

Project-based Learning in EFL educational settings: A meta-analysis study in EFL/ESL writing

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Abstract: As project-based learning (PjBL) has become very popular in education over the past few years, this study conducted a comprehensive meta-analysis to synthesize the effectiveness of PjBL in EFL/ESL writing by examining 11 articles based on databases of Scopus and Google Scholar from 2013 to 2023. The result reveals that PjBL had a significant positive effect size in EFL/ESL writing. Moreover, the effect sizes of some moderating variables were analyzed, including educational levels, sample size, research design, intervention duration, and group size. It was found that the most important moderating variable that affects the effectiveness of PjBL in EFL/ESL writing is intervention duration. The significant overall effect of PjBL on ESL/EFL writing implies the need for educators to consider using PjBL in language teaching and learning. Meanwhile future researchers might consider applying other moderating variables such as research design, instructional strategies, and student characteristics, to identify the best practices for implementing PjBL in ESL/EFL writing.

Keywords: EFL/ESL writing, effect size, meta-analysis, project-based learning



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1. Introduction

Teaching writing, which entails assisting students in developing the skills and confidence required to express themselves effectively through written communication, is one of the challenging tasks for teachers (Nurkamto et al., 2024). According to Rashid et al. (2022), the effectiveness of teaching writing may depend on how well the teachers utilize their teaching writing strategies. Hence, previous studies have focused on the results of the writing process and contrasted those results with various process techniques (Al-Wasy, 2020; Karlen & Compagnoni, 2017; Rafiq et al., 2023; Tian et al., 2024). The findings of such studies imply that educators need to comprehend and apply motivational strategies in teaching English as a second language (ESL)/English as a foreign language (EFL) writing (Camacho, 2021; Waddington, 2018).

A plethora of studies have investigated the effectiveness of teaching methods for writing, including genre-based approach, problem-based learning, and task-based language teaching (Hai-yan, 2014; Hermansson et al., 2019; Sari et al., 2021). Moreover, an increasing amount of scholarly work has acknowledged the potential of project-based learning (PjBL) in fostering writing proficiency. PjBL, an inquiry-based educational strategy, includes students in creating knowledge by having them complete tasks and produce valuable things (Brundiers & Wiek, 2013; Shin et al., 2021). It is distinct from other student-centered pedagogies in that it strongly emphasizes developing products that address real-world issues and the idea that students must work together to overcome real-world problems to successfully apply their newly acquired knowledge (Guo et al., 2020). As a continuous, real-world and daily-life-related learning strategy, PjBL sees learners as unique people who can build new knowledge using what they already know through an end-project that they work on collaboratively, encouraging participation and discourse while assisting learners in developing their language skills. As a result, PjBL has been proven to effectively promote language acquisition in various circumstances and levels, enhance language proficiency, increase positive learning attitudes, and promote reflective thinking in learners (Aghayani & Hajmohammadi, 2019; Quesada-López & Martínez, 2019).

In teaching writing, PjBL encourages students to write more effectively through authentic writing assignments (Argawati & Suryani, 2020). It requires them to produce written products based on actual issues or circumstances, such as reports, proposals, or research papers. This method frequently involves groups or teams of students working together. This cooperation can improve students' writing abilities by allowing for peer review and revision chances and by encouraging the growth of communication and interpersonal skills (Barus et al., 2021). Additionally, PjBL encourages students to participate in inquiry-based learning, which entails posing queries, gathering material, and synthesizing it that fosters the critical thinking and

analytical abilities necessary for good writing (Lestari et al., 2018) that also involves several drafts and revisions of written products, giving students a chance to get criticism from teachers and peers and then improve their writing in response to that input.

Some previous studies show that students write better after completing activities in the PjBL classroom (e.g. Alotaibi, 2020; Poonpon, 2017; Praba, et al., 2018). Poonpon's (2017) study examined Thai undergraduates students' perception of the effect of two-week project conducted in groups on a theme related to the role of information science in the society. At the end of the project the students had to present their writing. Following the completion of the project, the students thought that their writing was enhanced when PjBL was implemented in an interdisciplinary project. Research by Praba et al. (2018) showed a positive effect of PjBL on Indonesian ninth-grade students' writing. It was an experimental research applying one-group pretest-posttest design. The treatment was in the form of a project in developing recount texts. The study found that PjBL was effective in improving the students' achievement in writing recount texts. This is because in the PjBL, as Praba et al. (2018) explained, "potentially promotes students' critical thinking, communication, and creativity through collaborative work which benefits on students' writing skill" (p. 5). Similarly, Alotaibi (2020) conducted a quasi-experimental research involving two groups of secondary school students. The experimental and control groups were taught to write persuasive essays through four-week PjBL which applied 6 stages: motivation, modelling, planning, implementation, assessment, and public product. The result shows that the scores of persuasive texts of the students in the experimental group significantly outperformed those of the control group who experienced traditional way of teaching. Thus, secondary school students' level of persuasive writing performance in Saudi Arabia has significantly developed after receiving the explicit PjBL model.

