



International Journal of Language Studies

ISSN: 3078-2244 (Online)

2026, Vol. 3, No. 3, pp. 189–217

DOI: <https://doi.org/10.60087/ijls.vol3.n3.013>

Journal homepage: <https://ijlangstudies.org>



Investigating the Effects of the STEAM Approach on English Test Scores and Learning Experiences of Grade 5 Students at BVT School

Bui Phuong Anh 

Ho Chi Minh City University of Industry and Trade, Viet Nam

*Corresponding author: full name — e-mail: buiphuonganh1585@gmail.com

Abstract

This study investigates the impact of the Science, Technology, Engineering, Arts, and Mathematics (STEAM) approach on Grade 5 Vietnamese students' English achievement and learning experiences compared to the traditional Present-Practice-Produce (PPP) method. Employing a convergent mixed-methods quasi-experimental design, the research involved 91 students divided into an experimental group (STEAM) and a control group (PPP). Quantitative data were collected through pre-tests and post-tests measuring overall English proficiency, while qualitative insights were gathered via semi-structured interviews with the experimental cohort. Quantitative results indicated that both groups achieved statistically significant longitudinal score improvements; however, there was no significant difference in the growth trajectories between the two instructional methods, meaning the STEAM approach did not outperform the PPP method in immediate academic gains. Conversely, qualitative findings demonstrated that STEAM instruction significantly enhanced student engagement, motivation, peer collaboration, and perceived authentic language use through hands-on, real-world projects. In conclusion, while the STEAM approach may not yield superior immediate cognitive test outcomes compared to traditional instruction, it effectively cultivates essential non-cognitive competencies and positive affective attitudes that support long-term language development.

Keywords: *STEAM education; PPP method; English language learning; student engagement; primary school students*

Article information: Received: 05/06/2026;

Accepted: 18/08/2026;

Published: 25/09/2026

Copyright © 2026 The Author(s). Published by the International Journal of Language Studies. This is an open-access article distributed under the Creative Commons Attribution 4.0 International License (CC BY 4.0).

1. Introduction

1.1 Rationale of the Study

In Southeast Asia, English language education has become a priority as countries strive to improve global competitiveness and prepare citizens for a world that demands multilingual communication. In particular, English is a key tool for enhancing regional integration, economic growth, and access to global knowledge. For countries in the ASEAN region, English proficiency is considered a vital skill for success in both academic and professional contexts

(Fadhil et al., 2025, Truong & Wang, 2019). As a result, many Southeast Asian nations have made English a compulsory subject in their primary school curricula. This trend is particularly noticeable in countries such as Singapore, Malaysia, Thailand, and the Philippines, where English is taught early, and a significant emphasis is placed on developing communicative competence (Emilia et al., 2011).

The integration of English language education, particularly at the primary school level, offers numerous advantages. First, early English education equips students with the necessary skills to communicate globally and access information from various sources. This can help individuals in countries like Singapore and Malaysia advance their careers and better participate in the global economy (He & Ling, 2024). Furthermore, English proficiency is linked to broader educational outcomes, such as improved cognitive skills and better problem-solving abilities, which are crucial for student's future academic success (Andleeb et al., 2023). Additionally, English is seen as a bridge language for regional cooperation in ASEAN, allowing diverse linguistic communities to communicate and collaborate effectively.

However, despite the widespread implementation of English education in the region, significant challenges are associated with teaching English at the primary school level. One of the primary issues is the disparity in resources between urban and rural areas. Many rural schools in Vietnam struggle with a shortage of qualified English teachers and inadequate teaching materials (Do et al., 2022). In addition, the lack of adequate teacher training in many areas further exacerbates the problem, leaving teachers ill-equipped to meet the needs of their students (Do et al., 2022).

Furthermore, many primary school English programs in the region have been criticized for placing too much emphasis on grammar and memorization rather than on practical, communicative language use (Truong et al., 2022). This results in a situation where students may excel in exams but struggle with real-world communication, which diminishes the overall effectiveness of English education (Zein, 2022). Additionally, cultural and linguistic barriers often make it difficult for students to connect with English as a second language, particularly in countries where English is not widely spoken outside the classroom (Zein, 2022).

In Vietnam, the situation is no different. Although the Vietnamese government has made significant strides in promoting English language education through policies such as the National Foreign Language Project, many students in rural areas still face challenges in accessing quality English instruction (Do et al., 2022). Also, Vu (2024) highlights the shortage of qualified and well-trained primary teachers in rural areas. Bui (2025) compares learning engagement, classroom interaction, and academic achievement between urban and rural primary school students learning English in Vietnam and finds significant disparities between the two groups. Rural students show lower proficiency and participation levels, often due to insufficient exposure to English, limited technological support, and teachers' heavy workloads. Traditional teaching methods, which are often used in rural areas and which heavily focused on rote learning, dominate the education system, leading to student disengagement (Zein, 2022). As a result, there is a pressing need to explore alternative teaching methods that could address these challenges and enhance student engagement.

One such approach is the STEAM method, which integrates Science, Technology, Engineering, Arts, and Mathematics into the learning process. The STEAM method encourages active, project-based learning and has been shown to promote creativity, critical thinking, and problem-solving skills (Mustoip et al., 2024; Arifudin et al., 2025). By incorporating English with other subjects, the STEAM approach offers a more engaging and interdisciplinary way to teach the language, which could help address some of the issues related to student motivation and learning outcomes in Vietnam.

In Vietnamese primary schools, the adoption of STEAM is hindered by significant constraints. First, the STEAM method is still new, and few schools have sufficient resources to apply this method. For example, at BVT school, serving approximately 900 students across five grades with six classes per grade (each with around 30 students), English instruction lasts eight 35-minute periods per week, following a curriculum focused on listening, speaking, reading, and writing skills. While the school is equipped with basic facilities, including televisions in regular classrooms, two dedicated English rooms with interactive whiteboards and projectors, a computer lab, a spacious library, a playground, and a garden with diverse plants, it lacks a specialized science laboratory essential for STEAM's hands-on, experimental activities. Furthermore, the school's six English teachers, each holding teaching certifications and bachelor's degrees with at least five years of experience, are responsible for teaching an average of six classes across two grades, resulting in a high teaching workload.

Furthermore, none of these teachers has received training in innovative methodologies like STEAM, and the method has yet to be applied in English lessons at the school. Consequently, the school relies on the traditional Presentation-Practice-Production (PPP) method, which involves teacher-led presentation of language items, controlled practice, and limited free production. While resource-efficient and aligned with the school's curriculum demands, this approach often emphasizes memorization over creativity, potentially contributing to student disengagement despite relatively high average English scores of 8/10 or above.

1.2 Purpose of the Study

This study investigates how the STEAM approach influences Grade 5 Vietnamese primary school students' English achievement and their experiences of learning English through STEAM-based instruction.

1.3 Research Questions

The research will address the following questions:

Research question 1: To what extent does the STEAM approach improve participants' English scores compared to the PPP method?

Research question 2: How do participants experience learning English through the STEAM approach?

1.4 Significance of the Study

This study is significant because it investigates an innovative teaching approach that could address the challenges currently faced in English language education in Vietnam. By focusing

on the STEAM method, the research provides insights into how an interdisciplinary, hands-on teaching method can increase student engagement, foster creativity, and improve language learning outcomes. The findings could inform educators, policymakers, and researchers about the potential benefits of STEAM in language teaching, offering a practical solution to some of the challenges in Vietnam's English education system.

State the problem, context, research gap, objectives or research questions, significance, and the article's contribution. Use A⁴, one column, 2.5 cm margins, Times New Roman 12 pt, and 1.15 line spacing. Check the journal's current author guidelines before submission.

2. Literature Review

2.1 Definitions of Keywords

2.1.1. PPP Method

Richard and Rodgers (2014) defined the PPP as an approach to teaching linguistic structures like grammar and vocabulary in a foreign language. The approach includes three stages: Presentation (where language items are initially offered in context-appropriate situations); Practice (here learners complete manipulative exercises to increase accuracy of use, and drawing from this Production; where they get the chance to use the language more autonomously by means of communicative activities). The PPP has roots in the behaviorist theory and supports the idea that learners will move from the memorization stage to use what they learned; it is helpful for teaching grammar, speaking, and writing (Richards & Rodgers, 2014).

The PPP was widely taught at primary schools in South East Asian countries and proved effective to improve students' learning. For example, Nopiyadi et al. (2023) examined whether applying the PPP method improves vocabulary mastery among Grade 5 students at an Indonesian primary school. The authors reported that students showed improvement in correct pronunciation, spelling, word comprehension, and forming simple sentences correctly. They also became more enthusiastic and engaged in the learning process. Similarly, Kaniadewi and Sriyanto (2018) compared PPP with Task-Based Learning in teaching speaking to young Indonesian learners. The results show that the PPP group had a higher mean score than the TBL group. The PPP method was also effective in enhancing grammar and vocabulary proficiency among high school students in Indonesia (Fikri et al, 2023; Kaur, Febria & Marsevani, 2024; Oryza, Asad & Sorya, 2022).

