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Visualizing Thought: Students' Critical Thinking Development through Infographic Writing in Project-Based EFL Learning

Ayuni J Burhan[1*]
Universitas Negeri Makassar, Indonesia
ayunijb29@gmail.com

Muhammad Tahir[2]
Universitas Negeri Makassar, Indonesia
muhammadtahir@unm.ac.id

Andi Asrifan[3]
Universitas Negeri Makassar, Indonesia
andi.asrifan@unm.ac.id

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***Corresponding author:**
Ayuni J Burhan, Fakultas Bahasa dan Sastra, Universitas Negeri Makassar, Indonesia

Abstract

The increasing focus on higher-order thinking and multimodal literacy in modern language education has heightened interest in teaching methods that incorporate critical inquiry, digital communication, and significant writing experiences. Although there is growing interest in infographic-based learning, empirical information elucidating how infographic writing fosters critical thinking growth in secondary English as a Foreign Language classrooms is still scarce, especially in project-based pedagogical contexts. This study examined how infographic writing integrated into Project-Based Learning enhanced students' critical thinking and writing engagement in an Indonesian secondary school setting. The study utilized a convergent mixed-methods design, involving 64 eleventh-grade students and incorporating writing pre- and post-tests, critical thinking rubrics, questionnaires, and semi-structured interviews. Quantitative results indicated significant enhancement in the dimensions of interpretation, analysis, evaluation, inference, explanation, and self-regulation, along with improved organization and coherence in students' writing performance. Qualitative data indicated that infographic development fostered reflective thinking, collaborative problem-solving, information appraisal, and visual-textual meaning construction; nonetheless, students encountered problems associated with vocabulary restrictions and computer literacy. The study conceptualizes infographic writing as a modality of critical thinking practice rather than solely a visual learning exercise. The findings underscore the capacity of project-based multimodal composition to enhance cognitively stimulating and digitally adaptive EFL instruction in secondary education.
Keywords: Critical Thinking Development; Infographic Writing; Multimodal Literacy; Project-Based Learning; Secondary EFL Education

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Introduction

The rising demand for twenty-first-century skills has altered the focus of language education globally. Educational systems are now required to cultivate not just students' linguistic competency but also advanced cognitive skills, including critical thinking, creativity, teamwork, and problem-solving (Keszthelyi, 2024; Kolekar, 2026; Shadiev & Wang, 2022). Critical thinking has garnered significant attention among these talents since it empowers learners to critically assess information, synthesize knowledge, and make informed decisions in increasingly intricate digital contexts. In English as a Foreign Language (EFL) education, the cultivation of critical thinking has gained significance owing to the increasing exposure of learners to extensive online information, multimodal texts, and artificial intelligence-enhanced communication tools (Iskandar et al., 2025; Zablotska et al., 2026). Thus, modern EFL instruction is anticipated to incorporate pedagogical methods that foster both language proficiency and cognitive involvement along with reflective thinking.

Worldwide, apprehensions about pupils' critical thinking abilities persist in educational evaluations and worldwide reports. Research indicates that numerous students have difficulties in conducting in-depth analyses, formulating coherent arguments, and assessing the reliability of sources within digital learning contexts (Prayogi et al., 2023; Zhai et al., 2024). Comparable issues are apparent in Indonesia, where literacy and advanced cognitive function fall short of international standards. National educational reports and extensive examinations consistently reveal that Indonesian students encounter challenges in interpretation, reasoning, and analytical writing activities (Ismawati et al., 2023; Maryani et al., 2021; Sinambela & Saragih, 2018). These challenges are more pronounced in rural and marginalized educational settings, where access to literacy resources, critical discourse practices, and technology-enhanced learning is constrained. Consequently, there is an immediate necessity for creative pedagogical methods that can concurrently improve language acquisition and critical thinking skills in Indonesian EFL classes.

Critical thinking typically denotes the capacity to analyze, evaluate, interpret, and synthesize information to render informed judgments or logically resolve problems (Ilyas & Istaryatiningtias, 2025; Maharani & Zulkarnain, 2024; Wijaya, 2023). In educational practice, critical thinking is demonstrated when students interrogate assumptions, evaluate evidence, discern linkages among concepts, and systematically substantiate their reasoning. In EFL writing environments, critical thinking is seen in students' capacity to structure arguments coherently, assess information sources, and articulate significant findings. An new pedagogical method that may facilitate these processes is infographic writing. Infographic writing involves converting information into cohesive visual and textual formats that convey concepts clearly and effectively (Dunlap & Lowenthal, 2016; Kates, 2023; Shanks et al., 2017). Students might produce an infographic elucidating the effects of social media on adolescents by integrating statistical data, concise analytical descriptions, iconography, timelines, and visual comparisons. Such tasks necessitate that learners not only compose text but also identify pertinent information, structure ideas coherently, and make critical judgments concerning visual communication.

