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Project-based learning and digital literacy integration: Investigating task design and student collaboration in developing academic writing and thesis skills in EFL classrooms

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Abstract
With the increased emphasis on teaching advanced writing skills to foreign learners of English, this study looked at how project-based learning, university students' collaboration in writing and digital knowledge can assist in developing academic writing proficiency. The main purpose was to analyse how using a PBL method, with digital support, influences writing for EFL students and what role digital tools play in the process. An experimental pre-test/post-test design was applied in the study. A total of 94 undergraduate students participated in the study, segmented into two groups: the experimental group (EG) and the control group (CG). Evaluation of data was performed using standardised writing exams, a DLCQ and a CLPS which showed good validity via CFA and reliable results (Cronbach's α greater than .85). With ANCOVA, we found the EG achieved significantly higher post-test writing scores $F(1,91) = 21.394$, $p < .001$, $\eta^2 = 0.190$). MANOVA also confirmed that there were significant interactions between the instructional group and digital literacy on each writing subskill. It was shown through Structural Equation Modelling that digital tools played a major role ($\beta = 0.37$, $p < .001$) by boosting the impact of PBL on academic writing skills. These results are in line with constructivist and TAM theories, pointing out that writing is both a social and technology-related practice. It is concluded that achieving advanced writing in EFL settings needs combining genuine project design, teamwork and digital methods and three main actions are put forward by the study for this purpose: systemic curriculum reform, boosting teachers' competence and more suitable digital tools.

Keywords: academic writing development, digital literacy integration, collaborative learning, English as a Foreign Language (EFL), Project-Based Learning (PBL)

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1. Study Background and Context

Over the last few decades, English as a foreign language (EFL) programme have moved from the old, one-directional approach to using active, technology-aided methods in group learning (Khalsoom et al., 2025). Such a change is needed to help students gain crucial 21st-century skills, including working with technology, analysing situations and communicating in academic ways (Rahardi et al., 2023; Chahrazad & Menezla, 2019). At the heart of this change is the development of project-based learning (PBL) which follows constructivist thinking by asking students to engage in real-world style learning tasks (Latifaj, 2022). In particular, the EFL world—with many courses requiring academic writing—provides a useful setting for instruction that encourages students to develop thesis arguments.

While PBL seems to have a strong connection to academic writing instruction on paper, research looking at how it is done, especially in online and multilingual contexts, is still not common. While it is clear digital tools increase writing fluidity and learner independence (Yunus et al., 2013), tasks that appropriately blend technology with group and project activities do not always follow a common plan. It takes careful orchestration by educators to ensure such practises are effective, since this comes from well-designed challenges, opportunities for peers to help and lots of feedback (Wang & Wang, 2024; Liu & Zhang, 2024). With digital literacy now considered a main academic ability in EFL, questions about how it impacts writing and student engagement are important to study (Deiniatur & Cahyono, 2024; Al-Awawdeh, 2017).

The central idea in this research is that carefully designed digital PBL tasks in the context of group classes in EFL may help students develop key writing abilities and learn how to form strong theses (Arrif et al., 2025). Unlike using writing exclusively on your own, tasks in PBL help students work together, talk through their understanding, make use of different tools and benefit from each other's feedback and that of the teacher. Because of these discussions, students practise merging ideas, arranging arguments and expressing academic points of view which are key skills for writing a thesis. For this reason, the study suggests that EFL academic writing instruction be centred on collaboration, how tasks are made and digital abilities used together.

The gap that exists between what EFL students achieve in their writing and the strategies taught to support them—at advanced levels of thesis writing—is the focus of this study. University students generally deal poorly with writing requirements, mainly because there is not enough use of methods that blend brain, computer and social aspects of education (Alzubi et al., 2024; Torks et al., 2025). Additionally, the use of digital tools is commonly limited to assisting, instead of changing learning and practises for teamwork are not well-structured enough for meaningful interactions. Such fragmentation in teaching techniques limits how well students write and use their skills in true school situations (Hamouma & Menezla, 2019).