Even though PPP has these strengths, it also has some weaknesses. Because teachers can introduce target language items in a clear and structured way and reinforce them through repetition and guided practice, this can be helpful for students who are not as good at English. However, people often say that the model is too mechanical and focused on the teacher. Repetitive drills may diminish learner motivation, offer restricted opportunities for creativity, and allocate inadequate time for substantive communication or problem-solving (Richards & Rodgers, 2014). Consequently, students might acquire superficial knowledge of linguistic forms without the capability to apply them effectively in real-world contexts.

Consequently, a transition to the STEAM methodology is warranted in the current study. STEAM, on the other hand, combines Science, Technology, Engineering, Arts, and Mathematics through group projects, questions, and tasks that require students to work together. This kind of approach can give students more chances to use English to communicate while they work on real-world problems, come up with new ideas, make things, and show off their creativity. STEAM activities in language classrooms promote meaningful interaction, critical thinking, teamwork, and learner autonomy, skills that are not as important in the traditional PPP framework. Furthermore, for young learners, practical and interdisciplinary activities can enhance motivation and engagement, rendering language acquisition more pertinent and enjoyable. So, while PPP is still useful for teaching language forms, STEAM may be better for helping students use language in real life and learn 21st-century skills in this setting (Bui & Newton, 2021).

2.1.2. STEAM Method

The STEAM approach is an educational model that integrates Science, Technology, Engineering, Arts, and Mathematics as a transdisciplinary context for learning. This fosters a broad interdisciplinary education with hands-on experience and problem-solving activities stemming from the five working fields. It emphasizes skills like critical thinking, cooperation, and creativity - things learners of the 21st century need.” Internationally, the use of this method has been increasingly popular in several learning contexts to create more stimulating, lively, and practical learning activities towards improving academic achievement as well as promoting students’ creativity and curiosity (Mustoip et al., 2014; Arifudin et al., 2025). Including the arts within a traditional STEM model is intended to provide students with more opportunities for innovative thinking, creative expression, and real-world challenges. This integration allows students to perceive the application value of knowledge in real-life contexts and stimulates them to use it in various places (Mustoip et al., 2024; Arifudin et al., 2025). The STEAM approach, in the context of teaching English as a foreign language, employs complex projects from different fields that students solve using English, providing communication through tasks and motivating them to study the language.

2.1.3. Interest in Learning English

The desire to learn English is students' eagerness, curiosity, and motivation to participate in the English language learning process. It also includes their emotional, cognitive, and structural investment in language learning. As motivation affects effort and persistence in learning a language, it is believed to be an important factor. This research is supported by Li and Xue (2023) and Johansen et al. (2023) argue that teaching strategies influence students’ interest, content relevance in their lives, and the total learning environment.

Research has revealed that students who have intrinsic motivation to learn English are more likely to be interested in participating in class, using English beyond school, and retaining their language knowledge for more extended periods (Yue et al., 1985). The adoption of STEAM values has increased learners’ motivation to learn the English language from the inside, because learning is more interactive and context-embedded. Compared with memorisation-based approaches, which strictly require repetition of formulaic expressions (Guo, 2023), it is suggested that STEAM activities provide students with the use of English in class to facilitate

a variety of practical interactions and make the students more motivated for adequate learning progress.

2.2 Theory of constructivism

This study is grounded in constructivist learning theory (Piaget, 1952; Vygotsky, 1978) and Howard Gardner's Multiple Intelligences (MI) theory (Gardner, 1983). Constructivism posits that learners actively construct knowledge through experiences, exploration, and reflection, rather than passively receiving information. In the classroom, this translates into hands-on, problem-based, and experiential learning, where students engage in activities that promote critical thinking and meaningful understanding. STEAM education embodies these principles, as students integrate Science, Technology, Engineering, Arts, and Mathematics through collaborative projects and real-world problem-solving.

Howard Gardner's MI theory complements constructivism by recognizing that learners have diverse strengths and ways of learning, including linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, intrapersonal, and naturalistic intelligences. Incorporating MI in STEAM activities ensures that teaching strategies align with individual learners' abilities, allowing them to engage fully and construct knowledge in ways that resonate with their natural strengths.

By integrating constructivism and multiple intelligences, this framework supports a learner-centered, active, and inclusive approach. For example, when designing a bridge model, students not only experiment with materials (constructivism) but also apply spatial, logical-mathematical, and interpersonal intelligences, reflecting the interconnected, multi-dimensional nature of STEAM learning. This theoretical foundation guides both the design of instructional activities and the assessment of student learning outcomes, emphasizing engagement, creativity, and deep understanding.

Numerous studies show that applying these theories bring about positive results on students learning. For example, Sung et al. (2023) conducted a STEAM intervention integrating robotics for children aged 5–6; an experimental classroom design comparing groups with and without the STEAM program. The study evaluates outcomes in computational thinking, vocabulary, self-regulation, and social behavior. It provides empirical evidence of the effectiveness of STEAM learning through activity- and experience-based approaches, consistent with Piaget's constructivist framework.

Lu et al. (2022) designed a STEAM course based on project-based learning (PBL), combining traditional art (paper-cutting) with Micro:bit technology. The study shows that the STEAM-PBL approach supports the development of creativity and interdisciplinary understanding, a teaching method clearly grounded in the constructivist idea of learning-by-doing.

Trina et al. (2025) systematic review of tools and frameworks for assessing outdoor learning environments that support STEAM education in early childhood. The study is grounded in cognitive development theories (such as Piaget's) and emphasizes the role of rich, affordance-based environments in helping children "construct" knowledge through interaction.

From the above research, applying the PPP method combined with Steam brings many benefits to 5th grade children at my school. Students have improved their scores a lot, especially speaking skills. Steam brings students enjoyment in learning English at BVT Primary School.

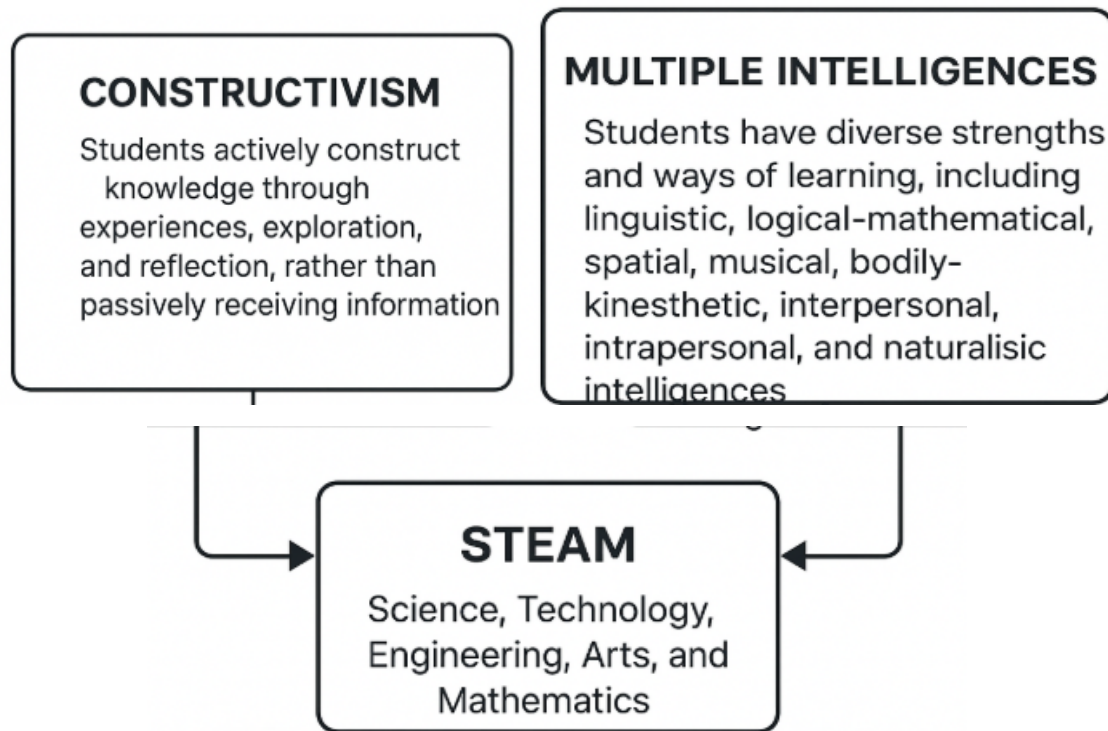


Figure 1. Theoretical framework of the study

2.2. Previous Studies

Integrating STEAM (science, technology, engineering, arts and mathematics) aspects into school curricula has attracted attention across academic studies regarding the potentially positive effects on student engagement and performance. In this part of the paper, we present literature that has examined the use of STEAM across various fields of education, including language learning.