While previous studies have highlighted the positive impacts of PjBL on writing proficiency, it is crucial to recognize the inherent limitations of conducting isolated investigations. While the aforementioned studies do offer encouraging results, their generalizability is often limited to specific contexts, methodologies, and scales. This complicates the process of gaining a comprehensive comprehension of the overall impacts of PjBL on EFL/ESL writing. Hence, although several studies have documented positive results regarding PjBL, a critical gap persists: the absence of a collective analysis encapsulating the broader effects and potential moderating variables of PjBL on EFL/ESL writing outcomes. This gap necessitates a deeper exploration through a meta-analysis that synthesizes and evaluates findings from diverse studies. Such an analysis goes beyond the confines of individual studies, providing a comprehensive perspective that reveals patterns that may elude investigations based on a single study, identifies subtleties, and potential limitations.

Therefore, this meta-analysis aims to fulfill this void by comprehensively reviewing the effects of PjBL on EFL/ESL writing, drawing on articles sourced from reputable databases such as Scopus and Google Scholar from 2013 to 2023. Furthermore, the present study aims to examine the impact of moderating variables, including educational levels, sample size, research design, intervention duration, and group size, on the implementation of PjBL in ESL/EFL writing. Chen et al. (2018) found that analysis of moderating variables contributed to the investigation of the links between prospective factors and learning outcomes. Therefore, this research endeavors to not only inform pedagogical practices but also contribute to the ongoing discourse on effective methodologies in EFL/ESL writing instruction. A meta-analysis is therefore conducted in order to investigate the following research questions:

1. What is the overall effectiveness of PjBL on EFL/ESL Writing?
2. What are the most important moderating variables that support the effective implementation of PjBL?

2. Theoretical Framework

2.1 Writing Strategies in ELT

As writing is known as the central pillar of language learning (Ardi et al., 2024; Ariana, 2018), the strategies in teaching ESL/EFL writing play a crucial part. Accordingly, previous studies have proved the effectiveness of teaching writing strategies in EFL classrooms. Anis and Anwar (2020) propose a novel way in teaching writing through the Self-Organized Learning Environment (SOLE) Teaching Approach. This learning and teaching concept allows the students to direct their learning, enabling them to comprehend the material independently. Moreover, another study suggested the flipped classroom as one instance of how to teach writing effectively (Ping et al., 2020). Students engage and learn to seek as much information from writing course materials, both within and outside the classroom, mainly when using technology. The students are given new information or have a solid basis in academic writing outside of the classroom through video lectures. When students are writing in class, teachers can utilize that time to scaffold individual learning, model thinking, provide instant feedback, clear up any misconceptions, and assist students in organizing, integrating, and applying their newly acquired knowledge (Walvoord & Anderson, 2010).

Besides the aforementioned teaching writing strategies, a gamut of literature has also suggested the effectiveness of project-based learning (PjBL) in teaching ESL/EFL writing in various educational levels and contexts. PjBL encourages students to pursue a solution in any way they see fit and is thought to be the most in line with their goals. In teaching writing, PjBL allows students to select the additional writing material they should study and the teaching methods they like (Li et al.,

2015). The students gain information and skills by working collaboratively over time to create an actual product, which they present (Collier, 2017). Due to its effectiveness to give the students practical experience, problem-solving skills, creative thinking, and knowledge of the scientific method, cooperation skills, and the ability to assess their performance (Nilsook et al., 2021), the present meta-analysis study provide a quantitative estimate of the extent to which PBL impacts ESL/EFL writing as well as the moderating variables that impact its effectiveness.

2.2 Project-Based Learning (PjBL) in EFL Writing

Widely known as an inquiry-based educational approach, project-based learning (PjBL) involves learners building knowledge by having them complete essential tasks and create valuable products (Brundiers & Wiek, 2013). The theoretical underpinnings of PjBL emerged from Dewey's (1916) and Kilpatrick's (1918) concept of education as a continuous, life-like experience that linked learning to life outside school. It has six characteristics, including a driving question, emphasis on learning objectives, engagement in learning activities, student collaboration, the use of scaffolding technology, and the production of tangible artifacts (Shin et al., 2021). PjBL differs from other student-centered pedagogies in that it emphasizes the creation of artifacts that address real-world problems and that learners must collaborate to solve real-world challenges to successfully integrate their new knowledge (Guo et al., 2020). PjBL contains five key components: projects-centered, questions- or challenges-focused, knowledge and skills construction, student-driven projects and real-life projects which are student-authentic. Also, PjBL focuses on collaborative learning, which promotes engagement and conversation in the classroom and helps students improve their language abilities (Bekiryazıcı, 2015).