As a result, the focus of the study is on upper-intermediate and advanced EFL learners completing writing tasks within research or thesis modules at the tertiary level. The purpose of the study is to look at how digital literacy and tasks designed with PBL inform both writing skills, students' engagement and their ability to cooperate. This research takes from empirical and theoretical perspectives in applied linguistics, educational technology and curriculum design to address the current lack of information on putting integrated writing pedagogies into practice (Ismail & Daud, 2021; Sartika et al., 2022). It is intended to provide practical advice for educators and curriculum makers hoping to modernise written English lessons in digitally rich and multilingual educational settings.

The following specific objectives are posed to guide this research:

a. To explore how project-based task design integrated with digital tools affects EFL learners'

academic writing and thesis development.

b. To investigate the role of structured student collaboration in enhancing writing quality in digitally mediated EFL classrooms.
c. To examine the challenges and affordances of integrating digital literacy into academic writing instruction for EFL learners.

1.1. Research Questions

i. How does the integration of project-based task design and digital tools impact the academic writing and thesis development skills of EFL learners?
ii. In what ways does structured peer-collaboration influence writing performance and engagement in EFL academic writing tasks?
iii. What are the perceived challenges and affordances of embedding digital literacy into academic writing instruction among EFL students and instructors?

2. Literature Review

2.1. Project-Based Learning in EFL Pedagogy

Project-based learning (PBL) has become widely used in teaching languages because it combines practical communication skills with learning specific topics through activities designed for and by students. Using socio-constructivist principles, like Vygotsky's core idea of the Zone of Proximal Development, PBL collaboratively involves all learners in deeper thinking and language use (Storch, 2005 Arochman et al. 2024). In many EFL classes, learners find it hard to apply what they practise in class to genuine conversations. PBL addresses this by making tasks and learning goals relevant to real situations outside of the classroom (Latifaj, 2022; Nwaikpo, 2025). For this reason, PBL helps a lot in teaching academic writing because it requires being fluent in the language, able to think creatively and sustainable in working with texts.

Centrally, PBL is based on bringing together experiential learning and constructivist language ideas, so students participate in making their knowledge rather than receiving it. This approach gives students in EFL writing classes an opportunity to work together to understand, edit their work carefully and meet the standards of academic writing. Nevertheless, the method helps learners develop autonomy and pay attention, but its outcomes mainly depend on how well activities are designed with linguistic exercises in mind. A lot of studies point out that in the absence of strong pedagogical support, PBL often becomes a simple group work with little academic interest (Cahyono et al., 2024; Liu & Zhang, 2024). Experimental studies confirm that PBL supports learner' writing skills, vocabulary use and the way their speech is organised. According to Aghayani and Hajmohammadi (2019), participation in project tasks over time enhanced students' facility with sentence structure and their sense of how spoken language should be structured. Arochman et al. (2024) also proved that EFL students involved in organised PBL projects made good progress in writing arguments and constructing a thesis. This study highlights how writing which naturally repeats, is helped by instruction that also repeats through projects. Even so, it is difficult to put PBL into practice in classrooms where there are many languages, because of issues with teacher training and linking tasks to writing used in school.

2.2. Digital Literacy and Academic Writing Development in EFL Contexts

Digital literacy which means assessing, making and sharing information digitally, is now required for success in academic and language fields. For those learning English as a foreign language, digital literacy means using various media to write, searching the internet ethically and knowing how to use digital

texts (Dhillion et al., 2025). With digital literacy, EFL learners have the skills to get involved in scholarly discussion, use technology to develop their ideas and keep academic integrity. Since digital literacy and writing development are so important, language education relies on their link (Deiniatur & Cahyono, 2024).

Current research points to the strong ways digital tools help academic writing, especially by guiding copyedited work; group input; and a student's ability to learn independently. In particular, Yunus et al. (2013) revealed that writing on blogs encourages students to improve their writing on their own based on interactions they receive with others. These tools change the way students interact with writing by allowing them to write and publish content themselves. Yet, for this process to happen well, digital literacy should move beyond simple platform use and address how critical evaluation of information is included (Al-Awawdeh & Khalsoom, 2022).

In this study, digital literacy acts as both a mediating factor and an important influence on student project-based work. With digital abilities built into academic writing tasks, this study attempts to understand writing both in theory and in practice for EFL students. It presents digital literacy as a way to encourage learners to become more skilled with texts, take responsibility for their learning and keep up with their school work (Deiniatur & Cahyono, 2024; Rahardi et al., 2023). The purpose of this blending is to reinterpret academic writing as a form of exchange guided by collaboration and digital tools, positioned across the world's networks for information.