The incorporation of infographic writing into Project-Based Learning (PBL) has lately garnered academic interest in language and digital literacy education. Project-Based Learning is a student-centric pedagogical approach wherein learners participate in genuine inquiry, collaborative problem-solving, and the creation of significant

products across a prolonged educational experience (Santoso et al., 2023; Zhang et al., 2024). Researchers conducted a study examining the integration of infographic-based activities in higher education to assess students' engagement with visual communication methods. The study, employing a qualitative review approach, determined that student-generated infographics improved creativity, engagement, and awareness of multimodal learning (Azudin et al., 2025; Kapel & Schmidt, 2021). The findings indicated that infographics serve not just as visual aids but also as cognitive instruments that facilitate knowledge creation.

Likewise, another study investigated the utilization of infographics to enhance critical thinking abilities in university students via classroom instructional activities. The research, utilizing a descriptive qualitative design, demonstrated that students enhanced their reflective and analytical skills during the infographic creation process, as they were compelled to identify pertinent evidence, structure arguments, and rationalize visual selections (Ibrahem & Alamro, 2020; Kates, 2023). These findings indicate that infographic creation may promote greater cognitive engagement than conventional writing tasks.

Conversely, certain research have concentrated predominantly on students' opinions of infographic utilization instead of investigating quantifiable cognitive results. A descriptive qualitative study examined high school students' impressions of infographics as a visual aid in classroom education. The findings demonstrated predominantly favorable answers about motivation, engagement, and comprehension (Alyahya, 2023; Basco, 2020; Dewi et al., 2023). Nonetheless, the study did not experimentally examine the impact of infographic writing on the real development of students' critical thinking skills. Likewise, an other classroom action research project examined the application of graphical summarizing to enhance EFL students' reading comprehension. The results indicated heightened student interest and enhanced comprehension of reading content (Cárcamo & Pino, 2025; Cupita & Franco, 2019). Nonetheless, the research focused on reading comprehension rather than critical thinking skills associated with writing.

Studies on critical thinking in EFL writing have highlighted inquiry-based and process-oriented pedagogical methods. In a quasi-experimental study, researchers investigated the impact of inquiry-based learning on enhancing students' critical thinking in argumentative essay composition. The investigation revealed notable enhancements in students' analytical reasoning, source assessment, and argumentation coherence through the utilization of pre-tests, post-tests, journals, and focus group discussions (Wiley et al., 2009; Yaemkhayai & Piyasatit, 2026; Yamin & Aulia, 2026). A review research on the integration of critical thinking in EFL writing classrooms highlighted explicit instruction, collaborative learning, reflective questioning, and digital resources as successful ways for fostering higher-order thinking (Algouzi et al., 2023; Farahian & Ebadi, 2022). These findings suggest that writing instruction can serve as a significant medium for cognitive development when learners are actively involved in inquiry, reflection, and knowledge transformation.

Collectively, prior research suggests that infographic-based learning, multimodal writing, and project-based instruction might enhance students' engagement, creativity, and higher-order thinking skills. Current research has demonstrated that critical thinking can be enhanced through writing-focused instructional methods that promote analysis, synthesis, and reflection. The increasing incorporation of digital media in education has enhanced opportunities for students to convey ideas visually and interactively.

Notwithstanding these encouraging results, some significant gaps persist unaddressed. Initially, the majority of prior research concentrated on either university students or their perceptions, neglecting to scientifically investigate the growth of critical thinking through graphical writing assignments. Secondly, a limited number of studies have incorporated infographic writing within a Project-Based Learning framework in secondary EFL settings. Third, prior studies have infrequently utilized mixed-method approaches that integrate quantifiable critical thinking results with qualitative investigations of students' experiences and difficulties. Ultimately, scant study has investigated these matters within Indonesian rural educational contexts, where the advancement of digital literacy and the instruction of critical thinking persist as major educational challenges. Addressing these gaps is crucial, as comprehending how infographic-based project learning influences students' critical thinking may yield more contextually relevant and cognitively significant methodologies for EFL training.

This study seeks to examine the growth of students' critical thinking through infographic writing in Project-Based EFL learning. This study specifically investigates the following research question: (1) Does Project-Based Learning via infographic authoring enhance students' critical thinking skills? How does Project-Based Learning enhance the cultivation of students' critical thinking skills through the creation of infographics? What problems and attitudes do students encounter throughout infographic writing exercises in Project-Based EFL learning? The study posits that infographic-based project learning will enhance students' critical thinking ability, grounded in the theoretical connection among multimodal composition, inquiry learning, and higher-order cognition.

This study use a convergent mixed-method design that integrates both quantitative and qualitative methodologies to achieve its aims. Quantitative data are gathered via pre-tests and post-tests assessing students' critical thinking in writing activities, whilst qualitative data are acquired through questionnaires and semi-structured interviews investigating students' thoughts and experiences. This methodological integration enables the study to analyze both quantifiable learning results and the cognitive processes involved in infographic production. Students engaged in infographic-based project learning are anticipated to exhibit enhanced analytical reasoning, superior information organization, and more reflective thinking in their writing performance.

