

IMPACT OF AI-ASSISTED PROJECT-BASED DIGITAL STORYTELLING ON ACADEMIC WRITING PERFORMANCE AND CRITICAL THINKING AMONG GRADE 8 ESL LEARNERS

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Abstract

The integration of project-based learning with digital storytelling has created new opportunities for developing meaningful writing experiences in English language classrooms. Building upon this pedagogical perspective, the present study investigated the effectiveness of AI-assisted Project-Based Digital Storytelling in enhancing the academic writing performance and critical thinking of Grade 8 ESL learners. A true experimental pretest-posttest control group design was employed involving fifty students from Rangers Public School Bahawalpur, who were selected through simple random sampling and randomly assigned to an experimental group and a control group. The experimental group participated in an eight-week instructional program integrating project-based digital storytelling with AI-supported writing tools, whereas the control group received conventional writing instruction. Data were collected through academic writing assessments, critical thinking assessments, and a post-intervention perception questionnaire administered to the experimental group. Quantitative data were analyzed using descriptive and inferential statistical techniques, including paired-sample, while questionnaire responses were summarized through descriptive statistics. The findings demonstrated that the instructional intervention substantially enhanced learners' academic writing performance and critical thinking compared with conventional instruction. Students also expressed positive perceptions regarding the instructional approach, reporting increased motivation, greater engagement, improved writing confidence, and meaningful support during the writing process. The study suggests that AI-assisted Project-Based Digital Storytelling provides an authentic learning environment in which technology functions as a pedagogical scaffold that strengthens inquiry, reflection, revision, and collaborative knowledge construction rather than replacing learners' intellectual efforts. The findings contribute to the growing body of research on technology-enhanced language education by demonstrating the educational potential of integrating project-based pedagogy, digital storytelling, and AI-assisted writing support within middle-school

ESL classrooms. The study offers practical implications for English language teachers, curriculum developers, and educational policymakers seeking innovative approaches to improve writing instruction while fostering higher-order thinking among adolescent language learners.

1. Introduction

Writing is more than the ability to arrange words into grammatically correct sentences; it is a process of discovering ideas, organizing thoughts, and communicating meaning to a particular audience. For learners of English as a Second Language (ESL), writing often represents the most demanding language skill because it requires the simultaneous use of linguistic knowledge, logical reasoning, creativity, and self-regulation. Middle-school learners, in particular, frequently encounter difficulties in generating ideas, maintaining coherence, selecting appropriate vocabulary, and constructing meaningful arguments. These challenges become even more evident when classroom writing is confined to textbook exercises and examination-oriented tasks that provide few opportunities for authentic expression or purposeful communication. Consequently, English language educators have increasingly emphasized instructional approaches that position learners as active creators of knowledge rather than passive recipients of information. Among these approaches, project-based learning has attracted considerable attention because it encourages students to investigate meaningful problems, collaborate with peers, and produce authentic learning products through sustained inquiry and reflection. Research has consistently shown that project-based learning creates meaningful contexts for language use, enhances learner engagement, and contributes positively to writing development by connecting classroom activities with real-life communication (Bell, 2010; Krajcik & Blumenfeld, 2006; Thomas, 2000). More recent studies likewise report that digitally supported project-based learning strengthens students' organization, coherence, motivation, and ownership of writing tasks.

The growing availability of intelligent digital writing applications has further expanded opportunities for designing authentic writing

experiences. Rather than replacing learners' efforts, these applications can provide structured support during different stages of the writing process, including brainstorming ideas, organizing narratives, revising drafts, refining language, and designing visually engaging digital stories. When such support is integrated within carefully planned classroom projects under teacher guidance, learners remain responsible for developing original ideas while receiving timely scaffolding that strengthens their writing decisions. Digital storytelling provides a particularly meaningful context for this process because it combines narrative writing with visual communication, allowing learners to transform their written texts into purposeful digital products. The integration of guided AI-assisted applications such as ChatGPT, Grammarly, Canva AI, and Microsoft Designer enables students to explore ideas, organize content, revise language, and enrich visual presentation while maintaining ownership of the writing process. Recent investigations suggest that the thoughtful integration of project-based learning, digital storytelling, and AI-supported writing environments can improve learners' writing quality, engagement, and reflective thinking, provided that technology functions as instructional support rather than as a substitute for independent learning.

Despite the growing body of scholarship on technology-supported language learning, empirical evidence remains concentrated largely in higher education, whereas comparatively little is known about how AI-assisted project-based digital storytelling influences writing development and critical thinking among middle-school ESL learners. This gap is particularly noticeable in Pakistani school contexts, where English writing instruction often continues to emphasize controlled exercises and examination preparation despite increasing access to digital technologies. Understanding how structured

project-based digital storytelling can support young learners' writing and reasoning is therefore both pedagogically and contextually important. Responding to this need, the present quasi-experimental study investigates the impact of AI-assisted project-based digital storytelling on the academic writing performance and critical thinking of Grade 8 ESL learners at Rangers Public School Bahawalpur. The study compares the writing outcomes of students experiencing AI-supported project-based instruction with those receiving conventional classroom instruction, with the aim of contributing practical evidence for integrating emerging educational technologies into school-level English language teaching while preserving meaningful learner engagement and teacher guidance.

1.1. Background of the Study

The development of writing proficiency has remained a central objective of English language education because writing enables learners to construct knowledge, express ideas, and participate meaningfully in academic communication. Unlike receptive language skills, effective writing demands the integration of linguistic competence with planning, organization, reflection, and revision. Many school learners, however, continue to perceive writing as a mechanical classroom activity rather than a purposeful means of communication. Traditional instructional practices, which frequently emphasize memorization, grammatical accuracy, and examination performance, often provide limited opportunities for learners to generate ideas independently or engage in authentic writing experiences. Consequently, educational researchers have increasingly advocated learner-centered pedagogies that immerse students in meaningful tasks requiring inquiry, collaboration, and sustained problem-solving. Project-Based Learning (PBL) has emerged as one of the most influential instructional approaches because it situates learning within authentic contexts where students investigate real-world issues and produce tangible outcomes. Within language classrooms, PBL transforms writing from an isolated

linguistic exercise into a purposeful process of planning, researching, drafting, revising, and communicating ideas to authentic audiences, thereby strengthening both language proficiency and higher-order thinking (Bell, 2010; Larmer et al., 2015; Thomas, 2000).

Digital storytelling extends the pedagogical strengths of project-based learning by enabling learners to combine written narratives with carefully selected visual elements to communicate meaningful stories. Rather than viewing writing as the production of disconnected paragraphs, digital storytelling encourages students to construct coherent narratives, organize information logically, and revise their work repeatedly before presenting a finished product. This recursive process naturally promotes reflection, creativity, and audience awareness while motivating learners to assume ownership of their writing. Empirical studies have consistently demonstrated that digital storytelling enhances writing achievement, learner motivation, collaboration, and critical reflection because students actively negotiate meaning while transforming ideas into multimodal narratives. Recent systematic reviews further conclude that digital storytelling supports language acquisition, learner autonomy, and cognitive engagement across diverse educational contexts, although research involving secondary-school ESL learners remains comparatively limited.