2.2.1. STEAM Education and Student Interest

Research consistently demonstrates that applying the STEAM approach can significantly increase student engagement. Liu et al. (2023), STEAM is a pedagogy of active learning which encourages the students to work on real-life related disputes, and engage in teamwork. This interdisciplinary, hands-on approach has been shown to increase student interest in the curriculum and deeper levels of understanding.

Adding the A in arts: $\text{STEM} + \text{A} = \text{STEAM}$ The incorporation of the Arts in a STEM education model is particularly beneficial for developing creative and problem-solving skills, essential for language acquisition. STEAM education fuses Science, Technology, Engineering, Arts, and Mathematics to create a collaborative learning environment full of excitement and better

engages students. Elvianasti et al. (2024) found that using PBL in combination with student worksheets focused on STEAM and using the ecoprint method greatly increased the motivation and creativity of 150 students. This approach encourages participation as students engage in real activities, like designing and performing ecoprint projects that reflect authentic problem-solving experiences. The study emphasizes that integration of STEAM with PBL develops critical skills such as problem-solving and logical thinking for the students today, which will facilitate them exploring innovative solutions through the ecoprint process.

Additionally, Suryaningsih et al. (2021) found that the application of STEAM-PjBL in chemistry teaching, related to acid-base titration concepts specifically, reported a high level of engagement (with interest at 83.4% and motivation at 84.4%). So that when learning meets real life, students' engagement grows disproportionately larger. These findings suggest that the STEAM approaches help to improve intrinsic motivation and engagement, where learning becomes more relevant and stimulating for learners.

2.2.2. STEAM in Language Learning

Research consistently shows that STEAM drives greater student engagement. Liu et al. (2023) claim that STEAM fosters active learning by enabling students to solve problems found in their world and work on group projects and collaborative projects. This experiential-learning, cross-disciplinary technique generates enhanced student interest in course material and deeper learning. When Arts comes into the picture with STEM, students can develop creativity and problem-solving skills vital for language development.

STEAM education promotes a dynamic and cross-disciplinary learning environment by combining Science, Technology, Engineering, Arts, and Mathematics, significantly enhancing student motivation. Elvianasti et al. (2024) revealed that the combined exposure to PBL with STEAM-based worksheets using the ecoprint technique enhanced motivation and creativity when shared among 150 study participants. This strategy fosters active engagement as students learn the types of hands-on tasks they will complete, generating ecoprint projects corresponding to real-world problem-solving challenges. The findings emphasize that the integration of PBL with STEAM prompts the development of essential abilities to solve problems and think logically in innovative thinking, as learners search for creative problems with ecoprint.

2.2.3. Challenges in Implementing STEAM

Although the importance of STEAM education for interdisciplinary learning is increasingly recognized, its implementation in Vietnam faces many difficulties, particularly those posed by resource-stricken areas. Pham Thi Thanh Hai and Tran Thi Hoai Thu (2025) noted that lack of resources, inadequate training of teachers, and regional disparities, especially between urban and rural contexts, are often some of the barriers against successful implementation of STEAM. In addition, project-based learning has not been fully exploited because of a heavy emphasis on theoretical approaches. Similarly, Hang et al. (2023) have also reported that problems such as the lack of a vertically aligned curriculum, limited teacher support, and high country-wide class sizes in primary schools of Thai Nguyen, Canada Education Province, all reduce teachers' confidence and prevent them from integrating creative, interactive activities. However, despite these challenges, STEAM has high potential for improving critical thinking, problem-solving

skills, and student engagement –contributing to innovation in education as driven by the Vietnam 2018 General Education Program (Pham Thi Thanh Hai and Tran Thi Hoai Thu, 2025; Nguyen Thi Thu Hang et al., 2023). This review highlights the need for targeted strategies to address these challenges and capitalize on the potential of STEAM-based education in Vietnam.

Summary

This chapter reviewed literature exploring English language teaching methods, focusing on the STEAM approach and its impact on student engagement, motivation, and language proficiency. The review also showed how STEAM can facilitate a more interactive learning environment, especially in the case of language education situations. Previous studies have found that STEAM-based learning activities improve students' academic performance and increase their initiative and motivation to learn English. This review provides a background for the present study, aiming to explore the particular influences of STEAM education on English language achievement and student experience in primary school at BVT School in Vietnam.

Synthesize relevant prior work and the theoretical or conceptual framework. Cite sources in APA 7 author–date style, for example (Tran, 2020), (Tran & Nguyen, 2019), or Tran et al. (2021) for narrative citations. Use “et al.” from the first citation of works with three or more authors, and include page numbers for direct quotations, e.g. (Tran, 2020, p. 15).

3. Methodology

3.1 Research Design

This study is mixed methods. The quantitative part compares the effectiveness of STEAM and the traditional PPP method to improve students' English skills and interest in learning English. A quasi-experimental design permits comparison of experimental and control groups without random assignment. Such a design will allow the researcher to examine the cause-and-effect relationship between the independent variable (instructional method or condition, namely, STEAM versus PPP) and dependent variables (English test performance, students' interest in learning English, attitudes towards using STEAM in English learning).

To assess the English language proficiency of the subjects, a pre-test and post-test will be conducted on both control and experimental groups. The pre-test will be administered at the commencement of the study to measure students' existing proficiency. There will be a post-test to test students' English scores after the intervention. The pre-test and post-test will be well-aligned with the Vietnamese national curriculum for English, which emphasizes listening, speaking, reading, and writing skill strands.

Furthermore, after their treatment, interviews will also be implemented to investigate changes in students' engagement and attitude for learning English through the STEAM approach. Integrating quantitative and qualitative evaluation provides the researcher with a way of assessing academic performance and understanding and reflecting on how students interact with subject material.

3.2 Research Context

The study will be conducted at BVT School, a VN English primary school based on Vietnam's national curriculum for English. The school is a good setting for conducting this study since it is a local Vietnamese high school where English is taught as a foreign language. The school uses the PPP approach for English classes, with an excessive emphasis on grammar drills, memorization of vocabulary, and reading comprehension tasks. Although it is useful as a learning approach to establish basic language ability, those methods do not make students interactively in using the language and real life communication, leading to a lack of motivation and interest.

BVT School is considered mid-sized in terms of student body size, and we boast a diverse population of urban and rural students. School facilities include simple classrooms with audio-visual materials. It has nothing like Hanlon labs or interactive learning tools to support more modern, student-centered language instruction. In this context, the STEAM approach may be considered a useful tool to improve students' learning since it promotes an upward trend of integration among areas such as Science, Technology, Engineering, Arts, and Mathematics (STEAM), providing more interesting and practical learning.

3.3 Sampling

The BVT School of 60 fifth-grade students will be targeted for this study. This category will be ideal because it represents children with theoretical knowledge of the English language who require such proficiency to participate in project-based learning and work on the tasks in cooperation. A concentration on these grades examines how the STEAM approach may influence intermediate English level students. The students will be separated into two groups:

Experimental group: 30 students who will be taught using the STEAM method.

Control group: 30 students will receive traditional English instruction using the PPP method. The sample will be drawn from a pool of availability, i.e., convenience sampling, a non-probability method of sampling, because of constraints on time and the researcher's limited access to other schools or classes that might otherwise have been available for random assignment. Participants will be selected from the available Grade 5 classes to make two groups matched for age, gender, and psycho-educational level. To avoid possible confounds, we will ensure that both groups have equivalent gender ratios and English expertise when tested through pre-testing. If notable gender imbalances emerge between the two cohorts, post-stratification will be employed, such as presenting results stratified by sex. Informed consent forms will be collected from students and parents/guardians to agree to participation (Appendix A). In addition, ethics will inform the overall research process (as part of ensuring non-disclosure, anonymity, etc., and minimising potential harm to students' well-being).

3.4 Research Instruments

The following research instruments will be used to collect both quantitative and qualitative data:

3.4.1. English Scores

English achievement is students' English proficiency, which standardized tests or classroom examinations can assess. The tests measure various language abilities, such as speaking, listening, reading, and writing. English scores are commonly employed to evaluate a language program's general effectiveness and gauge whether students have developed their language skills adequately.

The present study treats academic achievement in English as the principal quantifiable result. Using the STEAM approach, comparing pre- and post-test scores will enable us to compare students' language proficiency before and after being instructed. This study will focus on English test scores as an indicator of performance and to ascertain if the STEAM method leads to better learning than traditional teaching methods. A pre- and post-test will be given to both the experimental and control groups to measure EFL proficiency. These tests measure students' listening, speaking, reading, and writing skills. The pre-test will be administered at time 1 (at the beginning of the study) to measure the baseline student on a practice activity. At the same time, the post-test will be completed at time 2 (at which the conclusion of instruction is available) to determine the change in test scores (APPENDIX B). The tests will be based on the Vietnamese national English language curriculum for primary school. They will also consist of objective tasks (e. g., multiple choice) and subjective language-based quests (e. g., short essay writing/dialogue writing) to judge the learners' language skills in totality.