This work theoretically enhances the expanding literature on multimodal EFL pedagogy, the advancement of critical thinking, and the integration of Project-Based Learning. It advances prior research by framing infographic writing not only as a visual learning technique but also as a modality for critical thinking exercise. The findings may provide educators creative instructional approaches for incorporating digital literacy, visual communication, and higher-order thinking into EFL writing training. Moreover, the study provides contextual insights into how project-based multimodal learning can facilitate the development of critical thinking among secondary school students in Indonesian educational contexts.

Research Methods

1. Research Design

This research utilized a convergent mixed-methods approach to examine the growth of students' critical thinking through infographic composition in Project-Based EFL education. Mixed methods were deemed suitable as the study necessitated both quantifiable evidence of critical thinking enhancement and a comprehensive examination of students' views, experiences, and obstacles. The quantitative aspect

concentrated on examining students' pre-test and post-test scores to discern variations in critical thinking performance, whilst the qualitative aspect investigated learners' answers via questionnaires and semi-structured interviews. The approach facilitated triangulation and complementarity by merging numerical results with descriptive interpretations. The datasets were ultimately integrated and analyzed collectively to yield comprehensive and reputable research conclusions.

2. Research Context and Participants

This research was performed at a rural public secondary institution in Mamuju Regency, West Sulawesi, Indonesia. The school exemplifies an evolving educational environment where EFL instruction encounters difficulties stemming from insufficient literacy resources and disparate digital access. Notwithstanding these limitations, the school has implemented a curriculum that prioritizes 21st-century competencies, such as critical thinking, cooperation, creativity, and digital literacy. Sixty-four eleventh-grade students, aged 16 to 17 years, were recruited by purposive sampling due to their prior exposure to English writing resources pertinent to the study. The students were allocated into an experimental group and a control group to objectively compare instructional outcomes.

Table 1. Research Context and Participants

Aspect	Description
Research Setting	The study was conducted at SMA Negeri 1 Tapalang, a public secondary school located in Mamuju Regency, West Sulawesi, Indonesia.
Geographical Context	The school is situated in a rural area where students experience limited access to educational resources, digital infrastructure, and English learning exposure compared to urban schools.
Educational Context	The institution implements the Indonesian Merdeka Curriculum, emphasizing 21st-century competencies such as critical thinking, creativity, collaboration, communication, and digital literacy in EFL instruction.
EFL Learning Environment	English is taught as a foreign language with a focus on reading, writing, speaking, and multimodal literacy development through student-centered learning activities.
Digital Literacy Conditions	Students have moderate familiarity with smartphones and social media platforms; however, their experience with educational digital design tools and infographic creation remains limited.
Participants	The participants consisted of 64 eleventh-grade students enrolled in two intact classes.
Age Range	Participants were between 16 and 17 years old.
Sampling Technique	Purposive sampling was employed to select participants who had previously studied exposition and writing materials relevant to the research objectives.
Reason for Participant Selection	The selected students were considered appropriate because they possessed foundational English writing knowledge necessary for infographic-based Project-Based Learning activities.
Experimental Group	One class consisting of 32 students received infographic writing instruction integrated with Project-Based Learning.
Control Group	One class consisting of 32 students received conventional writing instruction without infographic-based project integration.

Research Focus	The study examined students' critical thinking development, writing performance, perceptions, and learning experiences during infographic-based Project-Based EFL learning.

3. Instructional Treatment and Research Instruments

The instructional approach utilized a Project-Based Learning (PBL) framework that prioritized inquiry, collaboration, and multimodal knowledge production. The learning steps encompassed driving questions, planning, inquiry, infographic development, presenting, and reflection. Students executed infographic writing assignments utilizing digital platforms like Canva and Piktochart on subjects pertaining to social and educational challenges. Collaborative group work and instructor scaffolding facilitated idea growth and critical examination. The intervention comprised eight sessions, each lasting 90 minutes. The research tools comprised pre- and post-tests, critical thinking and writing rubrics derived from Facione and Brown, Likert scale questionnaires, and semi-structured interviews investigating students' attitudes, challenges, and learning experiences.

4. Data Collection Procedures and Data Analysis

Data collection occurred in five phases: pre-test, Project-Based Learning infographic intervention, post-test, questionnaire administration, and semi-structured interviews. The pre-test assessed students' foundational critical thinking via writing assignments, whereas the intervention incorporated infographic-based collaborative learning with ongoing supervision and support. The post-test assessed students' final infographic authoring performance, accompanied by surveys and interviews examining perceptions and learning experiences. Quantitative data were evaluated utilizing SPSS via descriptive statistics, normality and homogeneity tests, and t-tests at a significant threshold of $p < .05$. Qualitative data were subjected to thematic analysis in accordance with Braun and Clarke's methodology. Ultimately, the two datasets were amalgamated via triangulation and collaborative interpretation.