2.3. Review of Empirical Studies

Studies into PBL in EFL academic writing have found positive results, even though their methods have been very different. In particular, Aghayani and Hajmohammadi (2019) found that using PBL in Iran helped EFL learners secure noticeable achievements in writing coherence, choice of vocabulary and understanding of language structure. While lessons in this field are planned with great care, they usually focus on numbers, leaving qualitative data that might display student thinking and experiences out of the picture. As a result, it is difficult to generalise about teaching and learning and there is a growing need for methods that combine different approaches to assess both how students do and their experiences in PBL.

Similarly, Arochman et al. (2024) set up a quasi-experimental study to determine if PBL can develop the academic writing abilities of Indonesian university students. After taking part in regular project cycles, students were shown to make advances in making arguments, analysis and controlling language. That said, the study did not take into account that digital tools are now a major part of academic writing. Nevertheless, despite its well-established pedagogical use, its best use in richly technology-based settings is not well understood (Khasaneh & Al-Awawdeh, 2024).

Rahardi et al. (2023) added a fresh perspective by using students' voices to help assess how PBL supports the learning of languages and general skills for the 21st century. What their data shows is that working on projects with others improves motivation and metacognition, mainly for courses that involve a lot of writing. Even so, depending on what learners report themselves introduces worries that their views may be coloured by wanting to look good or by remembering events in a flattering light. Using a mix of student opinions, written samples and peer feedback could help us see deeper into the way learning happens in PBL settings.

The use of technology in teaching writing is discussed by Yunus et al. (2013), who had students use blogs to support their written studies. The researchers report that writers can use online tools in repeat cycles to refine their work and reflect more independently. Still, the study does not fully explore how these practices connect to general digital literacy, so it treats technology much more as just a means

to an end than a key tool for change. Here, we extend this idea by also viewing digital literacy as a basic support for academic agency (Nwaikpo, 2025).

Deiniatur and Cahyono (2024) added to the discussion by looking at how new EFL teachers use digital tools for scholarly writing. The research points out that although technology is everywhere, not all teachers are confident in manipulating it in their lessons. This result aligned with what Alzubi et al. (2024) showed: Writing and communication skills can significantly improve when students work in groups using digital tools, but only if instruction is closely supervised. All of this research emphasises that digital technology can be a help or a hindrance to learning, based on the way lessons are created and taught.

Wang and Wang (2024) further enhanced the understanding by studying the connection between task complexity, collaboration and L2 syntactic development. The researchers have confirmed that holding tasks at just the right difficulty level, in groups, promotes the development of language skills. At the same time, the emphasis in this study on specific sentence structures may distract from paying enough attention to wider skills valued in academic writing such as organising arguments and blending sources. As a result, the current work investigates not only how students communicate at the micro-level but also how they use different communication styles in joint digital project work.

2.4. Theoretical Framework

The present study uses constructivist learning theory, with its socio-interactionist perspective explained by Vygotsky. Within this system, knowledge is seen as formed from our own experiences and the results of conversations with others. As a result, teaching in EFL classes focuses on students' involvement, group collaboration and activities close to everyday life (Storch, 2005). Combining PBL with a constructivist approach treats learners in a new way: as those who both learn from and produce language through shared and repeated operations (Latifaj, 2022; Arochman et al., 2024).

From a constructivist viewpoint, PBL is understood as a process involving learners who repeatedly prepare, work on, inspect and make changes to their assignments as they go. No matter if the artefacts are research abstracts, annotated bibliographies or thesis proposals, they act as both ways of thinking and methods for communication. According to Rahardi et al. (2023), working through meaning with others, getting peer comments on your writing and inquiry through tasks are all ways that work with constructivist thinking and develop important skills. Yet, today's teachers need to link collaboration with technology to use such methods successfully which is why TAM has been included as a second theoretical concept.