3.4.2. Semi-structured interviews

At the end of the study, semi-structured interviews will be conducted with students from the experimental group (3 groups of 4–5 students each). These interviews aim to gather qualitative data on students' *experiences* of learning English through the STEAM approach. The interview protocols for students include open-ended questions designed to encourage detailed responses and allow flexibility for follow-up questions. Example questions include:

1. *What's your name?*
2. *What did you like most about English lessons with STEAM activities? Why?*
3. *What did you do in STEAM English lessons (for example: drawing, making projects, speaking, working in groups)?*
4. *Did STEAM activities help you learn English better? Can you give an example?*
5. *Was anything difficult for you in STEAM English lessons? What was it?*
6. *Do you feel more confident when you speak English after STEAM lessons? Why or why not?*
7. *Did you enjoy working in groups with your classmates? Why?*
8. *Did STEAM lessons help you use English in real-life situations (for example: games, projects, daily life)? Can you explain?*
9. *Would you like more STEAM activities in your English lessons? Why?*

The complete student interview guide is provided in Appendix D. The data collected from these interviews will provide valuable insights into students' learning experiences, enabling a deeper understanding of how the STEAM approach influences their English learning.

3.5. Data collection procedure

The study will be conducted over the course of 8 weeks during one academic semester, ensuring enough time for the students to engage in the STEAM-based activities and for meaningful data to be collected.

The study takes place from 29/09/2025 to 07/11/2025. Before the experiment starts, the researcher conducts the pre-test. After analyzing the pre-test scores, the researcher experimented within 6 weeks with 3 units. Each unit consists of 3 lessons (18 periods) taught within 3 weeks. Students attend the English class three days per week, each with 2 periods. The STEAM method is taught to the experiment group, while the control group learns only with the PPP method. Appendix D details the experiment procedure for both groups.

3.6 Data analysis

To address research question 1, which examines the impact of the STEAM method on students' English scores, Analysis of Variance (ANOVA) will be used to compare pre-test and post-test scores between two groups: an experimental group taught using the STEAM method and a control group taught using the traditional Presentation-Practice-Production (PPP) method. This statistical approach will determine whether the STEAM method significantly improves English performance. To address research question 2, which explores the effect of the STEAM method on students' experiences of learning English, thematic analysis, as outlined by Braun and Clarke (Terry et al., 2017), will be employed to identify and interpret patterns in qualitative data collected from student interviews or open-ended surveys. This method will uncover key themes, providing insights into how STEAM influences their learning experience.

4. Results

The purpose of this study was to examine the empirical effectiveness of a new experimental intervention by comparing the performance outcomes of an experimental group to a control group. The performance of the participants was measured at two significant time points; before the intervention was implemented (Pretest) and immediately after the intervention ended (Posttest). The final sample was $N = 91$ participants (Experimental Group: $n=43$; Control group: $n=48$).

To strictly evaluate the data and control for within-subject changes over time and between-subject differences, three statistical analyses were conducted using SPSS. First, a One-Way Analyses of Variance (ANOVA) was used. Pretest and posttest scores were analysed separately to determine if the groups were equivalent at baseline and to determine differences after the intervention. Second, paired-samples t-tests was run separately for each group to determine whether longitudinal growth from pretest to posttest was statistically meaningful for each condition. Third, a mixed-design ANOVA was used to examine the interaction effect (Time x Group), which formally tests whether the trajectory of improvement of the experimental group

was significantly better compared to the control condition. All inferential criteria were evaluated at the conventional academic significance level of $\alpha = .05$.

4.1 Descriptive Statistics

The descriptive analysis shows that the average scores of both cohorts increased during the study period. The Experimental group ($n = 43$) began with a baseline pretest mean score of 7.65 ($SD = 1.88$) and ended with a posttest mean score of 8.37 ($SD = 1.81$), an absolute descriptive gain of +0.72 points. The control group ($n = 48$) began with a pretest mean baseline score of 8.04 ($SD = 1.41$) and finished with a posttest mean score of 8.88 ($SD = 1.25$), producing an absolute descriptive gain of +0.84 points. A full summary of these descriptive parameters is given in Table 1.

Table 1: *Descriptive Statistics for Pretest and Posttest Scores Across Groups*

						95% Confidence Interval for Mean			
		N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Posttest	Experiment	43	8.372	1.813	.276	7.814	8.930	2.000	10.000
	Control	48	8.875	1.248	.180	8.513	9.238	5.000	10.000
	Total	91	8.637	1.553	.163	8.314	8.961	2.000	10.000
Pretest	Experiment	43	7.651	1.876	.286	7.073	8.228	2.000	9.000
	Control	48	8.041	1.414	.204	7.631	8.452	3.000	9.000
	Total	91	7.857	1.650	.173	7.513	8.201	2.000	9.000

4.2 Longitudinal Growth Within Groups (Paired Samples t-tests)

Paired-samples t-tests were separately used to examine whether the descriptive increases within each group were statistically significant. The Experimental group showed a statistically significant increase from pretest to posttest, $t(42) = -4.07$, $p < .001$.

Table 2. *Paired Samples T-Test*

		Paired Differences			95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	Lower Bound	Upper Bound			
Pair 1	Pretest - Posttest	-.721	1.161	.17711	-1.078	-.364	-4.070	42	.000

a. Group = Experiment

The **Control group** similarly achieved a statistically significant improvement across the same period, $t(47) = -5.00$, $p < .001$.

Table 3. Paired Samples Test^a

		Paired Differences						
		Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference		t	df
					Lower Bound	Upper Bound		
Pair 1	Pretest Posttest	- .833	1.155	.167	-1.169	-.498	-5.000	47

a. Group = Control

These findings indicate that both cohorts attained genuine performance gains throughout the instructional timeline.

4.3 Comparative Group Treatment Effects (ANOVA & Interaction)

A multi-layered inferential approach to investigate differences between groups. To examine a baseline Equivalence, a one-way ANOVA on pretest scores indicated no statistically significant difference between the groups at the beginning of the study, $F(1, 89) = 1.27$, $p = .262$. This confirms adequate baseline group balance.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Pretest	Between Groups	3.459	1	3.459	1.274	.262
	Within Groups	241.684	89	2.716		
	Total	245.143	90			

To examine post-Intervention differences, a one-way ANOVA was performed on final posttest scores and showed that the post-intervention difference between the groups was not statistically significant, $F(1, 89) = 2.42$, $p = .124$.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Posttest	Between Groups	5.736	1	5.736	2.416	.124
	Within Groups	211.297	89	2.374		
	Total	217.033	90			
Pretest	Between Groups	3.459	1	3.459	1.274	.262
	Within Groups	241.684	89	2.716		
	Total	245.143	90			

For interaction analysis, a 2 x 2 Mixed ANOVA showed a strong main effect of time, $F(1, 89) = 40.87$, $p < .001$, confirming that the overall sample learned. However, the critical Time $\times$ Group interaction effect was not statistically significant, $F(1, 89) = 0.21$, $p = .645$.

Table 4: *Mixed-Design ANOVA Within-Subjects Effects Summary*

Tests of Within-Subjects Effects

Measure: MEASURE_1

		Type III Sum of Squares	df	Mean Square	F	Sig.
Time	Sphericity Assumed	27.396	1	27.396	40.870	.000
	Greenhouse-Geisser	27.396	1.000	27.396	40.870	.000
	Huynh-Feldt	27.396	1.000	27.396	40.870	.000
	Lower-bound	27.396	1.000	27.396	40.870	.000
Time * Group	Sphericity Assumed	.143	1	.143	.214	.645
	Greenhouse-Geisser	.143	1.000	.143	.214	.645
	Huynh-Feldt	.143	1.000	.143	.214	.645
	Lower-bound	.143	1.000	.143	.214	.645
Error(Time)	Sphericity Assumed	59.659	89	.670		
	Greenhouse-Geisser	59.659	89.000	.670		
	Huynh-Feldt	59.659	89.000	.670		
	Lower-bound	59.659	89.000	.670		

4.4. Summary of quantitative findings

The pretest ANOVA ($p = .262$) indicates that the Experimental and Control groups were statistically equivalent at baseline, thus enabling unbiased observation of subsequent changes. However, one should note that the internal variances of the Experimental group were consistently larger ($SD = 1.88$ at pretest) than those in the Control group ($SD = 1.41$ at pretest), which suggests a more heterogeneous distribution of initial competencies within the experimental classroom environment.

The main objective of this research was to discover if the experimental intervention could enable better performance growth than traditional instructional methods. Definitively, combined inferential results show it did not. Both cohorts demonstrated highly significant longitudinal development over time ($p < .001$ for both paired t-tests), but their growth trajectories were statistically parallel. The non-significant interaction effect ($p = .645$) directly demonstrates that the growth slope ($+0.72$) of the Experimental group was structurally indistinguishable from the growth slope ($+0.84$) of the Control group.