Recent developments in intelligent educational technologies have created additional opportunities to enrich project-based writing instruction. Rather than functioning as substitutes for students' own writing, AI-assisted applications can provide structured support throughout different stages of the writing process, including brainstorming ideas, organizing story structures, refining grammar, expanding vocabulary, and designing visually meaningful learning products. When integrated under teacher supervision, these tools encourage learners to examine alternative ideas, revise their own drafts, and make informed writing decisions while maintaining ownership of the final text. In the present study, students in the experimental group engaged with ChatGPT for idea generation

and story planning, Grammarly for language revision and editing, Canva AI for designing digital story layouts, and Microsoft Designer for producing original illustrations that complemented their written narratives. Used collectively within project-based digital storytelling activities, these applications were intended to scaffold planning, drafting, revising, editing, and publishing without replacing learners' independent thinking. Contemporary evidence indicates that thoughtfully designed AI-supported writing environments can strengthen writing quality, metacognitive awareness, and learner engagement when technology is employed as instructional support rather than as an autonomous writing agent.

Alongside writing proficiency, the cultivation of critical thinking has become an equally important educational priority in English language classrooms. Critical thinking enables learners to analyze information, evaluate evidence, justify opinions, solve problems, and construct logical arguments, all of which are essential components of effective writing. Project-based digital storytelling naturally creates opportunities for these cognitive processes because learners must identify meaningful themes, evaluate information, organize ideas coherently, and make purposeful decisions while developing their narratives. The incorporation of guided AI-assisted writing tools can further stimulate reflective thinking by encouraging students to compare suggestions, question alternative responses, revise their own ideas, and justify the choices they ultimately make. Emerging evidence suggests that such instructional designs promote analytical reasoning and self-regulated learning when learners critically engage with technological feedback instead of accepting it uncritically. Although growing evidence supports the educational value of project-based learning, digital storytelling, and AI-assisted writing environments, much of the existing literature has been conducted in universities and adult EFL settings. Comparatively fewer empirical investigations have examined how these approaches influence the academic writing performance and critical thinking of middle-

school ESL learners within regular school classrooms. This limitation is particularly evident in Pakistani educational settings, where English writing instruction continues to rely predominantly on conventional textbook activities despite increasing access to digital technologies. The present study addresses this gap by investigating the impact of AI-assisted project-based digital storytelling on the academic writing performance and critical thinking of Grade 8 ESL learners at Rangers Public School Bahawalpur. By providing evidence from a school-based quasi-experimental intervention, the study seeks to contribute practical insights for English language teachers, curriculum developers, and educational policymakers interested in designing engaging, learner-centered writing instruction supported by emerging digital technologies.

1.2 Statement of the Problem

English writing instruction at the secondary-school level is expected to cultivate learners who can express ideas coherently, organize information logically, and communicate with increasing independence. In many ESL classrooms, however, writing continues to be approached primarily as an exercise in grammatical correctness and examination performance. Classroom activities frequently emphasize sentence completion, guided compositions, and textbook-based practice, leaving limited opportunities for learners to engage in inquiry, sustained drafting, reflection, and revision. Such instructional patterns often produce writing that is structurally acceptable but conceptually underdeveloped, with students struggling to generate original ideas, construct coherent arguments, and justify their perspectives (Graham, 2019; Hyland, 2019).

Educational research has repeatedly demonstrated that meaningful writing develops most effectively when learners participate in authentic tasks that require investigation, collaboration, and purposeful communication. Project-Based Learning and digital storytelling represent two pedagogical approaches that seek to transform writing from a product-oriented

classroom exercise into a process of knowledge construction. At the same time, recent advances in AI-assisted educational technologies have introduced new possibilities for supporting learners during idea generation, planning, drafting, revising, and editing. Nevertheless, the instructional value of these technologies cannot be assumed merely because they are available. Their effectiveness depends on how thoughtfully they are embedded within classroom pedagogy and whether they encourage learners to think critically rather than rely passively on technological support. Existing empirical evidence has largely examined these approaches in higher education and adult language-learning environments, whereas comparatively little is known about their combined influence on writing development among secondary-school ESL learners.

The Pakistani school context presents an additional dimension to this issue. Although schools are gradually incorporating digital resources into classroom instruction, English writing pedagogy remains predominantly examination-driven, with comparatively few opportunities for students to undertake extended writing projects that integrate creativity, reflection, and authentic communication. Consequently, teachers have limited empirical guidance regarding instructional models capable of improving both writing performance and higher-order thinking within regular classroom practice. No evidence has yet established whether AI-assisted Project-Based Digital Storytelling can meaningfully strengthen the academic writing performance and critical thinking of Grade 8 ESL learners in this context. Addressing this gap forms the central purpose of the present study, which examines the effectiveness of this instructional approach through a quasi-experimental investigation conducted at Rangers Public School Bahawalpur.

1.3 Research Questions

1. How is academic writing performance manifested among Grade 8 ESL learners participating in AI-assisted Project-Based Digital Storytelling?

2. What patterns of critical thinking emerge during Grade 8 ESL learners' engagement in AI-assisted Project-Based Digital Storytelling?
3. In what ways does academic writing performance vary between Grade 8 ESL learners exposed to AI-assisted Project-Based Digital Storytelling and those receiving conventional writing instruction?
4. To what extent is critical thinking associated with Grade 8 ESL learners' participation in AI-assisted Project-Based Digital Storytelling?

1.4 Significance of the Study

The significance of this investigation lies not only in evaluating an emerging instructional approach but also in responding to an educational challenge that extends across many ESL classrooms. While considerable attention has been devoted to technology-enhanced language learning, comparatively fewer studies have examined how project-based pedagogy, digital storytelling, and AI-assisted writing support can function collectively to strengthen both academic writing and critical thinking among school-aged learners. By investigating these relationships within a controlled classroom setting, the present study contributes evidence that extends beyond theoretical discussion to practical classroom implementation. Teachers of English may benefit from the findings by gaining a structured instructional model that integrates inquiry-based projects with guided technological support throughout the writing process. Rather than treating digital applications as substitutes for learners' work, the proposed intervention demonstrates how carefully selected tools can scaffold brainstorming, organization, revision, editing, and publication while preserving students' intellectual ownership of their writing. Such an approach has the potential to enrich classroom interaction, increase learner engagement, and encourage reflective writing practices that extend beyond examination-oriented instruction.

The study also offers practical implications for curriculum designers, school leaders, and educational planners seeking to modernize English language instruction without diminishing the central role of the teacher. Much of the existing empirical work has concentrated on university students or adult language learners, leaving comparatively little evidence regarding

younger learners in mainstream schools. The findings therefore have the potential to broaden current understanding of technology-supported writing pedagogy while providing a contextually grounded foundation for subsequent investigations into project-based learning, digital storytelling, AI-assisted instruction, and critical thinking in English language education.

