



The Implementation of STEM Approach on English Learning in Students Writing Activities at SMP Negeri 12 Gorontalo (*Penerapan Pendekatan STEM dalam Pembelajaran Bahasa Inggris pada Kegiatan Menulis Siswa di SMP Negeri 12 Gorontalo*)

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Article Info	Abstract
Article history: Received: 24 Agustus 2026 Revised: 28 September 2026 Accepted: 29 September 2026 Keywords: STEM English Writing Instruction Student Engagement Writing Development Project-Based Learning Kata Kunci: STEM Pembelajaran menulis bahasa Inggris Keterlibatan Siswa Pengembangan Kemampuan Menulis Pembelajaran Berbasis Proyek	The integration of Science, Technology, Engineering, and Mathematics (STEM) into English language instruction has emerged as an innovative approach to support meaningful learning experiences and enhance students' writing development. This study aimed to explore the implementation of STEM-based English writing instruction and examine its contribution to students' engagement and writing development at SMP Negeri 12 Gorontalo. Employing a descriptive qualitative design, the study involved one English teacher and twenty-six eighth-grade students. Data were collected through classroom observations, semi-structured interviews, and documentation of students' written products. The findings revealed that STEM was implemented through a series of interconnected learning activities, including direct observation, technology-assisted learning, collaborative project construction, descriptive writing tasks, revision activities, and reflective presentations. The integration of STEM elements facilitated students' active participation throughout the learning process and promoted behavioral, emotional, and cognitive engagement. Furthermore, STEM-based activities supported students' writing development by providing authentic learning experiences that enabled them to generate ideas, organize information, expand vocabulary use, and produce contextualized descriptive texts. The findings also indicated that project-based STEM activities fostered creativity, collaboration, and problem-solving skills, which contributed positively to the quality of students' written products. Although some students continued to experience difficulties related to grammar and language accuracy, most were able to communicate ideas effectively and produce writing that reflected their observation and project experiences. These findings suggest that STEM-based English writing instruction offers a meaningful pedagogical framework for enhancing student engagement and supporting writing development through contextual, collaborative, and project-oriented learning experiences. Abstrak <i>Integrasi Science, Technology, Engineering, dan Mathematics (STEM) dalam pembelajaran bahasa Inggris semakin memperoleh perhatian sebagai pendekatan inovatif yang mampu menciptakan pengalaman belajar yang bermakna sekaligus mendukung pengembangan kemampuan menulis siswa. Penelitian ini bertujuan untuk mengeksplorasi implementasi pembelajaran menulis bahasa Inggris berbasis STEM serta mengkaji kontribusinya terhadap keterlibatan dan perkembangan kemampuan menulis siswa di SMP Negeri 12 Gorontalo. Penelitian ini menggunakan desain deskriptif kualitatif dengan melibatkan satu guru bahasa Inggris dan dua puluh enam siswa kelas VIII. Hasil penelitian menunjukkan bahwa pendekatan STEM</i>

diimplementasikan melalui serangkaian aktivitas pembelajaran yang saling terintegrasi, meliputi observasi langsung, pemanfaatan teknologi pembelajaran, konstruksi proyek kolaboratif, kegiatan menulis deskriptif, revisi tulisan, dan presentasi reflektif. Integrasi unsur STEM mendorong partisipasi aktif siswa selama proses pembelajaran dan memfasilitasi berkembangnya keterlibatan perilaku, emosional, dan kognitif. Selain itu, aktivitas berbasis STEM mendukung perkembangan kemampuan menulis siswa melalui pengalaman belajar autentik yang membantu mereka menghasilkan ide, mengorganisasi informasi, memperkaya penggunaan kosakata, serta menyusun teks deskriptif yang kontekstual. Temuan penelitian juga menunjukkan bahwa aktivitas proyek berbasis STEM mampu mengembangkan kreativitas, kolaborasi, dan keterampilan pemecahan masalah yang berkontribusi terhadap kualitas produk tulisan siswa. Meskipun sebagian siswa masih mengalami kesulitan pada aspek tata bahasa dan ketepatan penggunaan bahasa, sebagian besar mampu mengomunikasikan gagasan secara efektif dan menghasilkan tulisan yang merefleksikan pengalaman observasi serta proyek yang mereka lakukan. Temuan ini menunjukkan bahwa pembelajaran menulis bahasa Inggris berbasis STEM merupakan kerangka pedagogis yang potensial untuk meningkatkan keterlibatan siswa sekaligus mendukung perkembangan kemampuan menulis melalui pengalaman belajar yang kontekstual, kolaboratif, dan berorientasi proyek.