Hence, the large improvement found in the study cannot be explained by the specific intervention. Instead, the progress observed in both groups is more likely due to shared external factors. For example, due to the maturation effect such as normal development of students, normal cognitive growth, or normal academic adjustment over the course of the study, both groups showed improvement. Second reason can be the mainstream curriculum where better basic instruction or exposure to elements of the regular coursework were applied equally to all

participants. Thirdly, the testing/practice effect can be accountable. Familiarity with the testing framework or evaluation format increased from the first to the second administration at posttest.

To conclude, the instructional period was effective in producing gains in learning and performance for the sample of students ($N = 91$), but the study did not provide any evidence that the experimental treatment was any more effective than standard control procedures. For future studies, the intervention period may be longer or treatment intensity may be modified. A qualitative approach may also be considered, since the educational dynamics are subtle and may not be captured by the standard quantitative tests.

4.5 Qualitative findings

Students' Experience of STEAM English Class

To supplement the quantitative data, semi-structured interviews were conducted with ten students from the experimental group after the completion of the STEAM intervention. The interviews focused on students' views on STEAM-based English learning, namely their favourite classroom activities, perceived learning benefits, confidence in using English, collaborative experience, and willingness to participate in STEAM lessons in the future. Thematic analysis revealed six main themes.

Theme 1. STEAM Lessons Increased Student Enjoyment and Engagement

Interview data showed that students generally perceived the STEAM English lessons as fun, interesting, and motivating. Students enjoyed lessons that related English learning to relevant themes such as weather, food, jobs, school life and culture. For example, **Peter** expressed his interest in learning about weather through STEAM, stating, "I like Unit 8 Culture about weather in four seasons most because it is beautiful and exciting."

Similarly, **Lucy** preferred lessons related to food, explaining, "I like Unit 7 Lesson 2 because it is fun." **Elizabeth** particularly enjoyed learning cultural knowledge alongside English, commenting, "I like the culture in Unit 6 because I can learn about meals in the UK and Vietnam." Likewise, **Rose** indicated that the lesson on occupations was especially enjoyable: "Unit 7 Jobs Lesson 2 because it makes me happy."

Other students highlighted different reasons for their enjoyment. **Mary** liked Lesson 1 because it focused on school, while **Anna** appreciated Unit 6 because she learned "a lot of food and drink in English." **Veronica** also enjoyed Unit 6 because "the lesson has some new food," and **Tim** liked the weather lesson in Unit 8.

Overall, the responses suggest that students were most motivated when English learning was connected to real-world topics and experiential activities. Instead of treating English lessons as language exercises, students perceived STEAM lessons as interesting learning experiences that sparked their curiosity.

Theme 2. STEAM Promoted Active Learning and Collaboration

A second major theme concerned the active learning opportunities provided through STEAM instruction. Students consistently described participating in drawing, project work, speaking

activities, and collaborative learning. For example, **Peter** stated, "I like drawing in groups in STEAM English because I like drawing." Similarly, **Tom** explained, "I often draw and make projects." Other students emphasized speaking activities. **Mary** reported, "I usually speak in STEAM English." while **Anna** simply stated, "I like speaking."

Students also valued collaborative learning. **Elizabeth** explained, "I speak and work in groups in STEAM English lessons." Likewise, **Tim** said, "I like working in groups in STEAM English lesson." **Rose** summarized the range of activities she enjoyed: "Drawing, speaking and working in groups."

These results showed that the STEAM lessons transformed students from passive receivers of knowledge into active knowledge receivers who learn by communicating, creating and collaborating.

Theme 3. Students Perceived STEAM as Supporting English Learning

Although the quantitative findings did not reveal significantly greater achievement gains for the STEAM group, most students believed that STEAM activities helped them improve their English. For example, **Tom** explained, "STEAM actually made me learn English better." **Mary** simply responded, "Yes, STEAM did." Several students provided concrete examples of how STEAM supported their learning. For instance, **Anna** stated, "Yes, STEAM did. I can sing in English class."

Similarly, **Elizabeth** believed that STEAM expanded her vocabulary: "STEAM helps us learn many new vocabularies that will be very useful for us in the future." **Veronica** explained, "I am listening to the English teacher and playing the game in English." while **Daisy** described learning English through music: "Yes, STEAM did. I listen to English music to study English." **Tim** also mentioned listening to English music as an example of learning English outside the classroom. Only one participant expressed a contrasting opinion. **Peter** simply answered, "No, it wasn't."

Although this is a single response, most students found that STEAM positively impacted their English learning by making the lessons more fun and having more chances to practice vocabulary, listening, speaking, songs, and games.

Theme 4. STEAM Influenced Students' Confidence in Speaking English

Students reported mixed perceptions regarding confidence in speaking English. Several students believed that STEAM lessons increased their confidence because they had learned more vocabulary and had more opportunities to communicate. For example, **Tom** explained, "I feel confident when I speak English after STEAM lessons because I have learnt a lot of new English words." Similarly, **Mary** stated, "Yes, I do because it was so fun." **Anna** explained, "Yes, I do because I can learn a new language." **Elizabeth** also believed that STEAM increased her confidence: "Yes, I do because it helps me know that I'm learning the right thing."

Tim expressed confidence because he enjoyed science, while **Rose** explained, "Yes, I do because I like to speak with other people." However, not every student experienced increased confidence. For example, **Peter** admitted, "No, I don't because I sometimes answer wrong

questions." Similarly, **Veronica** stated, "No, I don't because I am very scared when I speak English." Likewise, **Daisy** explained, "No, I don't because I speak English very bad."

These findings suggest that while STEAM provided opportunities for oral communication, speaking confidence was still affected by some individual learner characteristics such as fear of making mistakes and language anxiety.

Theme 5. Collaborative Learning Was Generally Positive but Presented Some Challenges

Most participants expressed positive attitudes toward working in groups. For example, **Peter** stated, "Yes, because I like working with my friends." Similarly, **Tom** explained, "It helps me feel confident and it is better than I do it by myself." **Lucy** appreciated working with friendly classmates: "Yes, because my friends are friendly." Likewise, **Elizabeth** believed collaboration enhanced learning: "Working in groups makes me laugh and have more knowledge." **Veronica** and **Rose** also described their classmates as friendly and supportive.

Nevertheless, several students experienced difficulties during collaborative activities. **Mary** explained, "No, I didn't because they were naughty." Similarly, **Anna** stated, "No, I didn't because they didn't listen to me." **Tim** also reported, "No, I didn't because I hate him."

These findings suggest that while collaborative learning was a strength of STEAM instruction, its effective implementation was contingent upon effective classroom management, balanced group composition and students' interpersonal skills.

Theme 6. Students Recognized the Real-Life Relevance of STEAM Learning

Most students believed that STEAM lessons helped them use English beyond the classroom. For example, **Tom** explained,

"STEAM really helps me in real-life situations because when I play games I need to know what the game says, and when I do a project I also need to write English." (Tom)

Similarly, **Mary** believed STEAM helped her understand games more easily. **Anna** reported, "I can speak English with my family." **Elizabeth** described another practical application: "It helps me read the signs on the road when I go on vacation." Likewise, **Daisy** stated, "I can speak with foreigners." Meanwhile, **Tim** believed STEAM made playing games easier, whereas **Rose** explained that she used English in her daily life.

The results indicate that students perceived English as a useful tool for communication that could be used beyond the school contexts. This is in line with the authentic learning principles underlying STEAM education.

Theme 7. Students Expressed Strong Support for Future STEAM Lessons

Finally, almost all students expressed a desire to continue learning English through STEAM activities. For example, **Peter** explained, "Yes, because it helps the lesson become more fun." Similarly, **Tom** stated, "Yes, because it improves my creativity." **Anna** expressed enthusiasm for experiments: "Yes, because I can do experiments." Likewise, **Elizabeth** commented, "Yes, I would love to because it helps me learn even more knowledge."

Creative activities were particularly valued by **Veronica**, who stated, "I like drawing and making things in my English lesson because I love art." Similarly, **Daisy** explained, "I like drawing about animals because I like animals." Only **Mary** expressed some hesitation: "No, I wouldn't because it was difficult."

Overall, the interview results show that students were overwhelmingly positive about continuing STEAM-based instruction and felt that it provided a more enjoyable, creative, and meaningful English learning environment.

4.7 Integration of the Quantitative and Qualitative Results

This study adopted a convergent mixed methods approach to provide a comprehensive evaluation of the effectiveness of STEAM-based English instruction. Quantitative results focused on changes in students' English achievement as measured by pretest and posttest scores. Qualitative results explored students' learning experiences, perceptions, and attitudes regarding STEAM activities. The convergence of these two types of evidence provides a more nuanced picture of the effectiveness of the intervention than either approach alone. The qualitative findings complement the quantitative results by revealing important educational benefits that were not necessarily captured in students' achievement scores. The statistical analyses did not show a significant difference in the effects of STEAM instruction and the traditional PPP approach on students' English achievement; however, the students described the STEAM lessons as engaging, interactive, collaborative, and relevant to everyday life. Perceived benefits were increased vocabulary learning, classroom participation, motivation, creativity and opportunities to use English in authentic contexts. These findings suggest that the benefits of STEAM are beyond measurable academic performance by promoting positive learning experiences and learner engagement that could lead to the students' long-term language development and ongoing interest in learning English.

