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Development of a Contextual QR-Based English Module to Enhance Elementary School Students' Critical Thinking Skills

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Abstract: This study aims to develop and evaluate the feasibility and effectiveness of a contextual English module supported by QR codes to enhance fourth-grade students' critical thinking skills. The research employed a Research and Development (R&D) method using the ADDIE model, involving 27 fourth-grade students from SDN 1 Jeketro, an urban public elementary school in Central Java, as well as two external experts for content and media validation. Data were collected through expert validation sheets, classroom observations, and a critical thinking test using a one-group pretest–posttest design. The developed module demonstrated a high level of feasibility, achieving a mean validation score of 9.28 out of 10 from the content and media experts. Students' performance improved substantially, increasing from 32.59% in the pretest to 70.74% in the posttest, with an N-gain score of 0.55, which falls into the moderate category. Among the assessed dimensions of critical thinking, analytical ability showed the most significant improvement, followed by evaluation and problem-solving skills. This pattern suggests that students became more capable of identifying relevant information, interpreting meaning, and drawing reasoned conclusions from contextual English materials. These findings indicate that a culturally contextualized QR code–based module is both feasible and effective in fostering critical thinking skills in primary English learning. The integration of local cultural content with structured digital support appears to create meaningful learning experiences that encourage deeper cognitive engagement. Furthermore, the results suggest that combining contextual pedagogy with accessible technology can strengthen not only language acquisition but also higher-order thinking processes. This approach offers practical implications for primary educators seeking instructional strategies that connect language learning with students' lived experiences while promoting reflective and analytical thinking in a sustainable manner.

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Introduction

Primary education plays a decisive role in preparing learners to respond to the intellectual and social demands of the twenty-first century, particularly through the cultivation of critical thinking (Rahmayati et al., 2023). This competence extends beyond information recall; it entails the capacity to analyze evidence, evaluate arguments rationally, and reflect on decisions in a reasoned manner (Furaida & Ediyono, 2021). In the context of English as a Foreign Language (EFL) instruction at the elementary level, the acquisition of vocabulary and grammatical structures must therefore be accompanied by the ability to interpret meaning, connect texts to lived experience, and recognize the socio-cultural dimensions embedded in language use. Critical thinking in primary education encompasses

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analysis, evaluation, reflection, problem solving, and socio-cultural awareness (Hartati et al., 2022). Consequently, English instruction should aim not only to develop linguistic competence but also to foster higher-order cognitive skills.

Current pedagogical discourse emphasizes the importance of constructive alignment to achieve meaningful learning. Within the deep learning framework, (Biggs, 2014). argues that coherence among learning objectives, instructional activities, and assessment practices is essential to promote deep understanding. Instructional approaches that rely predominantly on mechanical language drills tend to produce surface-level learning outcomes. Accordingly, learning objectives in primary EFL should explicitly target critical thinking; classroom tasks should encourage inquiry, interpretation, and reflective dialogue; and assessment should authentically capture students' analytical and evaluative performance.

The Contextual Teaching and Learning (CTL) approach has been identified as an effective strategy for enhancing meaningful engagement by linking instructional content to students' real-life contexts (Sundari et al., 2021). This orientation is theoretically grounded in (Vygotsky, 1978) sociocultural perspective, which highlights the role of social interaction and scaffolding within the Zone of Proximal Development in advancing cognitive growth. Integrating local cultural content into English instruction can increase relevance and facilitate the progression from concrete experiences to abstract language use. Nevertheless, empirical evidence indicates that classroom practices in many primary schools remain teacher-centered and dominated by structural exercises (Febryani Nasution & Yusnaldi, 2024). Preliminary observations at SDN 1 Jeketro, an urban public elementary school in Central Java reveal limited student participation, minimal reflective discussion, and difficulty in relating English materials to everyday experience. These conditions are associated with weak reasoning skills and limited ability to formulate logical conclusions.