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1. INTRODUCTION

In the era of globalization and rapid technological development, English proficiency has transformed from merely an academic requirement into an essential competence that determines individual competitiveness in the international arena (Hasanova & Abdullayeva, 2025). At the junior high school (SMP) level, English learning should ideally include the integrated development of the four language skills, with an emphasis on writing as a complex and strategic productive skill. Writing skills, particularly descriptive texts, require students to be able to express ideas coherently, choose appropriate vocabulary, and construct logical and communicative text structures.

The reality in the field, particularly at SMP Negeri 12 Gorontalo, shows a significant gap between curricular expectations and the actual conditions of the learning process. Based on preliminary observations, the English learning process is still dominated by teacher-centred methods in which students tend to be passive and less actively engaged. Most students are not yet able to write simple paragraphs coherently; their writing often lacks logical sequence, depends heavily on teacher examples, and consists only of isolated words without forming proper paragraphs. Furthermore, preliminary data indicate that 56% of students stated that the learning process felt monotonous because it focused only on memorization and repetitive exercises (Andriani et al., 2024). This condition indicates the absence of opportunities for students to create, experiment, and use language in real contexts.

The research gap identified in this study is multilayered. First, studies on the implementation of the STEM approach in English language learning are still very limited, as most previous research has focused primarily on science or mathematics subjects. Second, studies that specifically analyze the quality of students' writing as the main data source, rather than merely perceptions or general test results, are still rarely found. Third, the implementation of the STEM approach at the junior high school (SMP) level in Indonesia—particularly in the Gorontalo region—has not been widely explored, thus requiring an in-depth empirical description of how this approach can be implemented and responded to by students within that specific context (Aprianty et al., 2020).

The STEM (Science, Technology, Engineering, and Mathematics) approach offers an alternative form of learning that is integrative, contextual, and oriented toward solving real-world problems. In the context of English writing instruction, STEM can bridge the gap between abstract linguistic exercises and meaningful language use through project-based activities (Bybee, 2013; Hsu et al., 2025). This relevance is

further strengthened by the principles of the Merdeka Curriculum, which promotes active, collaborative, creative, and experience-based learning. Therefore, this study is important both theoretically and practically: theoretically, the findings enrich the literature on the integration of STEM in language education; practically, this study provides empirical guidance for teachers in designing more creative and effective writing instruction (Mohsen et al., 2025).

This study aims to describe the implementation of the STEM approach in teaching English descriptive writing and the writing performance of eighth-grade students at SMP Negeri 12 Gorontalo after the implementation of STEM-based learning. The novelty of this study lies in its focus on (1) an in-depth description of the mechanism for integrating STEM elements into the writing learning cycle, (2) students' engagement in three dimensions (behavioral, emotional, and cognitive), and (3) the analysis of students' authentic written work as a learning product—not merely as a perception instrument—within the context of EFL at the junior high school (SMP) level in a region that has not been widely studied.

2. METHODS

This study employed a descriptive qualitative research design to explore the implementation of STEM-based English writing instruction and its contribution to students' engagement and writing development at SMP Negeri 12 Gorontalo. A qualitative approach was selected because it enables researchers to obtain an in-depth understanding of classroom practices, participants' experiences, and the learning processes that occur within natural educational settings. Rather than focusing on numerical measurement, this approach emphasizes the interpretation of phenomena as they occur in real-life contexts.