5. Ethical Considerations

This study adhered to ethical research norms to safeguard participants during the research procedure. All participants provided informed consent prior to the commencement of data collection. Participation was completely voluntary, and students could resign from the study at any point without repercussions. Confidentiality and anonymity of participants were preserved through the utilization of coded identities in all research documentation. Data privacy was meticulously safeguarded and utilized solely for scholarly purposes. Moreover, formal authorization to execute the study was acquired from the school and pertinent educational authorities.

Results and Discussion

Result

3.1 Quantitative Results

The quantitative results indicated a notable enhancement in students' critical thinking and writing abilities following the adoption of infographic-based Project-Based Learning. Descriptive statistics revealed that the mean post-test score significantly exceeded the pre-test score, showing positive learning advancement. The post-test exhibited reduced standard deviation values, indicating enhanced consistency in student performance. The minimum and maximum scores significantly increased, while

the percentage analysis revealed substantial overall enhancement. The data were displayed in descriptive statistics tables and illustrated by comparative charts. Subsequent examination of Facione's six aspects of critical thinking indicated enhancement in interpretation, analysis, assessment, inference, explanation, and self-regulation. The most significant advancements were observed in analysis and explanation, whereas self-regulation exhibited the least, yet still substantial, enhancement. Radar and bar chart displays distinctly depicted these comparative advancements.

Inferential statistical analysis employing paired-sample and independent-sample t-tests revealed statistically significant differences between pre-test and post-test scores at $p < .05$, thereby validating the efficacy of the intervention. The effect magnitude also demonstrated practical significance. Moreover, students' writing proficiency enhanced in content, organization, discourse, grammar, vocabulary, and mechanics. The study of the writing rubric and chosen student excerpts demonstrated enhanced concept generation, coherent organization, and more lucid arguing language following the educational intervention.

Table 2. Comparative Development of Students' Critical Thinking Dimensions in Infographic-Based Project Learning

Dimension	Pre-Test	Post-Test	Gain
Interpretation	57	81	24
Analysis	55	85	30
Evaluation	54	83	29
Inference	56	82	26
Explanation	58	86	28
Self-Regulation	53	79	26

Table 2 illustrates significant enhancement in students' critical thinking abilities following their engagement in infographic-based Project-Based Learning. All six dimensions shown positive advancements, notably in analysis, evaluation, and explanation. The results demonstrate that infographic writing tasks prompted students to methodically organize material, critically assess evidence, and communicate ideas more effectively. The elevated post-test results indicate that incorporating multimodal visual activities into EFL education can markedly improve higher-order thinking skills and cognitive engagement in secondary school students.

Figure 1. Comparative Progression of Critical Thinking Dimensions

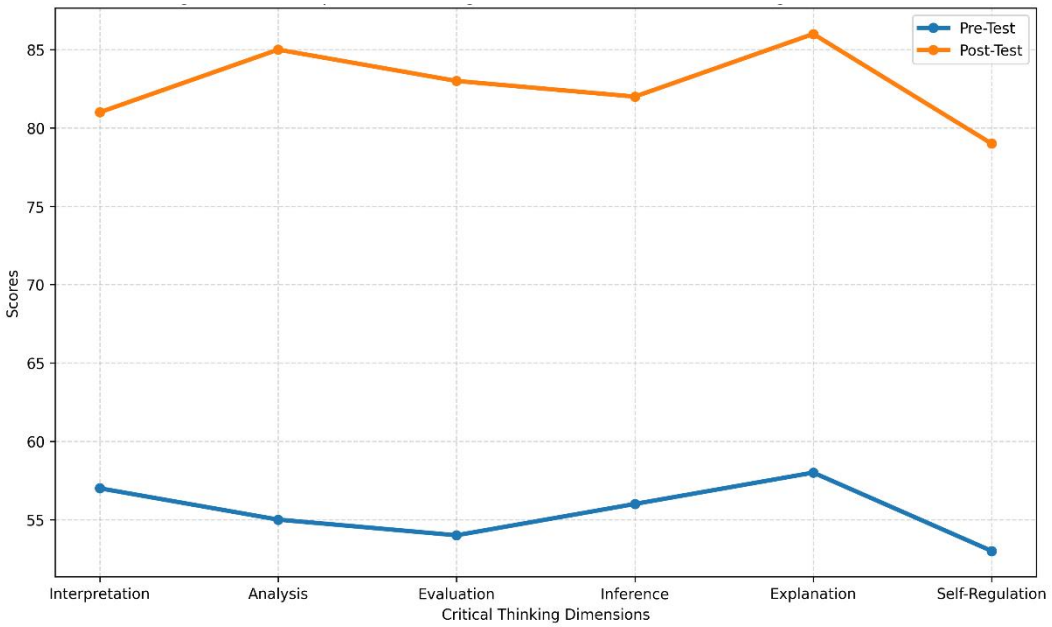

Figure 1 illustrates the comparative advancement between pre-test and post-test scores across all areas of critical thinking. The increasing trends demonstrate persistent enhancement following the educational intervention. The most significant enhancements were observed in analysis and evaluation, signifying improved thinking and decision-making capabilities. The graphic illustrates balanced cognitive development across various domains instead than single enhancement. The results affirm that infographic-based Project-Based Learning offers significant potential for reflective inquiry, multimodal thinking, and enhanced cognitive processing in EFL writing classrooms.