However, prior research has predominantly concentrated on isolated language competenciessuch as reading fluency or vocabulary acquisition or on general literacy achievement, with limited attention to how digitally enriched, context-based instruction can deliberately cultivate critical thinking among primary school learners within culturally situated learning environments. Recent international scholarship indicates that critical thinking in elementary language classrooms is often demonstrated through structured dialogic practices, including Visual Thinking Strategies (VTS), guided questioning, collaborative interpretation of visual texts, and simple problem-solving tasks that prompt learners to justify opinions with evidence and articulate reasoning (Yenawine, 2023; Kabilan & Annamalai, 2022) . These approaches show that even young learners are capable of engaging in analytical observation, inference-making, and reflective explanation when instructional scaffolding is intentionally designed. Nevertheless, studies that integrate such critical thinking practices with localized cultural content and QR Code-supported digital modules in primary English education remain limited, particularly within empirically tested frameworks (Li & Hu, 2024; Taboada Barber et al., 2022).

Based on this rationale, the present study investigates whether a contextual English module supported by QR Codes can meaningfully improve fourth-grade students' learning achievement and critical thinking skills, after first confirming its feasibility through expert review by content and media specialist. To determine its effectiveness, a pretest–posttest design complemented by N-gain analysis was employed to measure changes in students' performance following implementation. Accordingly, this study aims to (1) design and validate a contextual QR Code–integrated English module for primary education and (2) empirically evaluate its impact on students' learning outcomes and critical thinking development. The contribution of this research lies in providing tested evidence that

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culturally grounded content combined with structured digital support can function not merely as instructional enrichment, but as a purposeful pedagogical strategy to foster higher-order thinking in elementary English classrooms.

Research Method

This study employed a Research and Development (R&D) method to produce an instructional module and to examine its effectiveness within an authentic elementary classroom setting Sugiyono, 2019). The development procedure followed the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation, which offers a systematic and iterative framework for instructional product development. (Branch, 2009); (Fitri & Jazadi, 2025). A one-group pretest–posttest design was applied during the limited trial phase to obtain preliminary evidence of effectiveness prior to broader implementation.

The research proceeded through five sequential stages in accordance with the ADDIE framework: (1) Analysis of needs and contextual conditions; (2) Design of the contextual English module and research instruments; (3) Development and expert validation of the product; (4) Limited implementation in a primary classroom; and (5) Evaluation of feasibility, practicality, and effectiveness.

Analysis

The analysis phase identified instructional needs, learner characteristics, and contextual constraints in primary English learning. Data were collected through a need analysis questionnaire administered to teachers and students, consisting of 15 dichotomous items to ensure clarity and reduce response bias among young learners. Content validity of the instrument was established through expert review involving a classroom teacher and an academic supervisor to confirm alignment between each item and the objectives of the need assessment. Findings from this phase informed the design of learning objectives, activities, and assessment procedures.

Design

Based on the needs analysis, a contextual English module supported by QR Codes was systematically designed using the Contextual Teaching and Learning (CTL) approach. Vocabulary and expressions were linked to students' daily experiences and local cultural contexts to promote meaningful learning. Learning activities were structured to address critical thinking indicators, identifying main ideas, distinguishing simple facts from opinions, explaining cause–effect relationships, and drawing logical conclusions from texts (Hartati et al., 2022). Tasks included short narrative and descriptive readings, comprehension questions, and paraphrasing exercises. At this stage, research instruments were also prepared, including expert validation sheets, pretest and posttest items, and teacher and student response questionnaires. All components were aligned to ensure coherence between learning objectives and measurement procedures.

An instrument matrix was designed to map the theoretical dimensions of critical thinking analysis, evaluation, reflection, and problem solving onto measurable indicators embedded in contextual English texts (Hartati et al., 2022). Based on this blueprint, the pretest and posttest consisted of structured written assessments combining multiple-choice items and short constructed-response questions. The multiple-choice items were intended to measure students' ability to identify main ideas, interpret explicit information, and determine relationships among concepts. The short-response items required students to provide brief explanations, justify answers, or propose simple solutions to contextual problems, thereby capturing evaluative and reflective thinking processes. Both test forms were developed with parallel structure, content coverage, and difficulty level to ensure score comparability.