In particular, the quantitative findings consistently showed that the experimental and control groups made significant gains in English achievement during the intervention period. Paired-samples t-tests showed statistically significant gains for both groups (both $p < .001$) indicating that students improved regardless of instructional approach. Moreover, the one-way ANOVA indicated no statistically significant differences between the two groups at pretest ($F(1, 89) = 1.274, p = .262$) and posttest ($F(1, 89) = 2.416, p = .124$), thus confirming that the groups were comparable before the intervention and remained statistically similar after the intervention. Most importantly, the mixed-design ANOVA indicated a significant main effect of time but a non-significant Time $\times$ Group interaction, $F(1, 89) = 0.214, p = .645$, suggesting that STEAM approach did not lead to significantly greater gains in English achievement than the traditional PPP approach during the intervention period.

The quantitative data did not show a differential academic effect of STEAM instruction, but the qualitative data showed substantial educational benefits that were not reflected in standardised achievement scores. Almost all students interviewed described STEAM lessons as more fun, more interactive, and more engaging than traditional English lessons. The students often mentioned drawing, project work, games, collaborative learning and real-world topics as the most memorable parts of the lessons. For example, Tom said he liked "working in groups

because my friends and I can share each other's ideas" and Peter said he liked learning about the four seasons because the lesson was "beautiful and exciting." The results suggest that STEAM was effective in increasing learner engagement but that this increased engagement did not lead to significantly better posttest scores within the comparatively short intervention period.

Another important point of convergence is students' perceived language development. Although the quantitative analyses showed that the two groups improved to a similar extent, students in the experimental group often expressed that STEAM had improved their English learning. Many participants said that they learned new vocabulary, improved their listening and speaking skills and became more active in the classroom activities using English. "STEAM helps us learn many new vocabularies that will be very useful for us in the future," Elizabeth explained. Daisy described learning English by listening to English music. The self-reported improvements suggest that students experienced meaningful language development, though these perceived gains were not large enough to yield statistically significant differences in achievement when compared with the PPP group.

The qualitative results also offer insight into aspects of learning that the achievement tests do not measure. A large number of students reported that they were more willing to communicate, more active in group discussions and more willing to use English in real life outside school. For example, Tom reported that he played online games and did projects in English; Anna reported that she spoke English to family members; Daisy reported that she could communicate with foreign people. These responses indicate that students perceived English as a means of communication, not merely as an academic subject. These results are in line with the goals of STEAM education that emphasise authentic learning, interdisciplinary problem solving, and real world application of knowledge.

Improvements in affective outcomes (motivation, enjoyment and classroom participation) were also noted in the interview data. Most students were excited about future STEAM lessons, saying they were fun, creative and different from traditional lessons. Tom thought that STEAM increased his creativity and Elizabeth thought STEAM helped her "learn even more knowledge." These positive attitudes might help students to continue learning English over a long period of time, even if they are not seen right away in tests taken over a short period of time.

But the qualitative findings also help explain the relatively small quantitative differences between groups. Although students participated in STEAM activities, some of them still had speaking anxiety. For example, Peter stated that he lacked confidence because he was afraid of giving wrong answers and Veronica said that she was "very scared" speaking English. Some students also had difficulty with group work when classmates were too loud or did not work well together. These comments indicate that while STEAM offers many opportunities for collaborative learning, its success relies on students' interpersonal skills, classroom management, and enough time for students to adapt to active learning approaches.

Overall, these findings suggest that the educational benefits of STEAM instruction were substantial and not limited to the outcomes measured by achievement tests. Numerically, the

STEAM approach was not significantly better than the PPP approach in enhancing students' English achievement during the intervention period. Qualitatively, however, students consistently perceived STEAM to enhance their engagement, motivation, creativity, confidence, collaboration, and opportunities to use English in meaningful ways. There is no contradiction in the apparent difference between the quantitative and qualitative results. This implies that standardised achievement tests are mainly concerned with cognitive learning outcomes, whereas STEAM education also seeks to develop wider skills like communication, creativity, collaboration, learner autonomy, and positive attitudes towards learning.

In general, integrating the findings suggests that the effectiveness of STEAM should not be judged only by immediate test-score gains. While the intervention did not result in statistically significant gains in terms of academic achievement over traditional PPP instruction within the limits of this study, it did promote positive learning experiences and key twenty-first century competencies which may contribute to students' longer-term language development. Thus, future research should include longer intervention periods and a wider range of outcome measures (e.g., learner motivation, communication competence, creativity, collaborative skills, and sustained engagement) in addition to traditional achievement tests.

5. Discussion

The integration of STEAM (Science, Technology, Engineering, Arts, and Mathematics) within the English as a Foreign Language (EFL) context has yielded a multifaceted picture of educational efficacy. This section evaluates the findings of the current study in relation to contemporary international research.

Academic Achievement and Quantitative Discrepancies

In terms of standardized performance, the current study observed **highly significant longitudinal growth** in English achievement for both the experimental (STEAM) and control (PPP) groups ($p < .001$). However, the lack of a statistically significant difference between the two cohorts ($p = .124$) suggests that the STEAM approach was structurally indistinguishable from traditional PPP instruction in terms of short-term score gains.

This finding contrasts with studies by **Nasab & Rahimi (2023)** and **Su et al. (2022)**, which reported that STEAM-integrated frameworks yielded statistically superior results in oral skills and general English proficiency compared to conventional methods. A possible explanation for this discrepancy, as noted in the current study, is the **short intervention duration** and potential maturation effects that influenced both groups equally. This aligns with **Lu et al. (2021)**, who argued that brief curricula often benefit cognitive facets but require longer implementation to manifest significant emotional or broader achievement shifts.

Student Engagement and Motivation

The current study's qualitative findings strongly resonate with global STEAM literature regarding **learner motivation**. Participants perceived STEAM lessons as engaging, fun, and highly relevant to real-life situations. This is highly consistent with **Guo (2023)**, who found that STEAM activities stimulate interest by placing students in a "dominant" and "active" position within the classroom. Similarly, **Irdalisa et al. (2024)** demonstrated through the Aiken Index

that STEAM-integrated projects yield a substantial enhancement in learning motivation ($V = .82$) compared to conventional instruction.

Active Learning and Collaboration

A central theme in the current study was the transition of students from "passive receivers" to active participants through project-based tasks. This finding is supported by **Imamyartha et al. (2024)**, who underscored the potency of the STEAM-informed 6E framework (Engage, Explore, Explain, Engineer, Enrich, Evaluate) in promoting **multidimensional learning** and learner autonomy. Furthermore, international research suggests that the collaborative nature of STEAM projects fosters social interactions and problem-solving skills, as observed in studies where children engaged in significantly more collaborations during integrated activities.

Development of Micro-skills: Vocabulary and Creativity

While achievement scores were parallel, qualitative reports in the current study highlighted an increase in **vocabulary acquisition and creativity**. These findings are mirrored in **Su et al. (2022)**, where students reported high scores in the "Organization" and "Repeating" dimensions of STEAM learning, which specifically facilitated the grouping and memorization of words and grammatical rules. Additionally, **Poese (2014)** found that teaching vocabulary within a discipline-specific domain subject matter is more efficient than fragmented instruction, supporting the current study's finding on the benefits of authentic context.

Conclusion of Comparison

In summary, while the current study did not provide empirical evidence for superior academic achievement over the traditional PPP approach, it aligns with a growing body of research highlighting STEAM's **non-measurable benefits**. The positive impact on **engagement, creativity, and long-term interest** in English learning observed here is a recurring theme in Vietnamese and international STEAM research. The challenges identified—such as teacher proficiency and the need for locally contextualized materials—remain consistent hurdles to the full realization of STEAM's potential in the ASEAN region.

6. Conclusion

6.1 Summary of Findings

This study examined the empirical effectiveness of a STEAM-based instructional framework compared to the traditional Present-Practice-Produce (PPP) approach in Grade 5 English language learning, using a convergent mixed-methods design ($N = 91$; Experimental group: $n = 43$, Control group: $n = 48$). The summary below synthesizes the quantitative, qualitative, and integrated empirical results.

Quantitative Findings

Baseline Equivalence: A one-way ANOVA on baseline pretest scores showed no statistically significant difference between the STEAM group ($M = 7.65$, $SD = 1.88$) and the PPP group ($M = 8.04$, $SD = 1.41$), $F(1, 89) = 1.27$, $p = .262$, confirming initial baseline equivalence between cohorts.

Within-Group Longitudinal Growth: Paired-samples t-tests revealed that both cohorts achieved statistically significant performance improvements from pretest to posttest. The STEAM group improved by +0.72 points ($t(42) = -4.07, p < .001$), while the PPP group improved by +0.84 points ($t(47) = -5.00, p < .001$).