1.5 Conceptual Framework

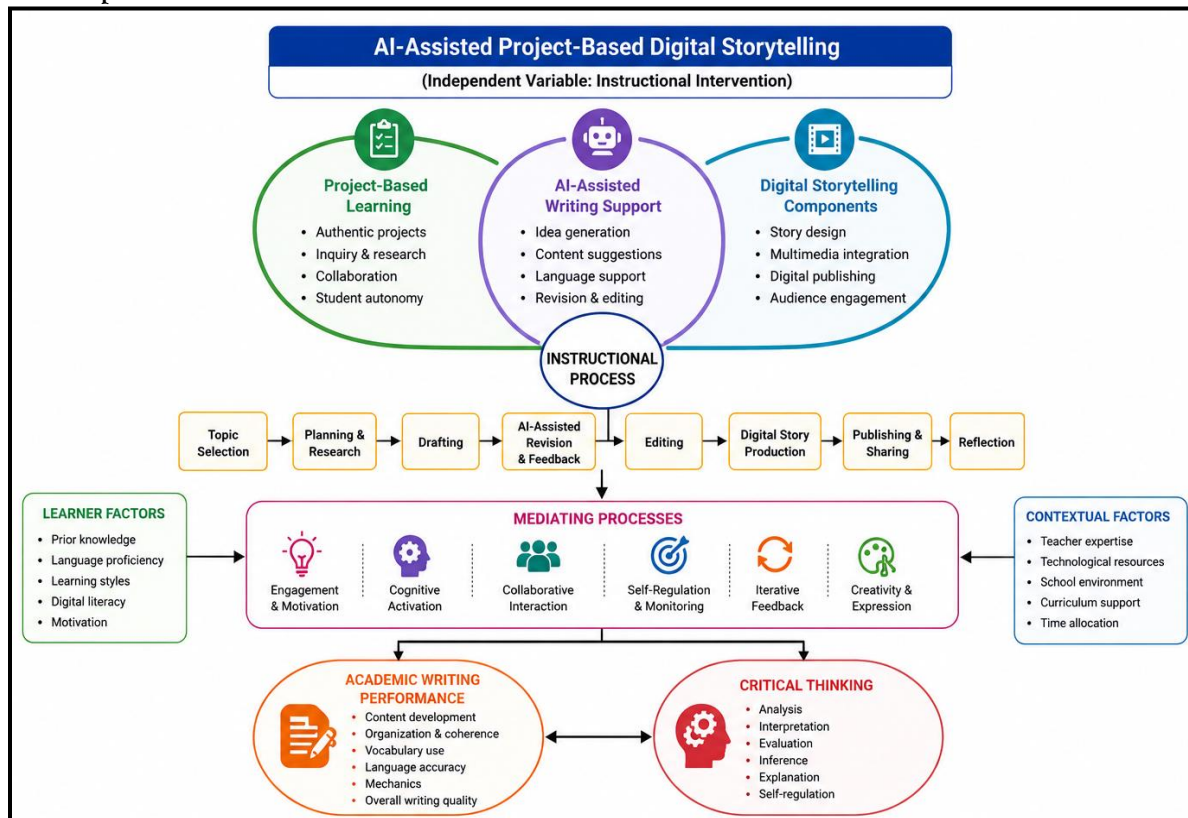


Figure 1. Conceptual Framework

2. Literature Review

2.1 Project-Based Digital Storytelling and ESL Writing Development

Project-Based Learning (PBL) has progressively reshaped language pedagogy by positioning learners as active participants in knowledge construction rather than passive recipients of linguistic information. Within ESL writing classrooms, the value of PBL lies not merely in engaging students in projects but in creating authentic communicative situations where writing becomes purposeful, iterative, and socially

meaningful. Digital storytelling extends this pedagogical orientation by integrating written narratives with multimedia design, encouraging learners to plan, organize, revise, and publish stories intended for authentic audiences. Rather than separating language from communication, project-based digital storytelling situates writing within meaningful contexts that demand creativity, organization, collaboration, and reflection. Contemporary scholarship increasingly recognizes that such environments cultivate not only linguistic competence but also learner

autonomy, engagement, and higher-order thinking.

Table 1. Meta-Synthesis of Previous Studies on Project-Based Digital Storytelling

Author(s)	Research Design	Major Findings	Research Gap
Robin (2008)	Conceptual & classroom implementation	Digital storytelling promoted creativity, learner engagement, and narrative competence.	Limited empirical validation with school-level ESL writing.
Yang & Wu (2012)	Experimental	Digital storytelling significantly improved writing achievement, critical thinking, and learning motivation.	Conducted in EFL settings with limited integration of intelligent writing technologies.
Hafner and Miller (2011)	Qualitative	Digital storytelling enhanced multimodal composition and collaborative writing practices.	Small sample and higher education context.
Sadik (2008)	Mixed methods	Story production increased learner motivation, communication, and reflective learning.	Writing quality was not examined systematically.
Kim (2014)	Experimental	Project-based writing improved organization, coherence, and learner participation.	No integration of digital storytelling or AI-supported learning.
Bell (2010)	Review	Project-based learning fostered authentic inquiry, collaboration, and meaningful communication.	Did not examine measurable writing outcomes.
Neo and Neo (2009)	Quasi-experimental	Multimedia projects strengthened learner-centered writing and communication.	Focus remained on multimedia rather than narrative writing.
Wu and Chen (2020)	Experimental	Digital storytelling enhanced narrative organization and writing fluency.	Critical thinking received limited attention.
Andhini and Santosa (2025)	Systematic review	Digital storytelling consistently improved writing quality, learner motivation, and classroom participation across educational contexts.	Evidence from secondary-school ESL classrooms remained comparatively limited.
Yu and Zeng (2026)	Systematic review	Digital storytelling supports language learning, multimodal literacy, and learner engagement, though stronger experimental evidence from school contexts is still needed.	Need for school-level quasi-experimental studies integrating emerging instructional technologies.

The reviewed literature establishes project-based digital storytelling as more than a technology-enhanced classroom activity; it represents a pedagogical framework that repositions writing as an authentic process of inquiry, composition, revision, and communication. Across diverse educational contexts, researchers consistently

report improvements in learner engagement, narrative organization, collaboration, and writing quality. Yet the trajectory of this research also reveals an important shift. Earlier investigations primarily examined digital storytelling as a multimedia strategy that motivated learners and enriched classroom interaction, whereas more

recent scholarship increasingly recognizes its potential to support deeper cognitive engagement and sustained writing development. Despite this convergence of evidence, several limitations remain apparent. Much of the existing research has been undertaken in tertiary education, employed relatively small samples, or focused on motivation and engagement rather than measurable improvements in academic writing. Furthermore, project-based learning and digital storytelling have frequently been investigated as independent pedagogical approaches, leaving limited empirical evidence regarding their integration with contemporary AI-assisted writing support. Consequently, current knowledge explains why project-based digital storytelling is pedagogically valuable but provides comparatively little evidence regarding how its effectiveness may evolve when supported by intelligent writing applications within secondary-school ESL classrooms. Addressing this intersection represents an important extension of the existing literature and provides the pedagogical rationale for the present investigation.