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In addition, a learning motivation questionnaire was developed to assess student's interest and engagement, guided by self-determination theory (Ryan & Deci, 2020). The preparation of the test blueprint followed established principles of instrument development, ensuring alignment among constructs, indicators, cognitive processes, and item formats This systematic mapping supported content validity and coherence across all components of the assessment (Al-Aarifin Ismail et al., 2020).

Content validity was established through expert judgment involving two English education lecturers and one instructional media expert. Construct validity was examined using item total correlation analysis with a minimum coefficient threshold of 0.30 (Qonita et al., 2025). Instrument reliability was assessed using Cronbach's Alpha, with values ≥ 0.70 indicating acceptable internal consistency (Vissoci et al., 2022). All instruments satisfied the required validity and reliability criteria prior to implementation.

Development

The development phase transformed the instructional design into a printed module integrated with QR Codes linking to instructional videos and interactive exercises. Product validation involved two external experts: a subject-matter expert in English education and an educational technology media expert. Evaluation criteria referred to the National Education Standards Board (BSNP, 2014), covering content appropriateness, presentation quality, linguistic clarity, and graphical design. A five-point Likert scale was used to assess feasibility, categorized as follows: 84–100% (highly feasible), 68–83% (feasible), 52–67% (moderately feasible), 36–51% (less feasible), and 20–35% (not feasible). Revisions were conducted based on expert recommendations to improve content accuracy, visual consistency, and QR Code functionality.

Implementation

A limited trial was conducted with 27 fourth-grade students. Learning activities combined printed worksheets (LKPD) and QR Code–supported digital resources. The teacher functioned as a facilitator, guiding discussion and supporting collaborative work. Practicality was evaluated using Likert-scale questionnaires (15 items for teachers and 15 for students) assessing usability, instructional clarity, visual appeal, material relevance, and digital integration. Effectiveness was analyzed through pretest and posttest results using descriptive statistics, normality testing, paired-sample t-tests, and N-gain calculations (Tene et al., 2023). In addition to overall score analysis, descriptive statistics were calculated for each critical thinking dimension analysis, evaluation, reflection, and problem solving without conducting separate inferential tests, considering the limited sample size and to avoid inflated Type I error.

Evaluation

The evaluation phase assessed the module's feasibility, practicality, and effectiveness. Student achievement was measured using contextual vocabulary and sentence-construction tasks administered before and after implementation. Learning improvement was determined using the N-gain formula. To enhance methodological rigor, data were triangulated through expert validation forms, achievement tests, classroom observations, and student response questionnaires. Statistical analyses were conducted using SPSS Statistics 18, including descriptive statistics, normality testing, and paired-sample t-test to examine differences between pretest and posttest scores.

Results and Discussion

This study sought to develop and evaluate the feasibility and instructional effectiveness of a contextual English module supported by QR Codes in enhancing fourth-

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grade students' critical thinking skills. The findings are presented based on expert validation and statistical analyses of learning outcomes.

Feasibility of the Module

Expert validation indicates that the developed module satisfies high feasibility standards. The material expert assigned a feasibility score of 92.5%, while the media expert awarded 100%, both classified as "very feasible" according to the criteria established by the National Education Standards Board (BSNP, 2014).

Table 1. Expert Validation Results

No	Validator Type	Feasibility Percentage	Feasibility Category
1	Content Expert	92.5%	Very Feasible
2	Media Expert	100%	Very Feasible

Figure 1. Excerpts from the module pages

These results demonstrate that the module meets established standards regarding content accuracy, linguistic appropriateness, structural coherence, and graphical presentation. According to (BSNP, 2014), feasibility scores exceeding 80% indicate strong validity and allow progression to the implementation stage with only minor revisions. Although the module achieved very high ratings, experts recommended refinements in QR Code usage instructions and typographic consistency to enhance clarity and accessibility.

Scientifically, the high validation scores indicate coherent alignment among learning objectives, instructional activities, and assessment procedures. This alignment reflects the principle of constructive alignment (Biggs, 2014), suggesting that the module was not merely technically functional but pedagogically integrated. The feasibility findings therefore confirm that contextual content and digital components were systematically organized to support learning outcomes rather than functioning as isolated features.