Combining constructivist theory and TAM, this study introduces a hybrid model to address all the main areas of student learning in digital EFL settings. How students work together to construct knowledge in PBL is explained by constructivism, while TAM explains why they use the technology. With this approach, we can investigate academic writing development not just as brain-based, but also as influenced by education tools, instructional design and learner attitudes (Cahyono et al., 2024; Alzubi et al., 2024). The present research sits at the point where theory and practice come together.

2.5. Conceptual Model

For this study, Project-Based Learning (PBL) and Collaborative Learning were the main approaches chosen to influence EFL students' ability to write and organise their theses. Digital tools can act as a bridge by boosting or limiting how well PBL and teamwork support learning how to use language in education. We measure the outcome by looking at how well participants produce advanced writing, emphasising the creation of theses and advanced sentences.

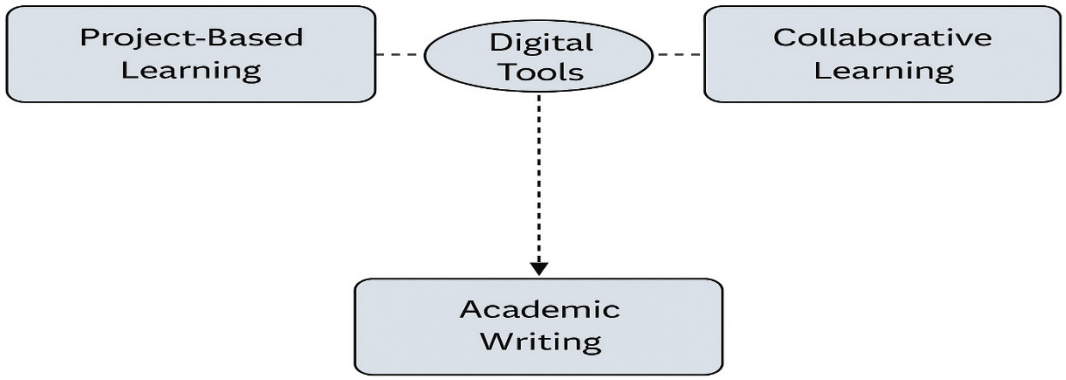

Fig 1: Graphical Representation of Conceptual Model

The conceptual model explains that academic writing outcomes are shaped by the relationships between how teaching is done and the technology involved. Project-Based learning and Collaborative learning are leading instructional approaches and digital tools control how well these strategies succeed. As a result of these features, students are better able to compose structured academic papers using research. This study uses the conceptual model to guide analysis and as a guide for designing instruction. This information shapes the way tasks are created, how various roles are completed together and how online tools such as collaborative edit programmes, citation aids and feedback software are integrated. The researchers in this study view writing like academic papers as a linked process using various technology, communication and knowledge construction, in line with constructivist and TAM principles.

3. Methodology

3.1. Study Approach

This study was designed as a quasi-experimental study, including pre-test/post-test exercises set to determine how using digital technology in projects supports learning academic writing and thesis composition in English as a foreign language (EFL). The participants were segmented into Experimental group (EG) and Control group (CG). The EG participants received the structured interventions using the implemented digital tools, while the CG participants carried on with standard writing instruction and no digital or project aspects. Using an ecological approach without random assignment, this design helped us capture what usually happens in class settings. The intervention involved ten weeks of teaching, during which students did writing tasks together, analysed data and became familiar with using new tools (for reference and shared writing). Academic writing was evaluated for both groups before and after a training period.

3.2. Participants

The research was conducted with 94 students in their final year of English study, all following a thesis curriculum at two different universities. In the EG, 47 students learned PBL and digital literacy and 47 students in CG followed the standard writing curriculum. Only participants who achieved a TOEFL ITP score of at least 480 participated so that their English levels were similar. We received ethical approval and every participant gave their consent and was guaranteed confidentiality and the freedom to take part. To see if any moderating effects were present, we collected data on participants' background and years of using digital technology.

3.3. Measuring Instruments

Three instruments were used: (1) a standardized academic writing rubric adapted from the IELTS Task 2 descriptors, assessing coherence, cohesion, argument strength, and lexical accuracy; (2) a Digital Literacy Competence Questionnaire (DLCQ) measuring functional, critical, and communicative competencies in digital environments; and (3) a Collaborative Learning Perception Scale (CLPS) to evaluate students' engagement in peer interaction, co-construction, and mutual regulation. Participants took each instrument before and after training, making it possible to check changes over time. All writing items were evaluated anonymously by two experienced assessors, to avoid biases between them, while both the DLCQ and CLPS data were collected using Likert scales to facilitate psychometric analysis.