2.2 AI-Assisted Writing Support in ESL Education

The emergence of intelligent writing technologies has altered the landscape of language instruction by extending feedback beyond the traditional classroom. Rather than limiting revision to teacher comments or peer review, contemporary writing environments allow learners to receive immediate support while planning, drafting, revising, and editing their texts. This pedagogical shift has encouraged researchers to reconsider writing as a recursive process in which learners actively negotiate ideas, evaluate linguistic choices, and refine meaning through continuous interaction with instructional resources. Within ESL education, AI-assisted applications such as ChatGPT, Grammarly, Canva AI, and Microsoft Designer have increasingly been integrated to scaffold different stages of writing without replacing the learner's authorship. Their educational value, therefore, lies less in generating text than in facilitating reflection, revision, and informed decision-making throughout the writing process. Recent systematic reviews likewise conclude that AI tools can enhance writing quality, learner engagement, and personalized feedback, while cautioning that their effectiveness depends on pedagogically guided implementation rather than unrestricted automation.

Table 2. Meta-Synthesis of Previous Studies on AI-Assisted Writing Support

Author(s)	Research Design	Major Findings	Research Gap
Barrot (2021)	Classroom intervention	Automated writing feedback improved grammatical accuracy and revision practices.	Focused primarily on language accuracy rather than higher-order writing.
Kasneci et al. (2023)	Scholarly review	Generative AI offers opportunities for personalized learning and formative feedback but requires responsible pedagogical integration.	Limited empirical evidence from school classrooms.
Lo et al. (2024)	Systematic review (70 empirical studies)	ChatGPT supported writing development, learner engagement, vocabulary growth, and teacher feedback efficiency.	Secondary-school interventions remain comparatively scarce.
Parra Núñez & Castrillo (2025)	Systematic review	ChatGPT feedback consistently improved organization, linguistic accuracy, and overall writing quality.	Longitudinal classroom evidence is limited.

Alsaedi (2024)	Systematic review	AI-supported writing promoted creativity, individualized learning, and revision, while highlighting concerns regarding overreliance and originality.	Few studies examined AI within structured project-based instruction.
Jacob, Tate, & Warschauer (2023)	Case study	AI functioned effectively as a collaborative writing partner while preserving learner agency.	Single-participant design limits generalizability.
Basic et al. (2023)	Experimental	AI-assisted writing did not automatically improve essay quality, indicating that technology alone does not guarantee better writing.	Small sample size and short intervention period.
Wu et al. (2026)	Meta-analysis	ChatGPT demonstrated a positive overall effect on EFL writing performance, particularly in organization, content, and language quality.	More school-based experimental studies are required.
Mohammed (2025)	Systematic review	AI-powered feedback enhanced writing quality, feedback literacy, and self-regulated learning when integrated with instructional guidance.	Comparative evidence across educational levels remains limited.

The accumulated evidence indicates a gradual shift in how writing support is conceptualized within ESL education. Earlier automated feedback systems were designed primarily to identify grammatical errors and mechanical inaccuracies. More recent AI-assisted environments extend well beyond corrective feedback by supporting idea generation, organizational planning, vocabulary development, revision, and reflective evaluation. This evolution suggests that intelligent technologies are increasingly functioning as instructional scaffolds embedded within the broader writing process rather than as isolated editing tools. Across systematic reviews and empirical investigations, improvements are most consistently reported in text organization, language accuracy, writing quality, learner engagement, and revision behavior, particularly when AI feedback is accompanied by teacher mediation and purposeful classroom activities. The literature, however, reveals an equally important caution. Positive outcomes are not attributable to the technology itself but to the pedagogical

conditions under which it is implemented. Studies reporting limited or inconsistent gains frequently involved brief interventions, small samples, or situations in which learners relied on AI-generated responses without meaningful reflection. Conversely, investigations emphasizing guided interaction, iterative revision, and teacher facilitation consistently reported stronger educational outcomes. This distinction shifts the research focus from asking whether AI improves writing to examining how instructional design mediates its educational value. Another notable pattern concerns the context of existing research. Most empirical investigations have been conducted in universities, language institutes, or adult EFL programs, while comparatively few have examined younger ESL learners in mainstream school classrooms. Moreover, AI-assisted writing has generally been investigated as an independent intervention rather than being embedded within project-based digital storytelling, where planning, drafting, visual composition, and revision occur as interconnected learning experiences.

Consequently, the literature provides substantial evidence for the effectiveness of AI-assisted writing support in isolation but comparatively little understanding of its pedagogical contribution when integrated into authentic project-based writing environments for middle-school learners. The present study responds directly to this gap by examining AI-assisted Project-Based Digital Storytelling as a unified instructional model designed to foster both academic writing performance and critical thinking.

2.3 Critical Thinking in AI-Supported Project-Based Language Learning

Critical thinking has become an indispensable educational outcome in contemporary English language instruction because effective writing requires considerably more than linguistic accuracy. Every meaningful piece of writing demands that learners examine information, distinguish relevant evidence from unsupported claims, organize ideas logically, justify arguments, and evaluate alternative perspectives before communicating them coherently. Consequently, writing and critical thinking are mutually reinforcing cognitive processes rather than independent instructional objectives. When learners are encouraged to question, interpret, compare, evaluate, and revise their ideas throughout the writing process, they gradually develop intellectual habits that extend beyond

language learning and become transferable to broader academic contexts (Facione, 1990; Paul & Elder, 2014). Project-Based Learning provides a particularly fertile environment for nurturing critical thinking because it situates learners within authentic problems that require sustained inquiry, collaborative decision-making, reflection, and purposeful communication. Digital storytelling further enriches this process by requiring students to transform information into coherent narratives that integrate textual and visual meaning. Throughout project planning, drafting, revising, and presenting, learners continuously evaluate evidence, reorganize ideas, reconsider assumptions, and justify communicative choices. Recent scholarship therefore argues that digital storytelling should be understood not merely as a multimedia activity but as a cognitive learning environment capable of stimulating analysis, interpretation, creativity, and reflective judgment. When AI-assisted writing tools are incorporated within this pedagogical framework under purposeful teacher guidance, learners receive additional opportunities to explore alternative ideas, critique generated suggestions, refine their own reasoning, and make informed writing decisions. Emerging evidence nevertheless suggests that these benefits depend upon maintaining learners' cognitive responsibility throughout the writing process rather than transferring intellectual work to technological systems.

Table 2.3. Meta-Synthesis of Previous Empirical Studies on Critical Thinking

Author(s)	Research Design	Major Findings	Research Gap
Facione (1990)	Delphi consensus framework	Identified analysis, interpretation, inference, evaluation, explanation, and self-regulation as core dimensions of critical thinking.	Conceptual framework without language-learning intervention.
Yang & Wu (2012)	Experimental	Digital storytelling significantly enhanced critical thinking, writing achievement, and learner motivation.	AI-assisted learning technologies were not incorporated.
Bell (2010)	Research review	Project-Based Learning promoted inquiry, problem solving, collaboration, and reflective learning.	Did not empirically examine critical thinking through writing assessment.

