that links school quality management with learning strategies that encourage critical thinking. Second, schools need to build a culture of quality that focuses not only on administrative processes but also on classroom learning. Third, policymakers need to ensure the allocation of resources and professional development that enable the implementation of such integrative approaches, especially in disadvantaged areas such as Sumenep. Although it makes a significant contribution, this study has several limitations. From a methodological perspective, the quasi-experimental design is appropriate for the educational context but lacks the high internal validity of a pure experimental design.

Finally, the research underscores the importance of equitable and ethical implementation. Schools must ensure that innovations in teaching and management benefit all students, regardless of background or access to learning resources. Future studies could expand the model to multiple schools and explore mediating variables, such as teacher competence, classroom climate, and student motivation, to further explain the mechanisms driving these effects.

CONCLUSION

This study concludes that integrating school quality management principles with a deep learning approach significantly and positively impacts the development of elementary students' critical thinking skills. The experimental group that received the integrative treatment achieved considerably higher post-

test scores and a larger effect size than the control group, demonstrating that managerial alignment and pedagogical innovation can synergistically enhance students' higher-order thinking. The findings affirm that when school management practices extend beyond administrative control toward fostering reflective and inquiry-based learning, classrooms become more conducive to meaningful engagement and reasoning.

Scientifically, this study contributes to the literature by providing empirical validation of the link between educational management and pedagogy and by extending the constructivist framework to the context of primary education. It offers a practical model for schools to embed quality assurance mechanisms into daily instruction to promote deep cognitive learning. However, the study's scope was limited to a single school in Sumenep, which may constrain the generalizability of its findings. Future research should involve a broader range of schools and employ mixed-method or longitudinal designs to explore how managerial–pedagogical integration influences student learning across diverse contexts.

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