3.4. Procedure

In the EG, we ran weekly writing workshops based on steps such as finding the problem, arranging a plan, researching it, producing a draft, sharing it for review and delivering the presentation, all accommodated with digital tools like Google Docs, Mendeley and Turnitin. The CG was taught through simple lectures and writing practises, but no group exercises or digital support were provided. All the participants were assigned the exact same writing prompts for assessment before and after the training. All participants received instructions for the DLCQ and CLPS during supervised tests that included both verbal and writing instructions. The team supervised data collection to keep practises consistent and after the experiment, a subset of EG participants was interviewed for more information. For twelve instructional weeks, data acquisition took into account both testing and the use of buffer periods.

3.5. Data Analysis

We analysed the quantitative data with both SPSS v27 and AMOS v24. To correct for any gaps in pre-test scores, writing scores were analysed with ANCOVA, with pre-test scores as the covariates. MANOVA was used to analyse if and how the combination of group and digital literacy influenced writing performance. SEM was used to check whether digital tools play a mediating role between the instructional intervention and how well students can write. The psychometric quality of the tests was validated by using both Cronbach's α and CFA. Results were interpreted using significance at $p < .05$ and by providing effect sizes for η^2 and Cohen's d.

3.6. Validity and Reliability

All the measurement instruments were built from existing scales and pre-tested with a different group ($N = 30$) which produced strong factor loadings in CFA (> 0.70). All of the subscales were shown to be reliable with Cronbach's alpha values above 0.80. The scores on writing assessments were in strong agreement as shown by a reasonably high Cohen's kappa of 0.89. Procedural validity was supported by having teachers use the same lessons, while collecting qualitative information let us explore the topic more thoroughly. Three applied linguistics experts checked the content validity to be sure it supports academic writing. Table 1 below presents the Cronbach alpha values for each instrument used in the study.

Table 1. Cronbach's Alpha Values for Key Instruments

Instrument	Subscale	Cronbach's α
Academic Writing Rubric	Coherence and Cohesion	0.87
	Lexical and Grammatical Accuracy	0.85
Digital Literacy Competence (DLCQ)	Functional Digital Skills	0.88
	Critical Evaluation	0.86
Collaborative Learning Perception	Peer Interaction & Regulation	0.89

4. Results and Discussion

4.1. Results

Here, results from the study are discussed first with participants' demographics and then through several statistical analyses of the main research questions. Academic writing development in the EFL context was explored using descriptive and multivariate statistics, drawing conclusions from the use of project-based learning, collaboration and technology. Initial analysis confirmed no major differences between groups and found the reliability of the instruments was good. The characteristics of participants in both the experimental and control groups are summarised in the following table.

Table 2. Demographic Characteristics of Participants (N = 94)

Demographic Variable	Experimental Group (n = 47)	Control Group (n = 47)	Total (N = 94)
Gender			
‣ Male	21 (44.7%)	19 (40.4%)	40 (42.6%)
‣ Female	26 (55.3%)	28 (59.6%)	54 (57.4%)
Age Group			
‣ 18–20	14 (29.8%)	13 (27.7%)	27 (28.7%)
‣ 21–23	26 (55.3%)	25 (53.2%)	51 (54.3%)
‣ 24 and above	7 (14.9%)	9 (19.1%)	16 (17.0%)
Prior Digital Literacy Training			
‣ Yes	32 (68.1%)	30 (63.8%)	62 (66.0%)
‣ No	15 (31.9%)	17 (36.2%)	32 (34.0%)
Average TOEFL ITP Score	M = 487.4 (SD = 8.6)	M = 485.9 (SD = 9.2)	M= 486.7 (SD = 8.9)

The distribution of participants in the experimental and control groups was equal and there were no important differences in gender, age or how much English the participants spoke at baseline. The largest number of participants (54.3%) were between 21 and 23 years old which is what one would expect from students working on theses in their final year. Most participants (66.0%) said they had previous digital literacy training and a larger share of those in the EG (68.1%) than the CG (63.8%) reported this. Linguistic skills before the intervention were similar for all groups, as indicated by similar average TOEFL scores. As a result, these observations confirm that the groups are suitable for comparison and control the likelihood of sampling errors in the main results.