In ESL/EFL learning, PjBL has commonly been used to develop learners' language learning at various levels and contexts. Sirisrimangkorn (2018) found that the student-centered end-product is helpful for learners' development of language skills. Moreover, PjBL activities promote students' attitudes toward learning in EFL classes, develop their motivation to use and encourage students to use reflective thinking, which benefits students' competencies in EFL (Aghayani & Hajmohammadi, 2019; Hasani et al., 2017; Praba et al., 2018). Regarding writing skills in particular, PjBL has positively impacted students' writing skills in both secondary and tertiary levels of education. It involves students solving complex, real-world problems through hands-on and collaborative projects by asking students to create written products, such as reports, proposals, or research papers that are based on real-world problems or situations, which motivate students to write more effectively and to take their writing more seriously (Guo et al., 2020).

PjBL often requires students to work in groups or teams where collaboration can enhance their writing skills by providing opportunities for peer feedback and

revision and promoting the development of communication and interpersonal skills. PjBL also encourages students to engage in inquiry-based learning, which involves asking questions, conducting research, and synthesizing information that help students develop critical thinking and analytical skills which are essential for effective writing. Typically, PjBL in writing involves multiple drafts and revisions of written products, which can provide students with opportunities to receive feedback from teachers and peers and to improve their writing based on that feedback (Lestari et al., 2018). Previous studies have highlighted the positive effect of PjBL on enhancing students' writing competence, promoting critical thinking, communication, and creativity, critical reading and writing performance, and level of persuasive writing performance (Aghayani & Hajmohammadi, 2019; Alotaibi, 2020; Poonpon, 2017; Praba et al., 2018; Zahran, 2018).

It was also found that PjBL improved their writing skills regarding organization, clarity, and coherence (Affandi & Sukyadi, 2016; Syarifah & Emiliyasi, 2019). Affandi and Sukyadi (2016) conducted research with mix-methods design to compare two methods of the teaching of argumentative writing, namely PjBL and Problem-based Learning (PBL). The quantitative element of the research aimed to compare effects of PjBL and PBL on students' argumentative writing achievement. The results of analysis showed that the two teaching methods were effective in improving the students' skills in argumentative writing with its components, namely content, organization, language use, vocabulary and mechanics. Data from the interview showed that students thought that PjBL enabled them to be more critical and aware of text coherence and organization. Meanwhile, Syarifah and Emiliyasi (2019) research explored students' opinions after being taught to write narrative texts by using PjBL. The findings showed that the students' thought that after being engaged in writing through PjBL, they developed their "ability and creativity in writing narrative essays" (p. 87). Regardless of the abundant research on PjBL conducted in various designs, a meta-analysis study is needed to fully understand the impact of PjBL on students' writing outcomes and to identify the most important moderating variables of PjBL practices for improving ESL/EFL writing.

2.3 Moderating Variables of PjBL in Writing

This research analyzes five moderating variables to determine whether other factors would impact the effectiveness of PjBL in ESL/EFL writing. Chen et al. (2018) found that analysis of moderating variables helped them investigate the connections between antecedent factors and final results. The moderating variables analyzed in the present study include educational level (secondary education and tertiary education), sample size (1-50 and 51-100), research design (true experimental research and quasi-experimental research), intervention duration (4 weeks, 8 weeks, and 10 weeks), and group size (individual, two students, and three students). For the purpose of identifying potential effects of various research

factors, the first three variables were coded. The final two were coded to examine how activity design influences PjBL's influence on the learning outcomes of EFL students.

Educational Level

A growing research literature has examined the impact of PjBL on students' writing at various educational levels. Although the majority of research on PjBL focused on university students (Nunn, 2020; Sa'diyah & Cahyono, 2019; Sukerti & Yuliantini, 2018) several of them also addressed secondary students (Lu, 2021; Nurhajati, 2016). At all educational levels, there seems to be some evidence that PjBL benefits students' writing abilities, with the effect being largest at university.

Sample Size

Sample size refers to the number of individuals or subjects that are included in the experimental studies which are analyzed in this meta-analysis study. The sample size is a crucial factor in determining the statistical power of a study, which refers to the ability of the study to detect a significant effect if it exists (Kokotsaki et al., 2016). The sample size in this study is categorized into two groups namely 1-50 and 51-100. A study by Giawa (2022), for example, examine the effectiveness of PjBL in writing with a sample size of 78, and Alotaibi (2020) used a 59 sample size to investigate the effect of PjBL on persuasive learning.

Research Design

Previous studies examining the impact of PjBL on students' writing abilities employed true experimental or quasi-experimental research (Alotaibi, 2020). True experimental research randomly assigns participants to different groups and manipulates an independent variable to measure its effects on a dependent variable. Quasi-experimental research, on the other hand, does not randomly assign participants to groups or manipulate an independent variable. Instead, this research designs compares groups that already exist or naturally occur, such as comparing the learning outcomes of a treatment group to the learning outcomes of a control group (Cobb et al., 2003). The different design used in the research are analyzed to see the effect of moderating variables to the effectiveness of PjBL in EFL/ESL writing.