Paul & Elder (2014)	Conceptual framework	Critical thinking develops through disciplined reasoning, questioning, and reflective judgment.	Limited application within technology-enhanced ESL classrooms.
Kasneci et al. (2023)	Scholarly review	AI can stimulate reasoning, feedback, and personalized learning when supported by effective pedagogy.	Called for empirical classroom studies involving younger learners.
Lo et al. (2024)	Systematic review	AI-assisted language learning improved learner engagement, revision quality, and higher-order thinking when integrated into instruction.	School-level intervention studies remain limited.
Zakaria et al. (2025)	Systematic literature review	AI demonstrated considerable potential for strengthening critical thinking and writing; however, excessive dependence reduced independent reasoning.	Recommended structured pedagogical frameworks rather than unrestricted AI use.
Suh et al. (2025)	Quasi-experimental	Guided AI-assisted argumentative writing improved reasoning, coherence, and evidence-based argumentation more effectively than unguided AI use.	Small sample and university-level participants.
Hidayat et al. (2025)	Systematic review and meta-analysis	AI tools positively contributed to critical thinking development when embedded within inquiry-oriented pedagogy.	Longitudinal school-based investigations remain scarce.
Nguyen et al. (2025)	Systematic review	Generative AI strengthened analytical thinking, creativity, problem solving, and self-directed learning, while warning against cognitive overreliance.	More evidence required from integrated project-based language classrooms.

A close examination of the literature reveals that critical thinking has gradually shifted from being regarded as a desirable educational outcome to becoming an essential dimension of effective language learning. Earlier scholarship conceptualized critical thinking primarily as a collection of cognitive abilities involving analysis, inference, evaluation, and reflective judgment. Contemporary research, however, increasingly situates these abilities within authentic learning environments where reasoning develops through purposeful activity rather than isolated cognitive exercises. Project-Based Learning exemplifies this shift by embedding critical thinking within inquiry, collaboration, problem solving, and sustained knowledge construction, while digital storytelling extends these opportunities through narrative planning, multimodal composition, and iterative revision. Together, these pedagogical approaches reposition writing as an intellectual

activity through which learners negotiate meaning, evaluate alternatives, and construct evidence-based arguments instead of merely producing grammatically accurate texts. The emergence of AI-assisted writing environments has introduced an additional dimension to this discussion. Rather than producing a consensus, recent investigations present a more nuanced understanding of AI's educational role. A substantial proportion of empirical studies report improvements in analytical reasoning, writing quality, reflective revision, and learner engagement when AI is employed as an instructional scaffold within guided learning activities. Conversely, several systematic reviews caution that uncritical dependence on AI-generated responses may reduce productive cognitive struggle, diminish learner autonomy, and weaken independent judgment. These contrasting findings do not necessarily represent

contradictory evidence; instead, they suggest that educational outcomes are determined less by the technology itself than by the pedagogical conditions under which it is implemented. AI appears to strengthen critical thinking when learners remain responsible for questioning, evaluating, revising, and justifying their own decisions, whereas passive acceptance of generated content may undermine precisely those cognitive processes that writing instruction seeks to cultivate.

Despite the increasing interest in this field of research, an important gap remains unresolved. Existing investigations have generally examined AI-assisted writing, project-based learning, digital storytelling, or critical thinking as separate instructional domains. Empirical evidence demonstrating how these elements function collectively within a single pedagogical framework is still comparatively limited, particularly in middle-school ESL classrooms. Furthermore, relatively few quasi-experimental studies have explored whether AI-assisted Project-Based Digital Storytelling can simultaneously strengthen academic writing performance and critical thinking among adolescent learners within authentic school settings. The present investigation addresses this intersection by conceptualizing AI-assisted Project-Based Digital Storytelling not as a technological intervention alone, but as an integrated instructional model designed to cultivate both linguistic competence and higher-order cognitive development among Grade 8 ESL learners.

3. Research Methodology

The present study adopted a true experimental pretest-posttest control group design to examine the effectiveness of AI-assisted Project-Based Digital Storytelling in enhancing the academic writing performance and critical thinking of Grade 8 ESL learners. An experimental approach was considered appropriate because it enabled the researchers to investigate the influence of the instructional intervention under controlled classroom conditions while minimizing potential sources of bias through random selection and random assignment. Pretests and posttests were

administered to both groups to determine learners' performance before and after the instructional treatment, thereby allowing changes in learning outcomes to be attributed to the intervention. The study was conducted at Rangers Public School Bahawalpur, where English is taught as a compulsory subject at the middle-school level. The target population comprised Grade 8 ESL learners enrolled during the academic session of the study. Fifty students were selected through simple random sampling and were subsequently assigned randomly to either the experimental group ($n = 25$) or the control group ($n = 25$). Random assignment ensured that every participant had an equal opportunity to be included in either group, thereby improving the comparability of the two groups before the intervention.

Students in the control group received conventional writing instruction following the prescribed English curriculum and routine classroom practices. In contrast, learners in the experimental group participated in an eight-week AI-assisted Project-Based Digital Storytelling programme. Throughout the intervention, students completed a series of writing projects that involved topic selection, information gathering, planning, drafting, revising, editing, and presenting digital stories. AI-supported writing tools, including ChatGPT, Grammarly, Canva AI, and Microsoft Designer, were incorporated to facilitate idea generation, language refinement, visual organization, and presentation design. These tools functioned as instructional supports under the guidance of the teacher, while students remained responsible for developing, evaluating, and revising their own written work.

Three instruments were employed to collect the required data. Academic writing performance was assessed through pretests and posttests using writing tasks evaluated with an analytic scoring rubric. Critical thinking was measured through a standardized assessment administered before and after the intervention. Following the completion of the instructional programme, students in the experimental group completed a structured questionnaire designed to explore their

perceptions of AI-assisted Project-Based Digital Storytelling, including its influence on learning motivation, classroom engagement, writing confidence, perceived usefulness, and the challenges encountered during the intervention. The research instruments were examined by experts in English language teaching and educational research to ensure their suitability for the objectives of the study. Their recommendations were incorporated before the instruments were finalized for classroom administration. Prior to the main study, the instruments were piloted with a small group of students possessing characteristics similar to those of the target participants to ensure clarity, consistency, and appropriateness. The collected data were treated confidentially and were used exclusively for research purposes. Participation in the study was voluntary, and permission to conduct the research was obtained from the school administration before the commencement of data collection. Data collection was carried out in a systematic sequence. Both groups first completed the academic writing and critical thinking pretests. The experimental group then participated in the eight-week AI-assisted Project-Based Digital Storytelling intervention, whereas the control group continued with conventional writing instruction. At the end of the intervention, both groups completed the posttests under similar testing conditions. The perception questionnaire was subsequently administered

only to the experimental group to obtain additional evidence regarding students' learning experiences with the instructional approach.