The results of the inferential analyses are provided in this order: baseline equivalence using pre-test scores, ANCOVA for writing performance, MANOVA for interactions between group assignment and digital literacy and SEM for assessing mediation by digital skills. Reliability results and data outputs from CFA are presented to verify the psychological soundness of the results. All analyses used a significance level of $p < .05$ and effect sizes were used to look at the practical meaning of the findings

Table 3. Independent Samples t-test for Pre-Test Writing Scores

Group	N	Mean	SD	t	df	p	Cohen's d
Experimental	47	64.13	4.92	0.681	92	0.498	0.14
Control	47	63.68	5.11				

The results of the independent sample t-test for the pretest indicated that:

i. The absence of a statistically significant difference in pre-test writing scores ($t(92) = 0.681$, $p =$

.498, $d = 0.14$) confirms baseline equivalence.

ii. Both groups commenced the intervention from comparable levels of academic writing proficiency, reinforcing the internal validity of post-intervention comparisons.

Table 4. ANCOVA Results for Post-Test Writing Scores (Pre-Test as Covariate)

Source	SS	df	MS	F	p	Partial η^2
Pre-Test (Covariate)	154.72	1	154.72	9.821	.002	0.097
Group (EG vs. CG)	336.89	1	336.89	21.394	<.001	0.190
Error	1439.11	91	15.81			

In table 4, it could be seen that:

a. Controlling for pre-test performance, the experimental group significantly outperformed the control group on the post-test academic writing task ($F(1,91) = 21.394$, $p < .001$, $\eta^2 = 0.190$), denoting a large effect size.

b. This underscores the efficacy of the PBL and digital integration intervention in enhancing higher-level academic discourse competencies among EFL learners.

Table 5. MANOVA: Group × Digital Literacy Interaction on Post-Test Sub-Scores

Dependent Variable	F	P	Partial η^2
Argument Structure	8.413	.005	0.084
Coherence & Cohesion	10.294	.002	0.101
Lexical Sophistication	6.117	.015	0.063
Citation & Integration	7.744	.007	0.078

It is evident in the multivariate analysis that:

a. There is a significant interaction effects between instructional group and digital literacy levels across all major subcomponents of academic writing.

b. Participants in the EG with high digital literacy demonstrated the greatest gains in cohesion, citation accuracy, and lexical complexity, suggesting that digital tools amplify the pedagogical benefits of PBL when aligned with learners' competencies.

Table 6. CFA Model Fit Indices for DLCQ and CLPS

Model	χ^2	df	CFI	TLI	RMSEA	SRMR
DLCQ (3-factor)	84.16	62	0.961	0.947	0.045	0.041
CLPS (2-factor)	58.39	43	0.973	0.958	0.042	0.039

The summary of the CFA analysis can be summarized thus:

a. Both scales demonstrated excellent fit to their theoretical constructs, with CFI and TLI > 0.95 and RMSEA < 0.05, indicating high construct validity.

b. This affirms the reliability of using these instruments to measure students' digital competencies and collaborative behaviors, integral to the study's theoretical model.

Table 7. Structural Equation Model (SEM): Mediation Analysis
Model: Digital Tools as Mediator between Instructional Intervention and Academic Writing

Path	Estimate (β)	SE	CR	p
PBL → Digital Tools	0.68	0.07	9.71	<.001
Digital Tools → Academic Writing	0.55	0.09	6.11	<.001
PBL → Academic Writing (direct)	0.32	0.10	3.20	.001
Total Effect	0.69			
Indirect (Mediated) Effect	0.37			

The SEM analysis revealed the following:

a. A significant mediating effect of digital tools ($\beta = 0.37$, $p < .001$) between PBL instruction and academic writing outcomes.
b. While PBL retained a residual direct effect, the dominant pathway was indirect, validating the transformational role of digital literacy as both facilitator and amplifier of advanced writing performance.