Intervention Duration

The intervention duration for experimental research can vary depending on the nature of the research question, the type of intervention being studied, and the study design (Ross & Morrison, 2013). In general, the intervention duration should be adequate to allow for the intervention to have an effect. The intervention

duration should be carefully considered in relation to the sample size of the study and the statistical power, as a longer intervention duration may require a larger sample size to detect significant effects. As one of moderating variables to the effectiveness of PjBL in ESL/EFL writing, this study classified the intervention duration into three categories namely 4 weeks, 8 weeks, and 10 weeks. The variation of the duration intervention among the experimental studies are assessed to see the degree of their influences on the effectiveness of PjBL in students' writing.

Group Size

The group size for PjBL might vary depending on some criteria, such as the project's objectives, its complexity, and the availability of resources (Kokotsaki et al., 2016). Individual projects, small group projects, and larger group projects are all viable group sizes for PjBL in general. Individual projects may be suitable for easier assignments in which students can individually accomplish a job or investigate a topic. Small group projects may be acceptable for more challenging assignments where students can share ideas and workload with one or two peers. Complex tasks that involve the input of several individuals with diverse skill sets and viewpoints may be suited to larger group initiatives. In analyzing the group size as the moderating variable on ESL/EFL learners' writing, the present study classified three group size that consist of an individual student, two students, and three students. The obtained data of classification were then analyzed to see their effect on the effectiveness of PjBL.

2.4 Review of the Included Studies for Meta-analysis

Using several set of criteria such as the application of PjBL on EFL/ESL writing, research method and adequate statistical data, we obtained 11 studies that were analyzed in this meta-analysis study. All of these studies investigate the effect of PjBL on writing. However, it is noted here that the analyzed studies had different dependent variables.

Alotaibi (2020) investigated the effect of PjBL on students' persuasive writing where a pre- and post-test in form of a persuasive essay were used to determine progress and growth over a certain amount of time at students' persuasive writing performance which is scored using Rachlin's (2008) persuasive essay scoring rubric. Sadeghi et al. (2016) had comparison and contrast paragraph writing as the dependent variable, which was measured through a pre and posttest, and analyzed using Soleimani et al. (2008) comparison and contrast scoring module. Sa'diyah and Cahyono (2019) investigate the effect of PjBL in students' blogging writing across self-efficacy levels that were measured through writing tests and Bandura's (2006) self-efficacy questionnaires. In this study, students' opinion essays and the questionnaire were marked Jacobs et al. (1981) recommendation. Some studies have the same dependent variable where they investigated the effectiveness of PjBL

on students' writing achievement at tertiary and secondary level (Affandi & Sukyadi, 2016; Aghayani & Hajmohammadi, 2019; Cahyaningrum & Widyantoro, 2020; Sari et al., 2021). They measured students' writing ability in writing essay text which was measured by using pre- and post-test. Setiawan and Herlambang (2022) examined the effect of PjBL on students' writing ability to write explanation text. Pre- and post-test were also used to measure the result of the intervention given to both experimental and control groups. Abbasian et al. (2017) focused on comparison and contrast paragraph writing skills of Iranian EFL students as the dependent variable. They used a comparison and contrast scoring module developed by Soleimani et al. (2008) to analyze the students' writing scores. The results were analyzed using t-test to assess whether the mean scores of pretest and posttest were statistically different from each other. Asrul et al. (2019) investigated students' achievement in writing narrative text as the dependent variable. The pretest and posttest were written in form of a narrative text with the theme "fable" that is decided by the researcher. The students' writing scores were analyzed using the t-test. Pohan (2020) investigated the secondary students' recount text skill as the dependent variable. The data were collected using pretest and posttest that the students wrote the simple recount text. The analysis of data used one sample t-test with a significance level 5%. These 11 studies have met the criteria of our research context and were used to be analyzed in this meta-analysis study.

3. Methods

3.1 Research Design

This study uses a meta-analysis methodology. A meta-analysis is essentially a review of prior research to get an integrated conclusion. A researcher evaluates previously published studies on a subject, examines the various findings, and looks for general patterns in the studies (Chan & Arvey, 2012). Meta-analysis has been used in language learning to evaluate advancement over time. In order to determine the impact of the instruments used, meta-analyses interventions have been used to compare data from experimental or quasi-experimental studies.

3.2 Search Strategy

We searched for relevant publications for this meta-analysis. The primary studies were obtained using Scopus and Google Scholars databases in the first phase. These databases were searched using the following two sets and combinations of keywords: PjBL and teaching writing, and EFL/ESL and writing. The data bases such as Linguistics and Language Behavior Abstracts, ERIC, and ProQuest were also used to expand our literature search. We have also focused our search on the writing journals such as *Journal of Second Language Writing* and *Assessing Writing Journal*.

However, the obtained articles were limited to our inclusion criteria based on our research context.

3.3 Inclusion and Exclusion Criteria

The literature search produced 6,134 journal articles as a result. We thoroughly scrutinized the titles and abstracts of the discovered articles to select the most relevant studies that matched the objectives and methodology of this investigation. The most crucial consideration, however, is that they must be clear and have sufficient information to address the research questions.