Effectiveness in Improving Critical Thinking Skills

Instructional effectiveness was examined using a one-group pretest–posttest design involving 27 fourth-grade students. Descriptive statistics are presented in Table 2.

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Table 2. Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRETEST	3.26	27	1.831	.352
	POSTTEST	7.07	27	1.752	.337

The data reveal a substantial increase in students' mean scores following implementation of the module. The average score improved from 3.26 in the pretest to 7.07 in the posttest. The comparable standard deviation values indicate that improvement occurred consistently across the group rather than being concentrated among a limited number of students. The calculated N-gain score of 0.55 falls within the moderate category (Tene et al., 2023), signifying meaningful cognitive development.

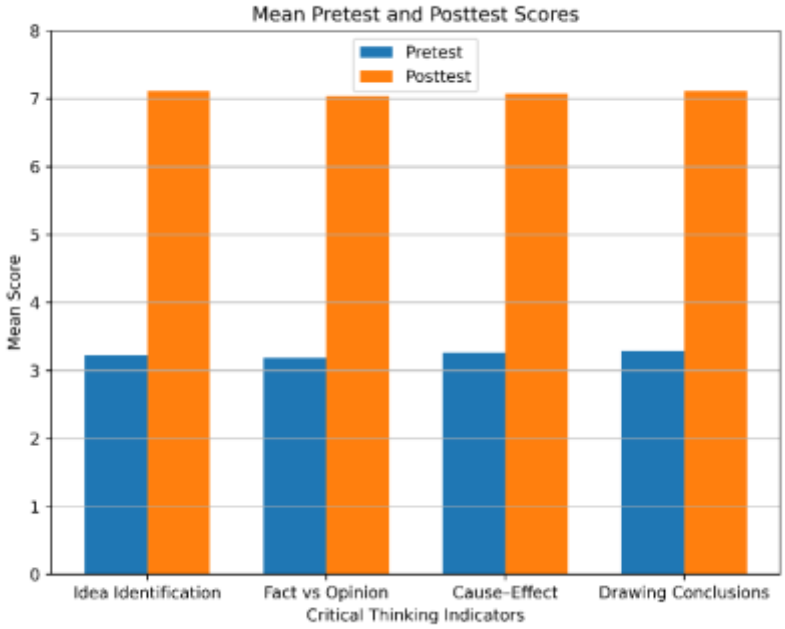

Figure 2. Mean pretest and posttest scores for each critical thinking indicator

As illustrated in Figure 2, improvements were observed across all critical thinking indicators, including idea identification, fact versus opinion analysis, cause–effect reasoning, and drawing conclusions. The consistent increase across categories indicates that learning gains were not confined to a single dimension of thinking but occurred comprehensively across analytical and evaluative skills. To determine whether this improvement was statistically significant, inferential analysis was conducted.

Table 3. Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
Pair 1				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
PRETEST – POSTTEST	-3.815	2.202	.424	-4.686	-2.944	-9.002	26	.000

The paired-sample t-test indicates a statistically significant difference between pretest and posttest scores, $t(26) = -9.002$, $p < 0.001$. The 95% confidence interval does not include zero, confirming that the observed gain reflects a systematic instructional effect rather than random fluctuation.

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The scientific finding derived from these results is that the contextual QR Code supported module contributed to measurable improvement in students' higher-order cognitive processes. The moderate N-gain suggests structured cognitive development, particularly in analytical and evaluative reasoning. This pattern likely emerged because learning activities required students to interpret meaning, analyze relationships, justify responses, and formulate conclusions. Such structured engagement fosters deeper cognitive processing rather than rote memorization (Biggs, 2014). The statistical trend therefore reflects not merely numerical growth but qualitative advancement in thinking processes.

Discussion

The central contribution of this study lies in demonstrating that the structured integration of Contextual Teaching and Learning (CTL), local cultural content, and QR Code–based scaffolding produces measurable improvement in elementary students' critical thinking within English instruction. The statistically significant pre–post gains and moderate N-gain indicate not only performance growth but structured cognitive development across participants.