The study was conducted at SMP Negeri 12 Gorontalo and involved one English teacher and twenty-six eighth-grade students who participated in STEM-based writing instruction. The participants were selected because they were directly involved in the implementation of the learning activities under investigation. The teacher served as the primary source of information regarding instructional planning, classroom implementation, and perceived challenges, while the students provided insights into their learning experiences and engagement throughout the instructional process.

Data were collected through classroom observation, semi-structured interviews, and documentation. Classroom observations were conducted to examine the implementation of STEM-based writing instruction, students' participation during learning activities, and the integration of STEM elements into writing tasks. Semi-structured interviews were administered to one English teacher and six students who voluntarily agreed to participate in the interview sessions. The interview protocol was adapted from previous studies conducted by (Corbita 2025; Iryani & Suryadi 2025; Nisa, 2024). Focusing on STEM implementation, project-based learning, student engagement, technology integration, and writing development. In addition, documentation in the form of lesson plans, student worksheets, photographs of learning activities, and students' written products was collected to support the observation and interview findings.

The collected data were analyzed using the interactive model proposed by Miles et al. (1996) which consists of data reduction, data display, and conclusion drawing and verification. During the data reduction stage, observation notes, interview transcripts, and students' written products were reviewed and categorized according to themes related to STEM implementation, student engagement, and writing development (Shahab & Rahmaniah, 2026). The reduced data were subsequently organized into descriptive narratives to facilitate interpretation. Finally, conclusions were drawn through continuous comparison and verification of findings obtained from multiple data sources. To enhance the trustworthiness of the study, triangulation of data sources and techniques was applied by comparing information derived from observations, interviews, and documentation (Chand, 2025).

3. RESULT AND DISCUSSION

3.1 The Implementation of STEM-Based Writing Activities

The classroom observation revealed that the implementation of STEM-based writing instruction at SMP Negeri 12 Gorontalo was systematically designed through the integration of Science, Technology, Engineering, and Mathematics elements within English writing activities. The lesson focused on descriptive writing under the topic *"My School and My Classroom"* and was organized using a project-based learning framework. Prior to the instructional activities, the teacher prepared lesson plans, student worksheets, visual learning resources, observation sheets, and project materials to support the implementation of STEM-integrated learning.

The preparation stage played an important role in establishing meaningful connections between writing instruction and authentic learning experiences. Rather than introducing descriptive writing solely through textbook explanations, the teacher designed activities that encouraged students to observe real objects within their school environment, discuss their observations collaboratively, construct miniature

models, and transform these experiences into written texts. This instructional design allowed students to engage with concrete learning contexts before entering the writing stage.

The findings further indicated that the integration of STEM elements was evident throughout the learning process. The Science component was reflected in students' observation of facilities, objects, and spatial arrangements within the school environment. Technology was incorporated through the use of LCD projectors and visual learning materials that provided contextual references for students before writing. Engineering emerged during the design and construction of miniature school models, while Mathematics was represented through measurement activities, object positioning, and the organization of spatial relationships during project development.

To facilitate the implementation of STEM-based writing instruction, the teacher organized the learning process into several interconnected stages, as presented in Table 1.

Table 1. Implementation of STEM Approach in English Writing Instruction

Learning Stage	Teacher's Activities	Students' Activities	STEM Elements
Pre-Writing Stage	Activating prior knowledge, showing pictures using LCD projector, giving guiding questions	Responding to questions, recalling vocabulary, observing visual media	Science (observation), Technology (LCD projector)
	Observation Stage Assigning observation tasks, guiding group discussion and observation activities	Observing school environment, identifying objects and locations, listing vocabulary	Science, Mathematics
Main-Writing Stage	Guiding students in drafting descriptive texts and organizing ideas Project Work Stage Instructing students to create school miniatures, guiding project completion	Writing descriptive texts based on observation and project activities Designing layouts, measuring object positions, building miniatures collaboratively	Science, Engineering, Language integration Engineering, Mathematics
Closing-Writing Stage	Providing feedback, guiding revision, evaluating students' writing	Revising writing, correcting vocabulary and grammar errors, reflecting on learning activities	Technology, Language integration

The observation findings demonstrate that writing instruction was not treated as an isolated language activity. Instead, students experienced writing as a process closely connected to observation, inquiry, project construction, and reflection. Such learning experiences correspond with Bybee (2013) perspective that STEM education should promote interdisciplinary learning through authentic problem-solving situations. Through observation and project construction, students were encouraged to apply knowledge from multiple domains while simultaneously developing language skills.