In this investigation, we considered three inclusion criteria. First, included studies must investigate the impact of PjBL on EFL/ESL writing skills; studies that employed strategies other than PjBL to develop EFL/ESL writing skills were excluded. Second, only experimental and quasi-experimental studies were included, whereas qualitative, descriptive, and correlational studies were excluded. Third, only studies with unambiguous data on means, standard deviations, *t* or *F* values, and the number of participants in each group were included; studies with insufficient data on any of the aforementioned elements were excluded. Following the application of these inclusion and exclusion criteria, eleven studies were included in this meta-analysis (see Figure 1).

3.4 Coding Procedures

This meta-analysis included studies that were coded for several variables. Some of these variables provided only descriptive information about these studies, such as the name of the researchers, the title of the journal, and the date of publication. Other variables that described the procedures used in these studies are educational level (secondary education and tertiary education), sample size (1-50 and 51-100), research design (true experimental research and quasi-experimental research), intervention duration (4 weeks, 8 weeks, and 10 weeks), and group size (an individual student, two students, and three students). The effects of various research characteristics were coded into the first three variables. The latter two were coded to investigate how activity design influences the impact of PjBL on the learning outcomes of students' EFL writing.

3.5 Calculating Effect Size

The current meta-analysis calculated Cohen's effect size to show the effectiveness of PjBL in ESL/EFL writing. The calculation of the effect size is divided into four steps (Borenstein et al., 2021). First, the effect size of each article was determined. Second, Hedges' *g* was utilized to determine the total weighted effect size. Third, the confidence interval of the average effect size was calculated using a random effect model. Fourth, the *Q*B value was utilized to calculate the effects of moderating

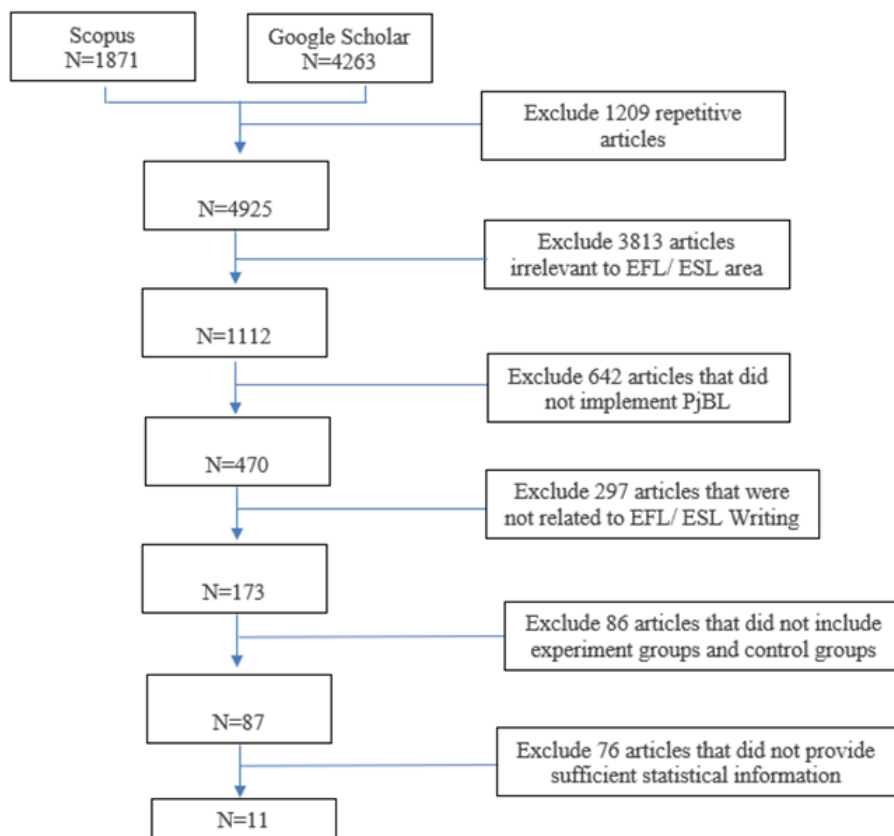


Figure 1: The search results.

variables. A random effect model was utilized to examine the effect size of moderator variables.

4. Findings

In this section, the overall impact size of the eleven articles will be discussed. These studies are analyzed across a variety of categories. First, the impact of PjBL on ESL/EFL writing as a whole is discussed. Then, an analysis of the moderating variables that most influence second language (SL)/foreign language (FL) writing acquisition will follow this discussion.

4.1 The Overall Effect of PjBL in EFL/ESL Writing

The effect of PjBL on ESL/EFL writing is summarized in Table 2 based on the preliminary analysis of eleven studies.

Table 1. Overall effect of PjBL in ESL/EFL writing

k*	Point Estimate	SD Error	Confidence Interval		p-value	Q-value	df(Q)	I-squared
			Lower	Upper				
11	0.691	0.216	0.267	1.115	0.001	50.812	10	80.426

Note: k = number of studies

The meta-analysis demonstrates a significant overall effect of PjBL on ESL/EFL writing with a point estimate of 0.691, which falls within the 95% confidence interval of 0.267 to 1.115. The p-value of 0.001 indicates that the effect of PjBL on ESL/EFL writing is statistically significant positive effect size. The Q-value (50.812) and I-squared statistic (80.426) reveal a high level of heterogeneity among the 11 studies, suggesting that there may be variability in the implementation and outcomes of PjBL in ESL/EFL writing contexts.