What distinguishes these findings is the functional role assigned to QR Codes. Rather than serving as supplementary access to digital materials, the QR components were embedded as task-guiding scaffolds that directed students toward analysis, justification, and conclusion-making within culturally familiar contexts. Unlike prior work that emphasized technology-driven engagement or general literacy improvement (e.g., Söğüt & Belli, 2024), the present study demonstrates that QR-based integration can be intentionally designed to structure evaluative and analytical processes in primary learners. The improvement observed, therefore, reflects guided reasoning rather than increased exposure to multimedia resources.

The contextualization of English materials within local culinary culture further differentiates this study. CTL was operationalized not merely as contextual relevance but as structured activation of prior knowledge linked to analytical tasks. This design aligns with sociocultural perspectives on scaffolded learning (Vygotsky, 1978), yet the present findings extend this framework by empirically validating its effect on measurable higher-order outcomes in primary English settings. The gains suggest that contextual familiarity reduced cognitive load associated with content comprehension, thereby enabling greater focus on evaluative reasoning.

Additionally, the multimodal structure was pedagogically constrained rather than technologically expansive. In contrast to studies that examine multimedia as an engagement tool, this module restricted audiovisual input to concept clarification and task reinforcement. The consistency of score improvements across students suggests that the dual-channel presentation supported structured comprehension rather than passive consumption (Mayer, 2002). Thus, the digital component functioned as cognitive support, not as an independent instructional driver.

Another distinctive element of this study is the alignment between instructional design and assessment structure. Critical thinking was measured through indicators explicitly targeting analysis, differentiation of fact and opinion, cause–effect reasoning, and conclusion drawing. This alignment ensured that higher-order processes were both taught and evaluated systematically, strengthening the validity of the observed gains. Unlike research that reports general learning improvement, the present study isolates development in defined critical thinking domains.

In sum, this study contributes specific empirical evidence that QR Code–supported contextual modules can be deliberately engineered to scaffold evaluative reasoning in primary English education. The findings move beyond confirming prior claims about digital

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engagement by clarifying how structured technological integration, when pedagogically aligned and contextually grounded, can produce measurable advancement in higher-order cognitive skills.

Conclusion

This study concluded that a contextual English module supported by QR Codes is pedagogically feasible and empirically effective within the scope of the limited trial. The statistically significant improvement in student achievement, accompanied by moderate N-gain results, indicates that the integration of contextual cultural content and structured digital support contributes meaningfully to the development of higher-order thinking skills in primary English learning.

The scientific contribution of this study lies in demonstrating that critical thinking in elementary EFL contexts can be fostered through coherent instructional alignment among objectives, contextual activities, and assessment. The module design grounded in Contextual Teaching and Learning (CTL) principles and enriched with QR Code–based multimodal resources, proved capable of facilitating analytical, evaluative, reflective, and problem-solving processes. These findings substantiate the research objective that a systematically designed contextual digital module can strengthen both cognitive engagement and learning achievement at the primary level.

Recommendation

For classroom practitioners, the findings suggest that QR Code integration should be purposefully embedded within structured analytical tasks rather than used solely as a supplementary digital feature. Teachers are encouraged to align contextual content with explicit critical thinking indicators—such as identifying ideas, distinguishing fact from opinion, analyzing cause–effect relationships, and drawing conclusions. Careful guidance and scaffolded questioning remain essential to ensure that technology supports reasoning processes rather than passive content access.

For teaching material developers, the results highlight the importance of coherent alignment between instructional design, contextual relevance, digital components, and assessment instruments. QR-based modules should be constructed to extend explanation, model reasoning steps, and provide guided evaluative exercises. Cultural contextualization should not merely serve motivational purposes but function as a cognitive bridge that activates prior knowledge and supports higher-order processing.

For future researchers, broader and more heterogeneous samples are recommended to examine the stability and generalizability of these findings across diverse primary school contexts. The use of more rigorous designs, including quasi-experimental or controlled comparisons, would strengthen causal claims regarding instructional effectiveness. Longer intervention periods may also clarify whether observed gains reflect sustained cognitive development. Additionally, future studies may explore differentiated scaffolding strategies to accommodate variations in students' initial ability levels and digital access.

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