Another noteworthy aspect of the implementation was the use of visual and technological resources to support learning. The teacher utilized projected images of school facilities and classroom environments before students conducted direct observations. These visual stimuli helped students identify relevant vocabulary, recognize object characteristics, and establish contextual understanding of the writing topic. During classroom observation, students appeared more attentive and responsive when visual materials were introduced, suggesting that technology served as an effective scaffold during the pre-writing stage.

The integration of technology within language instruction aligns with previous studies highlighting the role of visual media in supporting vocabulary acquisition and idea generation. Visual representations provide learners with concrete references that facilitate comprehension and reduce cognitive demands during writing preparation. Consequently, students can devote greater attention to organizing ideas and expressing meaning in written form.

Beyond technological integration, the implementation emphasized collaborative learning as a central instructional strategy. Students worked in small groups to conduct observations, exchange information, discuss findings, construct projects, and prepare descriptive texts. This collaborative structure encouraged students to negotiate meaning, share vocabulary knowledge, and support one another throughout the learning process.

The findings suggest that STEM-based writing instruction created an interdisciplinary and student-centered learning environment in which writing activities were meaningfully connected to authentic experiences. Rather than merely learning how to write descriptive texts, students actively observed, discussed, constructed, and reflected upon real-world phenomena before transforming their experiences into written communication.

3.2 Student Engagement in STEM-Based Writing Activities

Student engagement emerged as one of the most prominent findings throughout the implementation of STEM-based writing instruction. Classroom observation indicated that students demonstrated behavioral, emotional, and cognitive engagement during various stages of learning, including observation activities, group discussions, project construction, brainstorming sessions, writing tasks, and classroom presentations.

Behavioral engagement was reflected in students' active participation during classroom activities. Students followed instructions, completed observation tasks, contributed to group discussions, and participated in project construction activities. Rather than remaining passive recipients of information, students assumed responsibility for identifying objects, recording information, listing vocabulary, and organizing ideas for writing. The collaborative nature of the activities required students to contribute actively to the completion of shared tasks.

During observation activities, students interacted frequently with their peers while identifying school facilities and discussing object locations. Similarly, during project construction, group members negotiated responsibilities, shared materials, and collaborated in arranging miniature components. These interactions created opportunities for sustained participation throughout the learning process and encouraged students to remain actively involved in achieving collective learning goals.

Emotional engagement was equally evident during classroom observation. Students appeared enthusiastic while observing the school environment, discussing project ideas, and constructing miniature models. The learning atmosphere was characterized by frequent interaction, visible enthusiasm, and collaborative problem-solving. Many students appeared motivated to complete their projects successfully and expressed enjoyment while participating in group activities.

The integration of practical and creative tasks appeared to contribute significantly to students' positive attitudes toward learning. Unlike conventional writing activities that often emphasize individual work and textbook exercises, STEM-based learning provided opportunities for exploration, creativity, and hands-on engagement. As a result, students demonstrated curiosity and persistence when encountering challenges during project completion.

These observations support the argument proposed by Kahu (2013) who emphasized that meaningful and relevant learning experiences are closely associated with higher levels of student engagement. When students perceive learning activities as purposeful and connected to real-life contexts, they are more likely to invest effort and sustain participation throughout the learning process.

Cognitive engagement was demonstrated through students' active thinking processes during observation, project development, and writing activities. Students were required to observe their environment carefully, analyze information, identify relevant vocabulary, organize ideas, and transform observations into descriptive texts. During brainstorming sessions, students discussed observations, exchanged perspectives, and selected information that would later be incorporated into their writing.