4.2 Analysis of Moderating Variables that Affect the PjBL in ESL/EFL Writing

The significant heterogeneity among the studies indicates that the effect of PjBL on ESL/EFL writing may vary depending on certain factors. Therefore, the study also analyzes the moderating variables that mostly affect SL/FL writing learning as shown in Table 2. The moderators that might influence the implementation of PjBL in ESL/EFL writing were categorized according to their potential influence on the integration of PjBL. Detailed explanations of the analysis of the five moderating variables are provided in the following section.

Educational Level

With regard to the types of educational level, the results demonstrated that the effect size for tertiary education reached larger effect size ($g=1.006$) than that for secondary education ($g=0.365$). In addition, the Q_b reached significance ($Q_b=5.118$, $df = 1$, $p = 0.023$), indicating that there was a significant difference in effect size among different educational levels.

Sample Size

With respect to sample size, it was discovered that samples with 1 to 50 participants had the biggest effect size ($g = 0.867$), followed by samples with 50 to 100 participants ($g = 0.284$). According to the Q_b , which was significant ($Q_b = 8.249$, $df = 1$, $p = 0.004077$), the sample size of these two groups varied significantly.

Table 2. The analysis for moderator variables

Variables	Category	No. of studies	Proportion of studies	g	z	Qb	df	p
Educational level	Secondary education	5	45.45	0.365	1.532	5.118	1	0.023
	Tertiary education	6	54.55	1.006	3.123			
Sample Size	1-50	8	72.73	0.867	3.479	8.249	1	0.004
	51-100	3	27.27	0.284	0.724			
Research design	true-experimental research	2	18.18	1.208	5.581	11.268	1	0.000
	quasi-experimental research	9	81.82	0.562	2.316			
Intervention duration	4 weeks	6	54.55	0.277	1.322	28.839	2	0.000
	8 weeks	3	27.27	1.157	3.719			
	10 weeks	2	18.18	1.55	5.803			
Group size	Individual	7	63.64	0.426	1.812	20.432	2	0.000
	Two students	2	18.18	0.865	1.641			
	Three students	2	18.18	1.562	6.021			

Research Design

The analysis reveals that the research design significantly moderates the effect of PjBL on ESL/EFL writing. The results indicate that true-experimental research studies (n=2) make up 18.18% of the included studies, while quasi-experimental research studies (n=9) comprise 81.82%. The true-experimental research studies have a higher effect size (g=1.208, z=5.581, p=0.000) compared to the quasi-experimental research studies (g=0.562, z=2.316). The differences between the two categories are statistically significant, with a Qb value of 11.268 and a p-value of 0.000.

Intervention Duration

In terms of intervention duration, the findings showed that the effect size for 10 weeks (g= 1.55) was the highest, followed by 8 weeks (g= 1.157), and 4 weeks (g= 0.277). Additionally, the Qb was significant (Qb= 28.839, df = 2, p = 0.000), indicating that the length of the interventions varied significantly among the three groups.

Group Size

Regarding group size roles, the results indicated that the three-person group size had the largest effect size ($g=1.562$), followed by the two-person group size ($g=0.865$), while the one-person group size showed the least effect size ($g=0.426$). It was also revealed that there was significant difference in the average effect size among the three types of group size domains ($Q_b=20.432$, $df=2$, $p\text{-value}=0.000$).

5. Discussions

5.1 The Overall Effect of PjBL in EFL/ESL Writing

The results of the meta-analysis study revealed that PjBL have a significant positive effect on ESL/EFL writing. Based on the findings, it is worth noting that as students work on projects that are relevant to their interests and needs, they are more likely to get involved in the learning process and to put in greater effort. This can result in better learning outcomes, particularly in the area of writing, where students need to practice and receive feedback on their skills. This point has been emphasized in previous studies showing that PjBL can be a more effective approach to teaching writing than traditional methods that rely on grammar drills and isolated writing exercises (Aghayani & Hajmohammadi, 2019; Budianto, 2017). By integrating writing into a project that involves real-world tasks and problem-solving, students can develop their writing skills in a more authentic context (Ramadhan et al., 2020). They can also learn to collaborate and communicate effectively in English, which are essential skills for success in academic and professional settings.

5.2 Analysis of Moderating Variables that Affect the PjBL in ESL/EFL Writing

The second objective of this study was to identify the most influential moderating variables that support the effective implementation of PjBL. In response to this question, we analyzed the influence of the five moderating variables on the effects of PjBL in EFL/ESL writing. This analysis is discussed in detail below.