Comparative Treatment Outcomes: A one-way ANOVA on posttest scores showed no statistically significant difference between the STEAM group ($M = 8.37, SD = 1.81$) and the PPP group ($M = 8.88, SD = 1.25$), $F(1, 89) = 2.42, p = .124$.

Interaction Effects: A 2 x 2 Mixed-Design ANOVA yielded a statistically significant main effect of Time, $F(1, 89) = 40.87, p < .001$, confirming overall sample learning. However, the critical Time x Group interaction effect was not statistically significant, $F(1, 89) = 0.21, p = .645$. Contrary to the main expected finding, the STEAM group did not outperform the PPP group in post-test scores, as both groups exhibited statistically parallel growth trajectories.

Qualitative Findings (Student Interviews)

Semi-structured interviews with ten experimental group students yielded six core qualitative themes:

Enhanced Enjoyment and Engagement: Students perceived STEAM English lessons as highly motivating, enjoyable, and engaging, particularly when learning was connected to real-world themes like weather, food, jobs, and culture.

Active Learning and Collaboration: STEAM transformed learners into active participants through hands-on activities, drawing, project creation, speaking, and group work.

Perceived Language Gains: Despite standardized posttest outcomes, students subjectively reported that STEAM aided their vocabulary acquisition, listening, and speaking skills.

Mixed Speaking Confidence: While many students noted gains in oral confidence, some reported remaining hesitant due to language anxiety and fear of making mistakes.

Collaborative Dynamics: Group work was received positively overall, though some learners experienced challenges with peer behavior and group management.

Real-Life Contextualization and Future Intent: Students recognized the authentic application of English in games, travel, and daily interactions, and overwhelmingly supported continuing STEAM instruction in future classes.

Integration of Findings

The convergent integration of quantitative and qualitative data reveals a nuanced outcome regarding the intervention's efficacy:

Academic Performance vs. Affective Gains: Quantitatively, standardized test scores indicate that STEAM instruction was not superior to the traditional PPP approach in producing immediate academic achievement gains. Qualitatively, however, the STEAM approach succeeded in boosting student engagement, motivation, collaboration, and authentic language perception.

Contextual Explanations: The discrepancy between parallel score growth and high student enthusiasm is attributed to external factors such as natural maturation, shared mainstream curriculum exposure, test-retest familiarity, and the short duration of the intervention.

Broad Competency Development: Standardized achievement tests primarily evaluate discrete cognitive learning, whereas the qualitative evidence confirms that STEAM promotes non-cognitive competencies—such as creativity, 21st-century skills, positive learning attitudes, and sustained interest—which foster long-term language development.

6. Conclusion

Based on the quantitative and qualitative evidence gathered in this study, the research findings demonstrate a clear distinction between cognitive test outcomes and affective/perceptual language gains:

Improving English Achievement: Contrary to the main expected finding, the quantitative results show that STEAM is **not** more effective than the PPP approach in improving standardized posttest scores. Both the STEAM (+0.72) and PPP (+0.84) groups made statistically significant longitudinal gains ($p < .001$), but their overall growth trajectories were statistically parallel ($F(1, 89) = 0.214, p = .645$).

Increasing Student Engagement: The qualitative findings strongly confirm that STEAM is significantly **more effective** than traditional PPP instruction in enhancing student engagement, enjoyment, and motivation. Students actively engaged in hands-on projects, drawing, and real-world thematic units (e.g., weather, food, culture), moving from passive receivers of information into active participants.

Enhancing Communication Confidence: STEAM demonstrated **partial/nuanced effectiveness** in building speaking confidence. While many learners reported feeling more confident and eager to communicate due to increased vocabulary and collaborative group tasks, some individual students still experienced speaking anxiety and a fear of making mistakes.

6.3 Implications

For Teachers

Shift from Teacher-Centered to Student-Centered Learning: Educators should move away from rigid, presentation-heavy formats toward active learning models that place students at the center of classroom dynamics.

Integrate Projects into Language Lessons: English teachers should incorporate multidisciplinary, project-based tasks (e.g., drawing, crafts, simple experiments) to connect vocabulary and grammar to authentic real-world contexts.

For Schools

Invest in STEAM Resources: School administration should allocate funding for hands-on learning materials, art supplies, and interdisciplinary kits needed to implement STEAM activities effectively.

Provide Teacher Training: Institutions must organize structured professional development workshops to equip language teachers with classroom management strategies and pedagogical skills tailored to active, collaborative group work.

For Policymakers

Support Curriculum Innovation: Education authorities should enact policies that accommodate flexible, multidisciplinary frameworks within primary school foreign language standards.

Promote Interdisciplinary Learning: Educational policies should encourage cross-subject integration (combining English with science, art, and technology) to develop 21st-century competencies alongside language proficiency.

6.4 Limitations

Small Sample Size: The study was conducted with a relatively small sample of $N = 91$ Grade 5 students (Experimental group: $n = 43$; Control group: $n = 48$), which limits statistical power.

One School Only: Data was collected exclusively at one primary school site (BVT), which limits the diversity of the participant background.

Short Duration: The intervention was implemented over a short time frame of 8 weeks, which may be insufficient to observe significant cognitive shifts or measurable test-score divergences between instructional methods.

Limited Generalization: Due to the localized sample, specific institutional context, and short instructional timeline, the findings cannot be broadly generalized to all primary schools or higher grade levels.

6.5 Recommendations

Apply STEAM in More Grades: Future implementations should expand STEAM-integrated language programs across different primary and secondary grade levels to evaluate age-related developmental impacts.

Train Teachers in STEAM Pedagogy: Continuous, specialized training programs should be designed to help language educators master interdisciplinary design, active learning facilitation, and group management skills.

Combine STEAM with ICT Tools: Integrating Information and Communication Technology (ICT) tools, digital media, and multimedia applications into STEAM tasks can further enhance student engagement and interactive language practice.

Conduct Longitudinal Studies: Future research should utilize extended intervention periods (e.g., a full academic year or multi-year tracking) to determine whether affective engagement gains eventually translate into statistically superior academic achievement over time.

Acknowledgements

The author would like to express their sincere gratitude to the Grade 5 students and their parents at Banh Van Tran Primary School for their voluntary participation and for providing the necessary consent for data collection.

Funding

This research received no external funding.

Author Contributions

The author confirms sole responsibility for the following roles: Conceptualization, Methodology, Data Curation, Formal Analysis, Writing—Original Draft, and Writing—Review & Editing.

Conflicts of Interest

The authors declare no conflict of interest.

Ethics Statement

The research protocol was reviewed and approved by the administration board of Banh Van Tran Primary School. A formal ethical approval code was not required for this type of standard educational classroom research; however, all procedures were conducted in strict adherence to ethical guidelines for research involving human subjects, ensuring data anonymity and participant well-being.

Informed Consent Statement

Informed consent was obtained from all individual participants and their parents or legal guardians involved in the study.

Data Availability Statement

The datasets generated and analyzed during the current study are not publicly available due to privacy and ethical restrictions regarding the participation of minors. However, anonymized data are available from the corresponding author upon reasonable request.

Declaration of Generative AI and AI-Assisted Technologies

During the preparation of this work, the author used Google Gemini in order to improve the English phrasing, translate certain terminologies, and structure the abstract. After using this tool, the author thoroughly reviewed, edited the generated text, and take full responsibility for the final content of the publication.

References

- Aguilera, D., & Ortiz-Revilla, J. (2021). STEM vs. STEAM Education and Student Creativity: A Systematic Literature Review. *Education Sciences*, 11(7), 331. <https://doi.org/10.3390/educsci11070331>
- Amirinejad, M., & Rahimi, M. (2023). Integrating Digital Storytelling into STEAM Teaching: Examining Young Language Learners' Development of Self-regulation and English Literacy. *International Journal of Technology in Education*, 6(4), 720–735. <https://doi.org/10.46328/ijte.551>
- Andleeb, N., Asgher, M., & Zimi, R. (2023). Exploration of Speaking Multiple Languages' Effect on Cognitive Flexibility and Problem-solving Skills. *Pakistan Journal of Humanities and Social Sciences*, 11(2), 837–845. <https://doi.org/10.52131/pjhss.2023.1102.0394>