The observation further revealed that students engaged in higher-order thinking processes while constructing miniature models. They evaluated alternative designs, discussed object placement, considered spatial relationships, and made collective decisions regarding project completion. These activities required students to analyze information and solve problems collaboratively before communicating their ideas through writing.

The findings resonate with the engagement framework proposed by Fredricks et al. (2004) which conceptualizes engagement as a multidimensional construct consisting of behavioral, emotional, and cognitive dimensions. The STEM-based activities observed in this study appeared to foster all three dimensions simultaneously through authentic, collaborative, and project-oriented learning experiences.

Taken together, the findings indicate that STEM-based writing instruction contributed not only to language learning but also to the development of active participation, motivation, collaboration, and critical thinking. These forms of engagement created favorable conditions for writing development and enhanced students' involvement throughout the instructional process.

3.3 Writing Development, Problem-Solving Skills, and Creativity

According to Harrison and Parks (2016) the findings demonstrated that STEM-based learning supported students' writing development by providing meaningful experiences that facilitated idea generation, content organization, and contextualized writing. The writing process observed in this study consisted of several interconnected stages, including observation, brainstorming, project construction, drafting, revising, and presentation.

The observation stage served as a critical foundation for writing development. Students explored the school environment, identified relevant objects, and recorded important information regarding locations, facilities, and spatial relationships. These observations provided concrete references that later became the basis of their descriptive texts. Consequently, students relied on direct experiences rather than imagination alone when developing written content.

Following observation activities, students participated in brainstorming sessions and collaborative discussions. During these interactions, students exchanged ideas, clarified observations, identified relevant vocabulary, and organized information before drafting their texts. The brainstorming process enabled students to structure their thoughts systematically and prepare content for writing.

Project construction further enriched the writing process. Students worked collaboratively to design and build miniature representations of the school environment using simple materials. These projects functioned as visual representations that supported students' understanding of object locations and spatial relationships. By interacting with their miniature models, students gained additional references that facilitated more detailed and accurate descriptions in their writing.

The drafting stage revealed that students frequently referred to observation notes, vocabulary lists, and project outputs while composing their texts. This relationship between hands-on experiences and written production suggests that STEM-based activities provided valuable support for idea generation and content development.

In addition to writing development, the findings revealed evidence of problem-solving skills throughout the learning process. During project construction, students encountered challenges related to design decisions, object placement, and material organization. To overcome these challenges, students discussed alternatives, evaluated possible solutions, and reached collective decisions regarding project completion.

Problem-solving was also evident during writing activities. Some students experienced difficulties related to vocabulary selection, sentence construction, and idea organization. Rather than abandoning their tasks, students sought assistance from peers and teachers, demonstrating persistence and collaborative problem-solving behaviors. These interactions enabled students to address challenges while maintaining engagement in learning activities.

Creativity emerged as another significant outcome of STEM-based learning. Although students observed the same school environment, each group produced distinct miniature designs and visual arrangements. Differences were evident in object placement, layout organization, and the representation of school facilities. These variations reflected students' ability to interpret and represent their observations creatively.

Creativity was also visible in students' written products. While students collaborated during observation and project construction, individual writing tasks reflected personal interpretations, vocabulary choices, and descriptive styles. Students selected information they considered relevant and organized descriptions according to their own perspectives.

The quality of students' writing products further supports the positive contribution of STEM-based learning to writing development. The distribution of students' writing scores is presented in Table 2.

Table 2. Students' Writing Task Scores

Score Range	Category	Number of Students
86 – 100	Very Good	4
76 – 85	Good	9
66 – 75	Fair	10
≤ 65	Poor	3
Total		26 Students

The results indicate that most students achieved satisfactory performance in descriptive writing. The strongest aspects of students' writing were content development and idea organization. Most students successfully described school facilities, classroom environments, and object locations in ways that reflected their observations and project experiences.