Figure 2. Radar Mapping of Students' Critical Thinking Growth

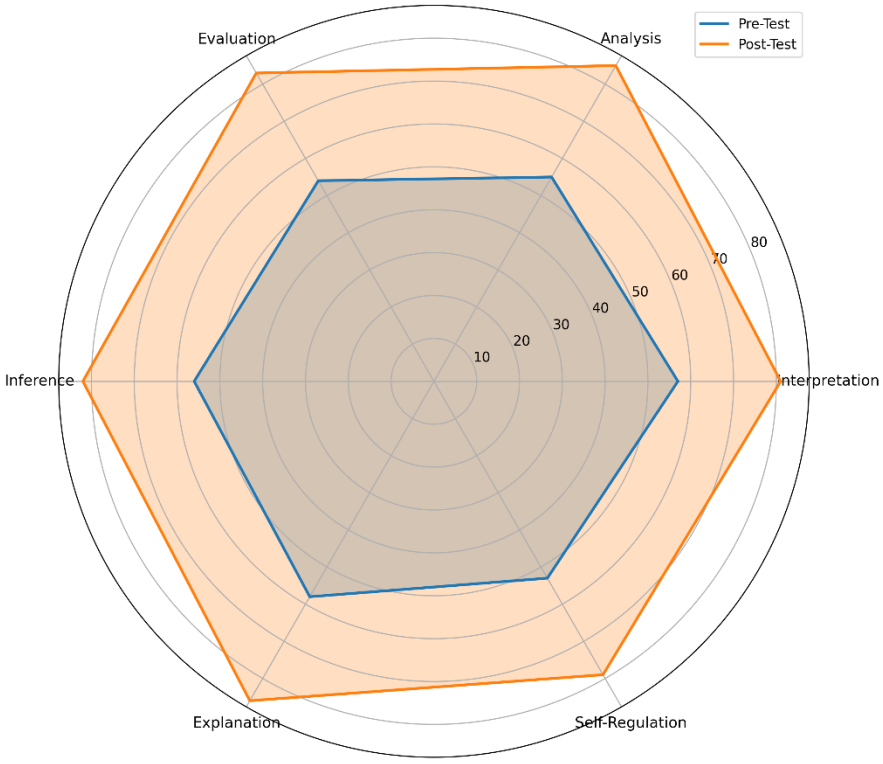

Figure 2 illustrates a radar chart depicting the enhancement of students' critical thinking skills prior to and during the intervention. The augmented post-test area underscores substantial cognitive advancement across all categories, especially in explanation and analysis. The image demonstrates how infographic writing facilitated interrelated cognitive processes, encompassing interpretation, inference, and self-regulation. The symmetrical form of the radar map indicates comprehensive enhancement rather than disjointed skill development. This discovery underscores the efficacy of using visual communication and project-based inquiry in EFL learning contexts.

3.2 Qualitative Results

The qualitative data indicated that students exhibited a favorable response to infographic writing in Project-Based EFL learning. The majority of participants indicated increased involvement, motivation, and satisfaction in the learning process due to the integration of visual creativity with collaborative writing tasks in infographic activities. Students indicated a preference for visual learning settings, stating that infographics facilitated clearer comprehension and organization of knowledge. A participant remarked that "creating the infographic prompted me to contemplate the significance of the information and how to convey it succinctly."

Multiple themes surfaced concerning the enhancement of critical thinking via graphical projects. Students exhibited enhanced skills in information processing, source assessment, idea structure, and argument formulation. Reflective thinking emerged throughout the infographic design process, as students persistently updated text, identified pertinent information, and rationalized visual choices. These activities prompted students to engage in critical thinking instead of simply executing writing tasks mechanically.

The results also underscored significant collaborative experiences facilitated by Project-Based Learning. Collaborative engagement, peer discourse, collective problem-

solving, and idea negotiation enhanced students' autonomy and communication abilities. Students noted several hurdles, including restricted language, difficulties in organizing visual information, limitations in computer literacy, time management issues, technical difficulties, and sometimes cognitive overload.

The amalgamation of quantitative and qualitative results revealed a convergence between statistical enhancement and students' experiences. The interview results corroborated the substantial improvements indicated by quantitative analysis, validating the efficacy of infographic-based Project-Based Learning in advancing students' critical thinking skills.