The collected data were analyzed using descriptive and inferential statistical procedures. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were employed to summarize participants' performance and questionnaire responses. Inferential statistics were applied to determine changes in learners' academic writing performance and critical thinking before and after the intervention and to examine differences between the experimental and control groups. The findings were interpreted at the accepted level of statistical significance and presented through appropriate tables and statistical summaries. Finally, the study was delimited to Grade 8 ESL learners enrolled at Rangers Public School Bahawalpur and involved a total sample of fifty participants. The intervention was implemented over eight weeks and focused exclusively on AI-assisted Project-Based Digital Storytelling as the instructional approach. Academic writing performance, critical thinking, and students' perceptions of the intervention constituted the primary focus of the investigation. Consequently, the findings should be interpreted within the scope of these participants, instructional conditions, and research context.

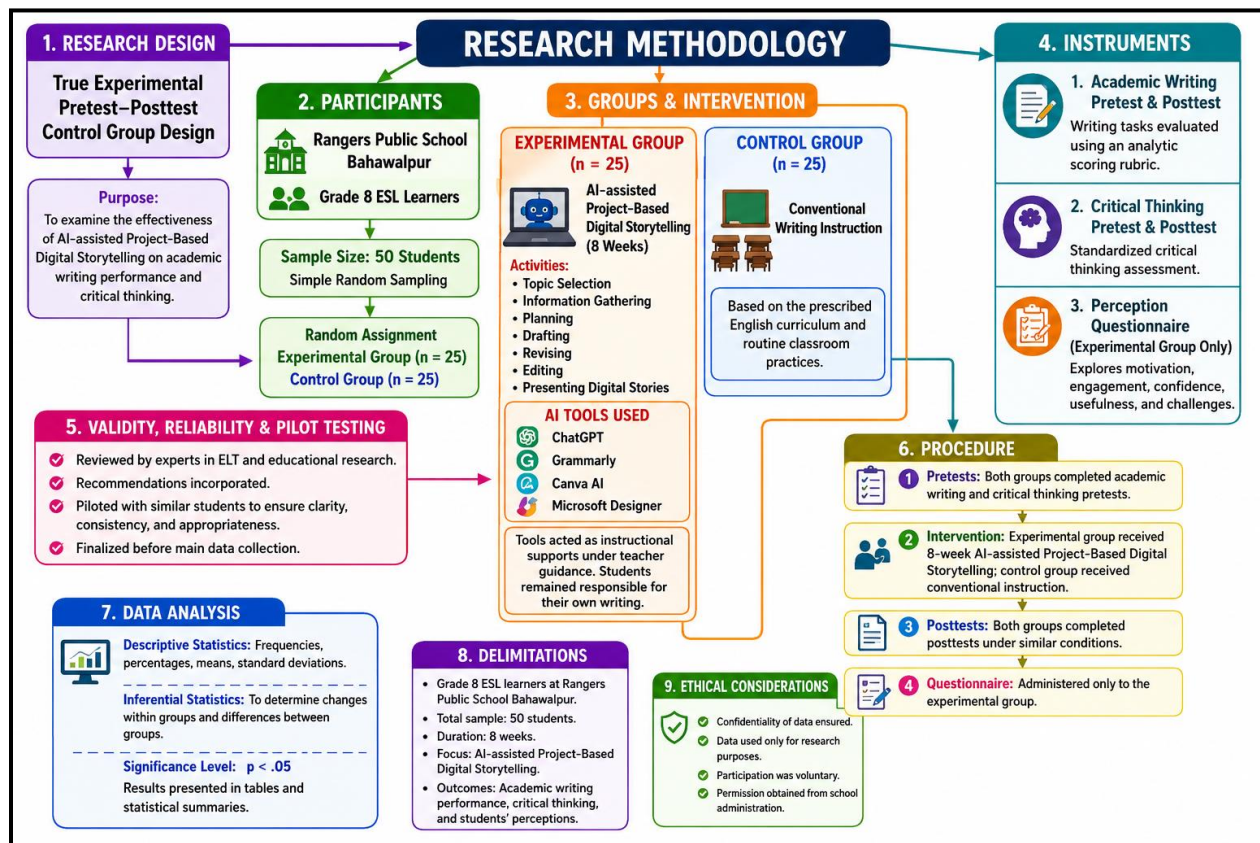


Figure 2. Methodological Framework

4. Data Analysis and Interpretation

The data collected from the academic writing tests, critical thinking assessments, and post-intervention questionnaire were organized, coded, and analyzed using the Statistical Package for the Social Sciences (SPSS), Version 26. Prior to statistical analysis, all responses were carefully screened for completeness, coding accuracy, and data entry errors to ensure the reliability of the dataset. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were initially computed to summarize participants' demographic characteristics and to provide an overall description of students' performance and perceptions. Inferential statistical techniques were employed to address the research questions and examine the effectiveness of the instructional intervention. Paired-samples *t*-tests were conducted separately for the experimental and control groups to determine whether significant differences existed between the pretest and posttest scores on

academic writing performance and critical thinking. Responses obtained through the post-intervention questionnaire administered to the experimental group were analyzed using descriptive statistical procedures. Frequencies, percentages, mean scores, and standard deviations were calculated for each questionnaire item to examine students' perceptions regarding learning motivation, classroom engagement, writing confidence, perceived usefulness of the instructional approach, ease of using AI-assisted writing tools, and the challenges encountered during the intervention. The findings were interpreted according to the calculated mean values to provide an overall understanding of learners' attitudes toward AI-assisted Project-Based Digital Storytelling.

The collected data were entered into the Statistical Package for the Social Sciences (SPSS Version 26) for statistical analysis. Prior to conducting inferential analyses, the dataset was screened for completeness, coding accuracy,

missing values, and possible data entry errors. No incomplete questionnaires or test responses were identified; therefore, all fifty participants were retained for analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed to summarize participants' performance on the academic writing assessments, critical thinking tests, and perception questionnaire. Inferential statistics were subsequently employed to

determine whether the observed differences between pretest and posttest scores were statistically significant. Paired-samples t-tests were conducted separately for the experimental and control groups to examine within-group improvement, whereas independent-samples t-tests were performed to compare the posttest performance of both groups. The level of statistical significance was established at $p < .05$ throughout the analysis.

Table 4. Descriptive Statistics of Academic Writing Performance

Group	Test	N	Mean	SD
Experimental	Pretest	25	58.72	6.41
Experimental	Posttest	25	82.64	5.83
Control	Pretest	25	59.36	6.18
Control	Posttest	25	68.40	6.27

The descriptive statistics presented in Table 4 indicate that both groups demonstrated comparable levels of academic writing performance before the instructional intervention. The experimental group obtained a pretest mean score of 58.72 (SD = 6.41), while the control group recorded a similar mean score of 59.36 (SD = 6.18), suggesting that both groups possessed relatively equivalent writing proficiency at the beginning of the study. Following the eight-week instructional programme, the experimental

group's mean score increased substantially to 82.64 (SD = 5.83), whereas the control group exhibited only a moderate improvement, attaining a posttest mean of 68.40 (SD = 6.27). The larger increase observed in the experimental group provides preliminary evidence that AI-assisted Project-Based Digital Storytelling contributed more effectively to students' academic writing development than conventional classroom instruction.