Educational Level

The findings indicated that there was a significant difference in effect size among different educational levels. Therefore, educational levels can influence the effectiveness of PjBL in EFL/ESL writing. Furthermore, the results indicated that tertiary education had a larger effect size than secondary education. This result was in line with the argument that PjBL has been widely understood to be a promising approach to improve students' learning in higher education as it cultivates their professional skills or transferable skills students need in the workplace (Guo et al., 2020; Holmes, 2012). PjBL was also known for its ability to raise students'

competitiveness and promotes the development of the society in the long term (Crosling et al., 2015). As for its lower effect in secondary education, we agree with Hallermann et al. (2016) who viewed that PjBL is hard to pin down as its much dependence on the particular circumstances in a school and the quality of classroom implementation.

Sample Size

In terms of sample size, the finding showed that there was a significant difference in effect size between various types of sample size. This finding suggested that the effectiveness of EFL/ESL writing was significantly influenced by the sample size of 1–50 participants. Depending on the complexity of the project and the learning objectives, different sample sizes could be used to perform project-based learning. It was effective with samples of various sizes (small ($n \leq 50$), medium ($51 < n \leq 100$), and large ($n > 100$). This study discovered that a small size of the research sample indicated the effectiveness of EFL/ESL writing. This finding was consistent with the research conducted by Balemien and Keskin (2018) showing that PjBL was shown to be most successful in studies with a small-scale sample size and quite effective in studies with medium- and large-scale sample sizes.

Five out of the eleven studies in this analysis used small sample size. These are acceptable for moderator analysis as the goal of the studies were exploratory rather than confirmatory (Int'Hout et al., 2015; Marot et al., 2009), as in the analyzed studies of Abbasian et al. (2017), Sa'diyah and Cahyono (2019), Sadeghi et al. (2016), and Sari et al. (2021), which aimed to help generating hypotheses or insights for future research. The small sample size was also tolerable in this analysis since some studies faced limited data availability due to certain constraints that researchers could only work with smaller sample size as in the analyzed study of Asrul et al. (2021), hence, the analysis still could provide valuable insights (Int'Hout et al., 2015; Marot et al., 2009; Tipton, 2015).

Research Design

This study suggests that the effectiveness of PjBL in ESL/EFL writing may be influenced by the research design employed in the studies. True-experimental research designs, which involve random assignment and control groups, might provide more reliable and accurate results compared to quasi-experimental designs that lack these features. This point has been highlighted in previous studies (e.g. Qasim et al., 2014; Williams, 2007) which suggested that true-experimental study provides higher level of reliability than quasi experimental study. However, conducting such studies are quite challenging in the educational context where the curriculum has been set for the students. Hence, quasi-experimental studies become the best alternative to conduct experimental study.

This meta-analysis prioritizes studies with robust methodologies and control groups to ensure the reliability of the synthesized findings and the consistency of the methodology used, and to reduce the variability in the dataset (Chambers et al., 2015; Hunter et al., 2014; Zakzanis, 1998). A number of previous studies without a control/comparison group and adequate statistical information have been excluded from this analysis in order to maintain the overall quality of the analysis, lower the risk of bias, improve the comparability of the findings for a more coherent analysis, and ensure that the results are based on reliable and quantifiable information.

Intervention Duration

The effectiveness of EFL/ESL writing was significantly affected by intervention duration, as seen by the significantly varying effect sizes among the various intervention durations. The findings showed that an intervention duration of 10 weeks had the greatest effect size. Through the completion of a project, PjBL engaged students in learning by doing that focused on the development of skills and knowledge. The complexity of the project and the learning objectives can affect how long it takes to complete. Based on the findings of the study, the most beneficial intervention duration is 10 weeks. This result was consistent with a study by Chevalère et al. (2021) showing that students were exposed to topics for a period varying from four to ten weeks. However, a clear timeline and plan for the project were needed to guarantee that the project was finished on schedule and that the students were able to achieve the learning objectives.

Group Size

The results also demonstrated a significant difference in effect size among various group sizes, which indicated that group sizes had a significant impact on PjBL effectiveness in EFL/ESL writing. The results revealed that three-person group size had the largest effect size than two-person and one-person group size. This finding was in line with the general assumption that PjBL works best when students autonomously and purposefully collaborate toward the completion of a project (Dado & Bodemer, 2017) as they find solutions together to the driving question and develop understanding of the relevant concepts (Krajcik & Czerniak, 2014). However, the smaller group sizes also showed positive effect in this study, as they apparently showed more motivation to learn during the project, share ideas and get peer feedback that assist them engage in reflection, expand their knowledge, and revise artifacts (Amalia et al., 2023; Chen & Yang, 2019). Nonetheless, the recommended group size for PjBL has been varied, some suggested work groups of two to four as a group of five or more makes it more challenging to ensure that each student contributes to the group effort and has a significant voice in team discussions (Hallermann et al., 2016). The researchers' views are in line with those who favored smaller collaborative team (Bertucci et al., 2010) as it is better suited

for students who have not yet learned teamwork skills during the PjBL and it will consume more time blocks in the teaching practice when the teacher intended to train every student's teamwork skills to complete the project.