Table 3. Emerging Qualitative Themes in Infographic-Based Project Learning Figure Names

Qualitative Themes	Frequency	Percentage
Positive Engagement	29	90.6
Motivation	27	84.4
Visual Learning Preference	25	78.1
Information Analysis	24	75
Argument Construction	22	68.8
Collaboration	28	87.5
Digital Literacy Challenges	15	46.9
Cognitive Overload	12	37.5

Table 3 delineates the predominant qualitative themes derived from students' interviews and questionnaires conducted during infographic-based Project-Based Learning. Positive engagement, collaboration, and motivation emerged as the predominant themes, signifying that students underwent active participation and significant interaction during the learning process. The results also indicated enhancements in information analysis and argument formulation. Several students, however, indicated difficulties concerning digital literacy and cognitive overload, implying that multimodal learning tasks necessitate sufficient technological support and instructional scaffolding.

Figure 3. Students' Qualitative Responses toward Infographic-Based Project Learning

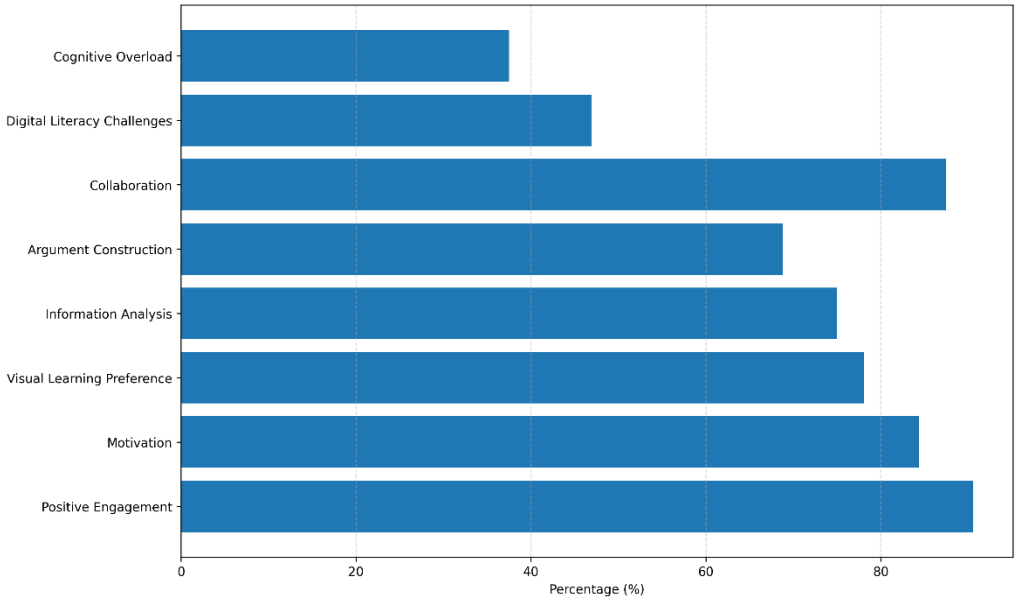

Figure 3 depicts students' qualitative answers to infographic-based Project-Based Learning through percentage-based thematic visualization. Positive engagement and collaboration were identified as the predominant responses, succeeded by motivation and visual learning preferences. The chart illustrates that students predominantly regarded infographic writing as a pleasurable and intellectually engaging learning experience. However, technological constraints and cognitive overload persisted as significant issues for numerous individuals. The visualization substantiates the beneficial impact of multimodal project learning on students' critical thinking experiences and classroom engagement.

Figure 4. Distribution of Emerging Qualitative Themes

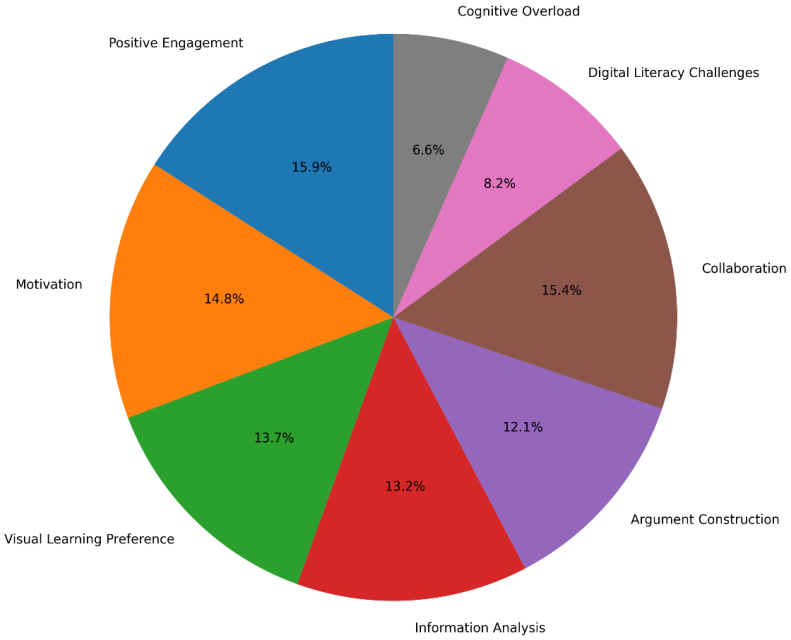

Figure 4 illustrates the distribution of nascent qualitative themes detected using thematic analysis. The image underscores the interrelatedness of students' experiences,