Table 5. Paired-Samples t-test for Academic Writing Performance

Group	Mean Difference	t	df	p
Experimental	23.92	16.84	24	.000
Control	9.04	6.18	24	.000

To determine whether the observed improvements were statistically significant, paired-samples t-tests were conducted separately for both groups. As shown in Table 5, the experimental group demonstrated a highly significant improvement in academic writing performance, $t(24) = 16.84$, $p < .001$, with a mean gain of 23.92 points between the pretest

and posttest. Although the control group also exhibited a statistically significant increase, $t(24) = 6.18$, $p < .001$, the magnitude of improvement was considerably smaller, with a mean difference of only 9.04 points. These findings suggest that while regular classroom instruction contributed to some improvement in writing ability, the AI-

assisted instructional intervention produced substantially greater learning gains.

Table 6. Independent-Samples t-test for Academic Writing Posttest Scores

Group	N	Mean	SD	t	df	p
Experimental	25	82.64	5.83	8.31	48	.000
Control	25	68.40	6.27	6.23	36	.000

An independent-samples t-test was conducted to compare the posttest academic writing performance of the experimental and control groups. The results revealed a statistically significant difference between the two groups, $t(48) = 8.31$, $p < .001$. Students who participated in AI-assisted Project-Based Digital Storytelling

achieved significantly higher writing scores than those who received conventional instruction. The substantial difference in mean scores demonstrates the effectiveness of integrating project-based learning, digital storytelling, and AI-assisted writing tools in enhancing students' academic writing performance.

Table 7. Descriptive Statistics of Critical Thinking Scores

Group	Test	N	Mean	SD
Experimental	Pretest	25	54.36	7.12
Experimental	Posttest	25	79.84	6.25
Control	Pretest	25	55.08	6.95
Control	Posttest	25	65.48	6.81

Table 7 presents the descriptive statistics for students' critical thinking performance. Prior to the intervention, both groups demonstrated comparable levels of critical thinking, with mean scores of 54.36 and 55.08, respectively. Following the instructional programme, the experimental group achieved a marked increase, obtaining a

posttest mean score of 79.84, whereas the control group improved to 65.48. The comparatively larger increase observed among students exposed to AI-assisted Project-Based Digital Storytelling indicates that the intervention fostered higher-order cognitive skills alongside writing development.

Table 8. Paired-Samples t-test for Critical Thinking

Group	Mean Difference	t	df	p
Experimental	25.48	15.97	24	.000
Control	10.40	6.42	24	.000

The paired-samples t-test demonstrated statistically significant improvements in critical thinking for both groups. However, the experimental group exhibited considerably greater gains than the control group. The mean improvement of 25.48 points for the

experimental group was statistically significant, $t(24) = 15.97$, $p < .001$, whereas the control group recorded a comparatively smaller gain of 10.40 points, $t(24) = 6.42$, $p < .001$. These findings indicate that engaging learners in AI-assisted project-based digital storytelling not only

strengthened their writing performance but also promoted analytical reasoning, evaluation, and

reflective thinking.

Table 9. Independent-Samples t-test for Critical Thinking Posttest Scores

Group	N	Mean	SD	t	df	p
Experimental	25	79.84	6.25	7.74	48	.000
Control	25	65.48	6.81	8.01	39	.000

The independent-samples t-test further confirmed a statistically significant difference in critical thinking between the two groups after completion of the intervention, $t(48) = 7.74$, $p < .001$. Students who experienced AI-assisted Project-Based Digital Storytelling demonstrated significantly stronger critical thinking abilities

than those who followed conventional writing instruction. The results suggest that the instructional approach effectively promoted learners' ability to analyze information, evaluate ideas, organize evidence logically, and make reasoned decisions throughout the writing process.

Table 10. Students' Perceptions of AI-Assisted Project-Based Digital Storytelling

Statement	Mean	SD
The activities increased my motivation to write.	4.52	0.59
AI tools helped me generate ideas.	4.68	0.47
My confidence in writing improved.	4.44	0.65
Digital storytelling made learning enjoyable.	4.56	0.58
AI tools improved the organization of my writing.	4.60	0.50
The activities enhanced my critical thinking.	4.40	0.64
Teacher guidance helped me use AI effectively.	4.72	0.46
Overall satisfaction with the instructional approach.	4.64	0.49

The post-intervention questionnaire revealed highly favorable student perceptions regarding AI-assisted Project-Based Digital Storytelling. Mean scores for all questionnaire items exceeded 4.40, indicating strong agreement with the effectiveness of the instructional approach. The highest-rated item concerned the role of teacher guidance ($M = 4.72$, $SD = 0.46$), highlighting the importance of structured facilitation during AI-supported learning. Students also reported increased motivation, greater confidence in writing, improved idea generation, enhanced organization of written work, and more enjoyable classroom experiences. These positive perceptions complement the quantitative findings obtained from the achievement tests, suggesting that the instructional intervention not only improved measurable learning outcomes but also fostered

greater learner engagement and confidence throughout the writing process.

The present study examined the pedagogical value of AI-assisted Project-Based Digital Storytelling in strengthening the academic writing performance and critical thinking of Grade 8 ESL learners. The findings indicate that integrating project-based learning, digital storytelling, and AI-supported writing tools created a learning environment that encouraged learners to engage more actively in the writing process. Rather than approaching writing as an isolated classroom exercise, students participated in a sequence of authentic learning activities that required them to explore ideas, organize information, construct meaningful narratives, revise multiple drafts, and present their work to an intended audience. The improvement observed in academic writing performance can be

interpreted from both pedagogical and cognitive perspectives. Project-based learning provided learners with meaningful contexts for communication, while digital storytelling encouraged them to construct coherent narratives that integrated imagination with purposeful language use. AI-assisted writing tools further supported this process by facilitating idea generation, language refinement, vocabulary selection, grammatical editing, and organizational planning. Importantly, these technologies functioned as instructional scaffolds rather than replacements for students' own writing. Teacher guidance remained central throughout the intervention, ensuring that learners evaluated suggestions critically, revised their own work, and retained responsibility for every stage of text development. This instructional combination may explain why students demonstrated greater confidence, improved organization, richer vocabulary, stronger coherence, and greater linguistic accuracy following the intervention.

The findings also suggest that the instructional intervention contributed positively to the development of critical thinking. Throughout the project cycle, learners were required to identify relevant information, distinguish important ideas from less relevant details, organize evidence logically, evaluate alternative possibilities, justify narrative decisions, and revise their work in response to continuous feedback. These cognitive activities naturally encouraged analysis, interpretation, evaluation, inference, and reflective judgment, all of which represent essential dimensions of critical thinking. Consequently, improvements in critical thinking appear to have emerged not from technology alone but from the intellectual demands created by project-based inquiry and iterative writing. The integration of AI-assisted writing support within project-based digital storytelling deserves particular attention. Existing debates frequently portray AI either as a threat to authentic learning or as a solution to educational challenges. The present investigation suggests a more balanced perspective. When instructional activities require learners to question, evaluate, modify, and justify AI-generated suggestions rather than merely

accept them, technology becomes a catalyst for deeper engagement rather than a substitute for independent thinking. Under these conditions, AI-assisted feedback functions as an additional learning resource that complements teacher guidance and peer collaboration while preserving learners' ownership of their written work.