The above discussion revealed that the most important and influential variable on supporting the effectiveness of PjBL in EFL/ESL writing is intervention duration ($QB = 28.839$). The results of the analysis reveal that longer intervention durations tend to produce better outcomes in terms of writing proficiency. This finding is consistent with the notion that PjBL requires time to allow students to engage in authentic and meaningful writing experiences, which can lead to deeper learning and improved writing skills (Ma, 2015). Therefore, it is essential to consider the intervention duration when designing and conducting experimental studies to ensure that sufficient time is given for PjBL to have a meaningful impact on writing skills.

5.3 Theoretical Implications

The results of the meta-analysis reveal significant implications for educational theories surrounding PjBL in the context of ESL/EFL writing. The findings emphasize the importance of aligning instructional strategies with students' interests and needs. The positive effect of PjBL on writing proficiency emphasizes the value of authentic, real-world tasks in fostering deeper engagement and learning outcomes. This aligns with theoretical frameworks advocating for student-centered approaches that promote active participation and meaningful learning experiences (Aghayani & Hajmohammadi, 2019; Cahyono et al., 2023). Furthermore, these results contribute to the ongoing discourse on the effectiveness of PjBL as a more advantageous approach compared to traditional methods in enhancing writing skills.

5.4 Methodological Implications

The moderating variable analysis in this study clarifies important methodological issues that need to be taken into account when using PjBL in ESL/EFL settings. Since the effects of educational level, sample size, research design, length of intervention, and group size vary, it is important for researchers to carefully consider these elements when designing studies. The results indicate that PjBL's efficacy may vary depending on sample sizes and educational levels, necessitating customized strategies for various student cohorts. Furthermore, the inclination towards specific research designs and durations of interventions highlights the methodological difficulties involved in carrying out experimental studies in educational environments. In order to improve the validity and dependability of findings in this field, researchers ought to take these subtleties into account while planning future investigations.

5.5 Pedagogical Implications

Practical implications derived from this meta-analysis highlight the pedagogical significance of integrating PjBL into ESL/EFL writing instruction. Educators and curriculum designers can leverage these findings to design more student-centric learning experiences that prioritize real-world problem-solving, collaborative communication, and authentic writing tasks. Understanding the optimal intervention durations, group sizes, and the significance of project complexity in driving learning outcomes can guide educators in structuring PjBL activities effectively. This emphasizes the need for teacher training and professional development initiatives geared toward facilitating successful PjBL implementation in language learning contexts. Additionally, policy-makers might consider advocating for the integration of PjBL approaches into curriculum frameworks to enhance students' writing proficiency and essential skill development.

6. Conclusions

The main objective of the present study was to use a meta-analysis design to determine the overall effectiveness of PjBL in EFL/ESL writing. The finding of this study has generally shown that PjBL has a positive effect on the improvement of the learning of EFL/ESL writing. As regards the moderating variables, an analysis to five moderating variables namely educational levels, sample size, research design, intervention duration, and group size shows that intervention duration ($QB=28.839$) is the most important and influential variable on supporting the effectiveness of PjBL in EFL/ESL writing. When the education level was concerned, PjBL displayed a larger effect on tertiary students than on secondary students. Regarding intervention duration, 10 weeks duration was shown to be the most beneficial, followed by 8 weeks and 4 weeks. In terms of the sample size, PjBL had a more substantial impact with 1-50 participants than 50-100 participants. Concerning to research design, true-experimental research performed better than quasi-experimental research in implementing PjBL. Regarding group size, three-person group size had the most significant effect compared to two-person group size and one-person group size.

The findings of this study showed the promising implementation of PjBL in EFL/ESL writing in the future. Yet, this study was constrained by some limitations. First, only 11 articles met the meta-analysis criteria, thus, generalizing these findings should be done with caution. Future research should broaden the data sources in order to gather additional studies and a better understanding of the impacts of PjBL in EFL/ESL writing. Second, this meta-analysis only investigated the effects of 5 moderator variables, so future studies should examine the impacts of other moderator variables as the effect of PjBL on student learning is still debatable due to its similarities with problem-based learning (PBL). Additionally, future studies integrating technology in PjBL for ESL/EFL writing are also suggested as it has the

potential to motivate students to complete projects and improve their writing competences.

The findings of this meta-analysis have several implications for educators, researchers, and stakeholders involved in teaching ESL/EFL writing. The significant overall effect of PjBL on ESL/EFL writing supports the integration of PjBL in language teaching and learning. Educators should consider incorporating PjBL strategies into their lesson plans to improve students' writing abilities. However, given the high level of heterogeneity among the studies, it is crucial to examine the specific factors that may influence the effectiveness of PjBL in different contexts. Researchers should conduct further investigations into moderating factors, such as research design, instructional strategies, and student characteristics, to identify best practices for implementing PjBL in ESL/EFL writing. Moreover, stakeholders should also recognize the potential benefits of PjBL in ESL/EFL writing and support professional development opportunities for educators to learn about and implement effective PjBL strategies. Additionally, they should promote research to better understand the factors that contribute to the success of PjBL in ESL/EFL writing and use these findings to inform policy and practice.

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