Nevertheless, several challenges remained evident. Some students experienced difficulties related to grammar, vocabulary usage, spelling, and sentence structure. Errors involving word forms and prepositions occasionally appeared in students' texts. Despite these linguistic limitations, most students were still able to communicate ideas effectively and maintain relevance to the assigned topic.

These findings suggest that STEM-based learning contributed substantially to content generation and organizational aspects of writing while simultaneously highlighting areas requiring continued language support. Writing development appeared to emerge from the integration of observation, collaboration, project work, and reflection rather than from isolated language exercises alone.

3.4 Teacher and Student Perspectives on STEM-Based Writing Activities

The interview findings provided additional insights into how STEM-based writing instruction was perceived by both the teacher and students. Overall, the interview data revealed positive perceptions regarding the implementation of STEM activities and their contribution to student learning.

The teacher demonstrated a clear understanding of STEM as an interdisciplinary approach that integrates Science, Technology, Engineering, and Mathematics into meaningful learning experiences.

According to the teacher, STEM-based learning provided opportunities for students to engage actively with learning materials while developing language skills through authentic activities. The teacher emphasized that observation activities, project construction, and collaborative learning enabled students to generate ideas more easily than traditional writing exercises.

From the teacher's perspective, one of the major advantages of STEM-based learning was its ability to increase student participation. Students who were usually reluctant to contribute during conventional writing lessons became more actively involved when learning activities included observation and project-based tasks. The teacher also noted that STEM activities encouraged collaboration, communication, and creativity among students.

Student interviews produced similar findings. Most students reported that observing the school environment and constructing miniature projects helped them generate ideas for writing. They indicated that direct observation made it easier to describe objects, locations, and facilities because they had concrete references available during the writing process.

Several students also highlighted the importance of group discussions in supporting vocabulary development and idea organization. Through collaboration, students exchanged information, clarified observations, and learned from their peers. This interaction reduced anxiety and increased confidence during writing activities.

Despite these positive experiences, some students acknowledged difficulties related to grammar and vocabulary. Although observation and project work helped generate ideas, certain students still struggled to express those ideas accurately in English. These responses are consistent with the writing assessment findings, which indicated stronger performance in content development than in linguistic accuracy.

Overall, the interview findings complement the observation data by illustrating how both teachers and students perceived STEM-based learning as a meaningful and engaging approach to writing instruction. The combination of observation, project work, collaboration, and reflection appeared to provide a supportive environment in which students could develop ideas, participate actively, and engage more confidently in writing activities.

4. CONCLUSION AND SUGGESTIONS/RECOMMENDATIONS

4.1 Conclusion

The findings demonstrate that STEM-based writing activities were successfully implemented in English writing instruction at SMP Negeri 12 Gorontalo through the integration of Science, Technology, Engineering, and Mathematics within project-based learning activities. The learning process involved observation, collaborative discussion, project construction, drafting, revision, and presentation, providing students with authentic and contextualized learning experiences.

The implementation of STEM-based activities supported students' behavioral, emotional, and cognitive engagement throughout the learning process. Students actively participated in classroom activities, demonstrated enthusiasm toward learning tasks, and engaged in meaningful problem-solving processes while developing their writing.

The analysis of students' writing products revealed generally satisfactory outcomes, particularly in content development and idea organization. STEM-based activities provided concrete experiences that facilitated idea generation and enabled students to produce descriptive texts grounded in real observations. Although challenges related to grammar, vocabulary, and sentence structure remained evident, students were generally able to communicate ideas effectively and produce relevant written texts.

These findings suggest that STEM-based writing instruction offers a meaningful approach to supporting student engagement and writing development by connecting language learning with authentic, collaborative, and project-oriented experiences.

4.2 Suggestions/Recommendations

Teachers are encouraged to integrate STEM-based activities into English writing instruction to provide students with meaningful contexts for language use and idea development. Future researchers may further investigate STEM-based writing instruction across different educational levels, writing genres, and learning contexts to enrich understanding of its implementation and potential contributions to language learning.

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