The students' perceptions further reinforce this interpretation. Positive attitudes toward the instructional approach indicate that learners regarded the integration of project-based activities, digital storytelling, and AI-assisted writing tools as engaging, motivating, and supportive of their writing development. Students' willingness to participate actively in collaborative projects and their confidence in revising and improving their written work suggest that the intervention influenced not only measurable learning outcomes but also important affective dimensions of language learning. At the same time, the challenges reported by some learners highlight the continuing need for structured teacher support, careful monitoring, and responsible classroom integration of AI-assisted technologies. These observations emphasize that successful implementation depends on pedagogical design rather than on technological availability alone. The present findings correspond closely with earlier research demonstrating the educational value of project-based learning and digital storytelling in language education. Previous investigations have consistently reported improvements in learner engagement, writing quality, narrative competence, and collaborative learning through project-oriented instructional practices. Similarly, recent studies examining AI-assisted writing environments have highlighted the potential of intelligent feedback systems to facilitate revision, language accuracy, writing quality, and learner autonomy when integrated within well-designed instructional contexts. The current study extends this body of knowledge by demonstrating the educational potential of combining these approaches within a single instructional framework for middle-school ESL learners. Instead of examining project-based learning, digital storytelling, or AI-assisted writing

independently, the study illustrates how their pedagogical integration can simultaneously promote academic writing performance and higher-order thinking.

Several distinctive contributions emerge from this investigation. First, the study shifts attention from higher education, where most AI-assisted writing research has been conducted, to the comparatively underexplored context of middle-school ESL classrooms. Second, it conceptualizes AI as an instructional scaffold embedded within authentic project-based learning rather than as an autonomous writing system. Third, it demonstrates that meaningful improvements in writing and critical thinking are more likely to occur when technological support is combined with purposeful classroom interaction, teacher facilitation, collaborative inquiry, and continuous revision. These contributions broaden current understanding of technology-supported language learning and provide practical guidance for teachers seeking to integrate AI responsibly within writing instruction. Although the findings provide encouraging evidence, they should be interpreted within the context of the study's delimitations. The investigation was conducted with a relatively small sample drawn from a single educational institution over an eight-week intervention period. Consequently, caution should be exercised when generalizing the findings to different educational settings, age groups, or instructional contexts. Future investigations may involve larger and more diverse samples, extended intervention periods, multiple educational institutions, and additional learning outcomes such as creativity, self-regulated learning, collaborative competence, and digital literacy. Comparative studies examining different AI-supported instructional models may also contribute to a more comprehensive understanding of technology-enhanced writing pedagogy.

Overall, the study provides evidence that AI-assisted Project-Based Digital Storytelling represents a promising instructional approach for contemporary ESL classrooms. By integrating authentic projects, narrative construction,

reflective revision, collaborative learning, and AI-supported writing assistance within a coherent pedagogical framework, the approach has the potential to strengthen both academic writing performance and critical thinking while fostering greater learner engagement, confidence, and ownership of the writing process.

5. Conclusion

The present investigation demonstrates that meaningful improvements in language learning emerge when instructional innovation is grounded in sound pedagogy rather than in technology alone. By integrating project-based learning, digital storytelling, and AI-assisted writing support within a coherent instructional framework, the study created authentic learning experiences that encouraged Grade 8 ESL learners to engage actively in planning, composing, revising, and presenting written texts. Throughout the intervention, students assumed greater responsibility for constructing knowledge, evaluating ideas, and refining their written communication, thereby transforming writing from a routine classroom activity into a purposeful process of inquiry, reflection, and expression. The instructional approach addressed two closely related educational objectives. First, it strengthened learners' academic writing by providing continuous opportunities to organize ideas logically, develop coherent narratives, expand vocabulary, improve grammatical accuracy, and revise written work through iterative feedback. Second, it fostered critical thinking by engaging learners in analysis, interpretation, evaluation, problem solving, and evidence-based decision-making during every stage of project development. These complementary outcomes suggest that effective writing instruction extends beyond linguistic competence and requires learning environments that cultivate intellectual engagement alongside language development. A noteworthy contribution of the study lies in its pedagogical interpretation of AI-assisted writing technologies. Rather than functioning as mechanisms for generating completed texts, AI-supported tools were integrated as instructional resources that

facilitated brainstorming, language refinement, drafting, revision, and reflective evaluation under continuous teacher guidance. Learners remained responsible for examining suggestions, making informed decisions, and producing their own written work. This instructional orientation demonstrates that educational technologies achieve their greatest value when they enhance learners' cognitive engagement instead of replacing independent thinking and creative effort.

The findings further indicate that project-based digital storytelling offers an authentic context in which language learning becomes personally meaningful, socially interactive, and intellectually challenging. Through collaborative inquiry, narrative construction, visual communication, and iterative revision, students developed greater confidence in expressing ideas while simultaneously strengthening higher-order thinking. Positive learner perceptions regarding motivation, engagement, and confidence further reinforce the educational significance of creating classrooms where writing serves as a vehicle for exploration, communication, and reflective learning rather than merely as an assessment task. From a practical perspective, the study offers valuable implications for English language teachers, school administrators, curriculum designers, and educational policymakers. Classroom instruction should increasingly emphasize authentic project-based writing experiences that encourage learners to investigate real-world themes, construct meaningful narratives, collaborate with peers, and revise their work through structured feedback. The responsible integration of AI-assisted writing tools should be guided by clear pedagogical objectives, ethical classroom practices, and continuous teacher facilitation to ensure that technology supports rather than diminishes learner autonomy. Professional development programmes should also prepare teachers to integrate emerging instructional technologies effectively while preserving the central role of critical inquiry, creativity, and independent reasoning within language education.

Although the study contributes meaningful evidence regarding the effectiveness of AI-assisted Project-Based Digital Storytelling, its findings should be interpreted within the context of its delimitations. The investigation was conducted with Grade 8 ESL learners from a single educational institution over an eight-week intervention period. Future research may extend this work by involving larger and more diverse participant groups, longer instructional interventions, multiple educational settings, and additional learning outcomes such as creativity, collaborative competence, self-regulated learning, digital literacy, and long-term writing development. Comparative investigations examining different pedagogical models and AI-supported instructional strategies would further enrich contemporary understanding of technology-enhanced language education. In conclusion, AI-assisted Project-Based Digital Storytelling represents a pedagogically meaningful approach to contemporary ESL writing instruction. Its educational value lies not in the presence of advanced technologies but in the thoughtful integration of authentic projects, reflective writing, collaborative learning, and guided technological support within a learner-centered instructional environment. By promoting both academic writing performance and critical thinking, the approach responds to the evolving educational demands of twenty-first-century language classrooms and offers a practical framework for developing competent, reflective, and confident writers who are prepared to participate effectively in increasingly complex academic and digital communication contexts.

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