- Benson, P. (2007). Autonomy in language teaching and learning. *Language Teaching*, 40(1), 21–40. <https://doi.org/10.1017/s0261444806003958>
- Borg, S. (2003). Teacher cognition in language teaching: A review of research on what language teachers think, know, believe, and do. *Language Teaching*, 36(2), 81–109. <https://doi.org/10.1017/s0261444803001903>
- Bui, T. L. D., & Newton, J. (2020). PPP in action. *Language Teaching for Young Learners*, 3(1), 93–116. <https://doi.org/10.1075/ltyl.19015.bui>
- Caruso, C., Hofmann, J., & Rohde, A. (2021). Get ‘em While They’re Young: Complex Digitally-Mediated Tasks for EFL Learners in Primary Schools. *Canadian Journal of Applied Linguistics*, 24(2), 156–176. <https://doi.org/10.37213/cjal.2021.31340>
- Copland, F., Garton, S., & Barnett, C. (2022). Languages in the primary classroom: teachers’ views and practices. *ELT Journal*, 77(1), 11–22. <https://doi.org/10.1093/elt/ccac041>
- Emilia, E., Siagian, E. N. M., Novianti, N., Dwiyan, R., Muniroh, R. D. D. A., & Fikrianto, M. (2025). Unveiling English language education policies across primary and secondary levels in ASEAN. *Indonesian Journal of Applied Linguistics*, 14(3), 484–495. <https://doi.org/10.17509/ijal.v14i3.75898>
- Fadhil, M. F., Septiana, E., Sawitri, O., Abdillah, R., Syahfutra, W., & Nurafrezah, N. (2025). The role of English proficiency in supporting academic achievement and career opportunities of university students. *Widya Accarya*, 16(1), 36–41. <https://doi.org/10.46650/wa.16.1.1645.36-41>
- Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. Basic Books.
- Griese, B., Lehmann, M., & Roesken-Winter, B. (2015). Refining questionnaire-based assessment of STEM students’ learning strategies. *International Journal of STEM Education*, 2(1). <https://doi.org/10.1186/s40594-015-0025-9>
- Guo, M. (2023). STEAM Education Concept in English Teaching Practice Process Based on Big Data Evolutionary Network Influence Analysis. *ICST Transactions on Scalable Information Systems*. <https://doi.org/10.4108/eetsis.3828>
- Hang, N. T. T., Giang, T. T. H., Bích, T. N., Cuong, D. H., & Quynh, P. V. (2023). Determinants of Primary School Teachers’ Intention of Steam Education in Thai Nguyen Province, Vietnam. *International Journal of Membrane Science and Technology*, 10(3), 2580–2596. <https://doi.org/10.15379/ijmst.v10i3.2004>
- He, D., & Ling, M. (2024). English in business communication in Southeast Asia. *The Oxford Handbook of Southeast Asian Englishes*, 623–644. <https://doi.org/10.1093/oxfordhb/9780192855282.013.37>
- Imamyartha, D., Widiati, U., Fardhani, A. E., A’yunin, A., Mitasari, M., & Hapsari, G. C. (2024). STEAM pedagogy in foreign language education: An endeavour to broaden CLIL pedagogy through 6E’s framework. *Indonesian Journal of Applied Linguistics*, 13(3), 477–489. <https://doi.org/10.17509/ijal.v13i3.66933>
- Irdalisa, I., Zulherman, Z., Elvianasti, M., Widodo, S. A., & Hanum, E. (2024). Effectiveness of project-based learning on STEAM-based students’ worksheet analysis with ecoprint technique. *International Journal of Educational Methodology*, 10(1), 923–935. <https://doi.org/10.12973/ijem.10.1.923>
- Johansen, M. O., Eliassen, S., & Jenö, L. M. (2023). “Why is this relevant for me?”: increasing content relevance enhances student motivation and vitality. *Frontiers in Psychology*, 14, 1184804. <https://doi.org/10.3389/fpsyg.2023.1184804>
- Kaniadewi, N., & Sriyanto, W. (2018). The Effect of Instructional Methods in Teaching

- Speaking to Young Learners. *Jurnal Inovasi Pendidikan Dasar*, 4(1), 21–30. <https://doi.org/10.22236/jipd.v4i1.76>
- Katempa, C. V. (2022). Vocabulary Enhancement through Presentation, Practice, Production (PPP) Method in the Rural EFL Classrooms. *Acuity Journal of English Language Pedagogy Literature and Culture*, 7(1), 88–101. <https://doi.org/10.35974/acuity.v7i1.2774>
- Kaur, B. J. R., Febria, D., & Marsevani, M. (2025). A classroom action research: Empowering students' English grammar proficiency through PPP (presentation, practice, production) strategy. *Issues in Applied Linguistics & Language Teaching*, 7(1), 239–247. <https://doi.org/10.37253/ialltech.v7i1.10002>
- Li, J., & Xue, E. (2023). Dynamic Interaction between Student Learning Behaviour and Learning Environment: Meta-Analysis of Student Engagement and Its Influencing Factors. *Behavioral Sciences*, 13(1), 59. <https://doi.org/10.3390/bs13010059>
- Liu, C. Y., Wu, C. J., Chien, Y. H., Tzeng, S. Y., & Kuo, H. C. (2023). Examining the quality of art in STEAM learning activities. *Psychology of Aesthetics, Creativity, and the Arts*, 17(3), 382–393. <https://doi.org/10.1037/aca0000404>
- Lu, S. Y., Lo, C. C., & Syu, J. Y. (2021). Project-based learning oriented STEAM: the case of micro-bit paper-cutting lamp. *International Journal of Technology and Design Education*, 32(5), 2553–2575. <https://doi.org/10.1007/s10798-021-09714-1>
- Ngoc Truong, T. N., & Wang, C. (2019). Understanding Vietnamese college students' self-efficacy beliefs in learning English as a foreign language. *System*, 84, 123–132. <https://doi.org/10.1016/j.system.2019.06.007>
- Ngoc, T. T. N., Noordin, N., Ismail, L., & Yahya, Y. (2022). Revisiting views of grammar and grammar learning strategy use: A multiple case study in Vietnam. *Language Value*, 15(1). <https://doi.org/10.6035/languagev.6124>
- Nowell, L., Norris, J. M., White, D., & Moules, N. J. (2017). Thematic Analysis. *International Journal of Qualitative Methods*, 16(1). <https://doi.org/10.1177/1609406917733847>
- Onu, P., Pradhan, A., & Mbohwa, C. (2023). Potential to use metaverse for future teaching and learning. *Education and Information Technologies*, 29(7), 8893–8924. <https://doi.org/10.1007/s10639-023-12167-9>
- Oryza, F., Fitriah Asad, & Irma Soraya (2022). Presentation-Practice-Production (PPP): Elicitation Technique Used by the English Teacher to Teach Grammar. *FOSTER: Journal of English Language Teaching*, 3(3), 149–159. <https://doi.org/10.24256/foster-jelt.v3i3.104>
- Pham, T. T. H., & Tran, T. T. H. (2025). Literature review of STEM/STEAM teaching in Vietnam. *VNU Journal of Science: Education Research*. <https://doi.org/10.25073/2588-1159/vnuer.5250>
- Piaget, J. (1952). The origins of intelligence in children. International Universities Press.
- Richards, J. C., & Rodgers, T. S. (2014). Approaches and methods in language teaching (3rd ed.). Cambridge University Press.
- Rushton, E. A. C., Smith, E. R., Steadman, S., & Towers, E. (2023). Understanding teacher identity in teachers' professional lives: A systematic review of the literature. *Review of Education*, 11(2). <https://doi.org/10.1002/rev3.3417>
- Su, Y. S., Lai, C. C., Wu, T. K., & Lai, C. F. (2022). The effects of applying an augmented reality English teaching system on students' STEAM learning perceptions and technology acceptance. *Frontiers in Psychology*, 13.

- <https://doi.org/10.3389/fpsyg.2022.996162>
- Sumarni, W., & Kadarwati, S. (2020). Ethno-Stem Project-Based Learning: Its Impact to Critical and Creative Thinking Skills. *Jurnal Pendidikan IPA Indonesia*, 9(1), 11–21. <https://doi.org/10.15294/jpii.v9i1.21754>
- Sun, L., Hu, L., Yang, W., Zhou, D., & Wang, X. (2020). STEM learning attitude predicts computational thinking skills among primary school students. *Journal of Computer Assisted Learning*, 37(2), 346–358. <https://doi.org/10.1111/jcal.12493>
- Sung, J., Lee, J. Y., & Chun, H. Y. (2023). Short-term effects of a classroom-based STEAM program using robotic kits on children in South Korea. *International Journal of STEM Education*, 10(1). <https://doi.org/10.1186/s40594-023-00417-8>
- Tra, T. T., Sellars, M., & Le, T. T. (2022). Primary English Language Education Policy in Vietnam's Disadvantaged Areas: Implementation Barriers. *Education Sciences*, 12(7), 445. <https://doi.org/10.3390/educsci12070445>
- Trina, N. A., Monsur, M., Cosco, N., Shine, S., Loon, L., & Mastergeorge, A. (2025). Tools for Assessing the STEAM Learning Affordances and Quality of Outdoor Learning Environments of Childcare Centers: A Systematic Review. *Early Childhood Education Journal*, 54(3), 1091–1107. <https://doi.org/10.1007/s10643-025-01911-0>
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Yue, Z., Zhao, K., Meng, Y., Qian, X., & Wu, L. (2022). Toward a Better Understanding of Language Learning Motivation in a Study Abroad Context: An Investigation Among Chinese English as a Foreign Language Learners. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.855592>