wherein participation, collaboration, and the development of critical thinking were intricately linked to infographic creation activities. The figure also illustrates the simultaneous presence of beneficial learning events and pedagogical difficulties. Although the majority of themes indicated cognitive and motivational advantages, several individuals encountered challenges associated with technology utilization and information organization. These findings underscore the intricacy of executing multimodal Project-Based Learning in EFL environments.

Discussion

This study's findings indicate that including infographic writing into Project-Based EFL Learning enhances students' critical thinking, writing performance, and learning engagement. Infographic manufacturing served not just as a visual classroom exercise but also as a cognitive task necessitating learners to pick material, assess relevance, organize concepts, formulate arguments, and convey meaning across textual and visual modalities. The qualitative findings indicated that students found the activity to be engaging, collaborative, and intellectually rigorous, albeit they had obstacles concerning language, digital proficiency, time management, and visual organizing. The findings indicate that the research hypotheses were affirmed: infographic-based project learning enhanced students' critical thinking, promoted reflective and analytical learning processes, and uncovered both pedagogical advantages and practical obstacles in EFL classrooms.

A key finding pertains to the enhancement of students' critical thinking across the six aspects of interpretation, analysis, evaluation, inference, explanation, and self-regulation. This enhancement suggests that critical thinking was cultivated not as a standalone cognitive ability but as a cohesive process interwoven inside multimodal writing practices. Students were required to analyze the issue, discern essential concepts, assess sources, deduce linkages among facts, articulate their rationale, and refine their work. These processes align closely with Facione's critical thinking framework, which highlights judgment, evidence assessment, inference, and reflective oversight (Bunt & Gouws, 2020; Leighton et al., 2021; Molerov et al., 2020). In this regard, infographic writing prompted students to progress from superficial writing to intentional knowledge transformation.

The most significant advancement was observed in analysis, appraisal, and explanation. This pattern holds theoretical significance as infographic writing necessitates that learners distill intricate material into succinct, meaningful, and visually clear ideas. In contrast to traditional writing assignments that prioritize paragraph form and language, infographic writing requires students to make determinations regarding hierarchy, relevancy, emphasis, and audience perception. These decisions necessitate analytical reasoning and evaluative judgment. Students were required to evaluate the significance of information, its relevance, and the appropriate method of representation, rather than merely replicating it. This substantiates the assertion that multimodal composition enhances higher-order thinking by necessitating learners to integrate verbal, visual, spatial, and rhetorical decisions (Miller, 2010; O'Halloran et al., 2015; Smith et al., 2024).

The results further validate the educational significance of Project-Based Learning as a framework for critical engagement. PBL offered an inquiry-based framework wherein students engaged in steps of questioning, planning, investigating, creating, presenting, and reflecting. These stages provided learners with opportunity to engage

with writing as a process rather than a singular result. The project's collaborative character fostered peer negotiation, collective problem-solving, and the justification of ideas. This aligns with constructivist learning theory, which posits that knowledge is developed through active involvement, social interaction, and significant problem-solving (Gono & Moraes, 2023; Huang, 2021; Niemi et al., 2018). This study revealed that the infographic project served as a platform for students to develop comprehension through engagement with texts, collaboration with peers, utilization of digital technologies, and reception of teacher feedback.

The qualitative findings enhance this interpretation. Students said that generating infographics enhanced their learning experience and facilitated clearer comprehension of content. This favorable perspective can be elucidated by the Cognitive Theory of Multimedia Learning, which posits that learners assimilate information more efficiently when verbal and visual modalities are cohesively combined (Boateng et al., 2016; Pratiwi et al., 2025; Tin et al., 2018). Nonetheless, the advantage did not arise merely from incorporating visuals into text. Learning transpired as pupils were mandated to convert information across several modalities. The process of transforming written material into visual representations compelled students to restructure knowledge, elucidate intricate concepts, and discern relationships among ideas. Consequently, the infographic served as both an educational resource and a cognitive instrument.

These findings correspond with prior research indicating beneficial impacts of infographic-based learning on student engagement, understanding, creativity, and critical thinking. Consistent with previous classroom research, the current study revealed that the creation of infographics prompted students to engage more profoundly with evidence, audience, and meaning. This also endorses research on EFL writing that posits critical thinking may be cultivated through process-oriented, inquiry-based, and collaborative writing activities (Azizifard, 2025; Lu, 2019; Mehta & Al-Mahrooqi, 2014). This study builds upon previous research by contextualizing infographic writing within a project-based EFL framework and analyzing both quantifiable performance and students' experiential learning journeys.

The findings contrast with research that primarily regarded infographics as visualization tools or ancillary media. Numerous prior research indicated that pupils reacted favorably to infographics due to their aesthetic appeal and enhanced comprehensibility. This study indicates that the most instructional value arises when students independently produce infographics. The transition from ingesting visual information to generating visual argumentation is essential. When learners assume the role of meaning-makers, they participate in selection, evaluation, synthesis, and reflection (Hattwig et al., 2013; Kalaf-Hughes, 2022). This differentiation elucidates why infographic writing can more effectively foster critical thinking compared to passive engagement with visual content.

Nonetheless, the study also uncovers significant problems. Certain pupils had challenges due to a restricted English vocabulary, hindering their ability to articulate ideas succinctly. Others encountered challenges in arranging visual information, choosing suitable icons, or achieving a balance between text and graphics. Digital literacy influenced students' learning experiences; individuals with greater proficiency in digital platforms concentrated more on content and reasoning, whereas those with lower digital confidence devoted more effort to addressing technical issues (Eltahir et al., 2023; Martzoukou et al., 2020). These issues indicate that infographic-based project-based learning should not be executed without scaffolding. Educators must offer

exemplars, lexical assistance, criteria for source assessment, design frameworks, and avenues for correction.

This study theoretically enhances the literature on EFL writing, multimodal literacy, and critical thinking by framing infographic writing as a modality of critical thinking practice. It demonstrates that critical thinking in EFL learning can be cultivated not solely through argumentative essays or discussion-oriented exercises, but also via visual-textual creativity. The study provides an instructional framework for educators aiming to incorporate digital literacy, writing, and advanced cognitive skills. Infographic projects can enhance writing by making it more purposeful, collaborative, and intellectually stimulating, especially in secondary education settings where students frequently have difficulties with abstract argumentation.

Numerous constraints must be recognized. The study was conducted in a single secondary school context, perhaps restricting the generalizability of the findings. The intervention time was brief, rendering the long-term sustainability of students' critical thinking development questionable. Third, the students' levels of digital literacy differed, potentially impacting their performance in infographic development. The evaluation of critical thinking via written and visual outputs may not comprehensively encompass all aspects of students' reasoning. Ultimately, while qualitative data enhanced the analysis, students' replies may have been affected by social desirability bias.

Future study ought to investigate infographic-based project-based learning in broader and more varied English as a Foreign Language contexts, encompassing urban, rural, and higher education environments. Longitudinal research are necessary to ascertain whether students' improvements in critical thinking are maintained over time. Subsequent research may analyze handwritten, digital, and AI-assisted infographic composition to examine how various tools influence students' reasoning and writing progression. Moreover, subsequent research might investigate teacher scaffolding techniques, peer feedback dynamics, and the influence of digital literacy as a mediating variable in the advancement of multimodal critical thinking.

This study concludes that infographic writing in Project-Based EFL Learning is a viable avenue for enhancing students' critical thinking and writing skills. Its importance resides not just in enhancing scores but in revolutionizing students' interaction with knowledge, language, and visual representation. Infographic-based project learning necessitates that learners examine, evaluate, organize, and convey ideas through multiple modalities, so transforming EFL writing into an active, reflective, and intellectually significant endeavor.

Conclusion

This study investigated the impact of infographic writing incorporated into Project-Based EFL Learning on the enhancement of students' critical thinking skills in a secondary school setting. The study aimed to investigate if multimodal project-based writing activities may enhance cognitive engagement, improve writing performance, and foster more significant learning experiences in EFL classes.

The results indicate that infographic-based project learning effectively enhanced students' skills in information analysis, source evaluation, concept organization, argument construction, and communication through visual and textual formats. The research indicated that collaborative inquiry and multimodal composition fostered reflective thinking, active engagement, and learner independence. In addition to

cognitive improvement, students reported favorable reactions to the learning experience, characterizing infographic writing as interesting, inspiring, and intellectually exciting. The study concurrently found other instructional obstacles, notably concerning vocabulary constraints, digital literacy, and the manipulation of visual information, underscoring the necessity of organized pedagogical support.

This study theoretically enhances the existing scholarship on multimodal literacy, EFL writing, and critical thinking by framing infographic writing as a modality of critical thinking practice rather than simply a visual learning exercise. The findings provide an alternate teaching approach for incorporating higher-order thinking, digital literacy, and project-based pedagogy into language education. Educators are urged to implement scaffolded infographic projects that enable students to critically engage with material while enhancing their communication and collaboration abilities. Educational institutions and policymakers ought to facilitate access to digital learning resources and provide training for educators in multimodal pedagogy.

Future research may expand upon this study by investigating longitudinal impacts, AI-assisted infographic composition, and cross-context application in various educational environments. This study illustrates that infographic-based Project-Based Learning can redefine EFL writing as a thoughtful, analytical, and transformative educational practice, equipping students for the cognitive challenges of modern digital education.

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