4.2. Discussion of Findings

Results from the study prove that a combination of project-based learning, teamwork and digital tools results in much better academic writing for EFL students. ANCOVA analysis found that EG students wrote better after the intervention, showing the difference was significant despite making sure both groups were similar at the start. This result agrees with Arochman et al. (2024), who discovered that EFL students who follow project cycles showed enhanced thesis organisation and writing skills. This study went further by making digital tools key parts of the lessons which greatly improved the usefulness of the PBL approach.

The first research question, about how using digital tools in project-based tasks can improve academic writing and thesis development, was supported by both inferential and mediation analyses. The SEM showed that digital tools played a big part in increasing the way PBL helped students' writing proficiency. These findings fit with the analysis of Yunus et al. (2013), finding that blog-based sites lead to repeat writing and better reflection. Rather than simply picking up new tech trends, the present study views digital tools as helping devices to build knowledge structure and writing skills through the help of citation managers, collaborative editors and AI feedback tools.

The conclusions agree strongly with the ideas in the Technology Acceptance Model (TAM) which reflects that success with educational technology depends on how useful and easy it is to use (Deiniatur & Cahyono, 2024). Those students with strong digital skills in the programme tended to get more from project tasks and wrote academic texts that were stronger in structure and argument. The combination of technology and task design is key here as Aghayani and Hajmohammadi (2019) only added writing fluency, without including digital elements which therefore minimised transferring the lesson benefit to universities. By contrast, the present study helped participants achieve results that were easier to transfer to publication writing.

Research Question 2 which explored how structured collaboration and writing are related, received support from both statistics and questionnaire responses. Analysis of the MANOVA results indicated that peer interaction and co-construction played important roles in all the measured parts of academic writing, mainly enhancing cohesion and proper citation practice. The results match Rahardi et. al. (2023) by showing that PBL activities in teams lead to better rhetorical knowledge and critical skills in students. However, while Rahardi discussed these results in detail, we decided to quantify them and discovered that, along with digital skills, working together increased learning and noticeably enhanced work in more advanced academic genres.

Unlike Ismail and Daud (2021), who observed modest results from collaborative learning due to weak assignment construction and minimal technology support, our findings suggest better performance in writing. This study shows that simple collaboration is inadequate unless it takes place when teams are tackling tough, digital projects. As a result, collaboration cannot be treated as a separate method but only becomes an effective process when the larger system is aligned with task challenges and the tools being used.

The third research question which looked at the difficulties and benefits of using digital literacy in academic writing, is confirmed in part. Although the digital tools helped participants improve their writing, it revealed that those with low initial digital skills found it harder to engage and produce good writing. This corresponds to Alzubi et al. (2024), who encouraged providing ongoing help in digital literacy so that EFL students do not face technological marginalisation. This finding also proves the point made by Deiniatur and Cahyono (2024) that students with different levels of digital skills in the same grade may have poorer instructional results unless we take action.

The main addition to research from this study is that it understands digital literacy as a factor that can steer or separate practises in writing pedagogy. Adopting a different approach than previous studies (such as Yunus et al. in 2013), our research demonstrates empirically that digital tools connect students in creating, organising and referencing ideas in their writing. Because of this, the discussion in EFL writing about technology moves from simple tool use to understanding the way technology affects knowledge—an important transformation for today's EFL students.

Additionally, this study shows that improving writing in EFL academic contexts depends on how closely the task matches its real purpose and how well it uses technology. In contrast to previous approaches that kept grammar or rhetoric lessons separated, the model we used had learners work together on combining resources, structuring arguments and organising references by genre standards. The current study, following Cahyono et al. (2024), explains why a task's authenticity matters but also adds empirical proof using a complete PBL-digital framework.

Strong empirical findings confirm that project work, team assignments and technology-assisted teaching can transform learning. Yet, the results also reveal some remaining problems. Those students who had little experience in writing or technology had difficulty first using the platforms. This outcome also supports the claim by Sartika et al. (2022) that teacher help and training in using technology must be available before PBL can be justly successful. So, future strategies should prioritise pre-task digital guidance and give students different levels of help so everyone can participate and gain knowledge that lasts.

5. Conclusions

This empirical study demonstrates that, when merged with digital literacy and combined collaborative schemes, PBL can strongly promote EFL academic writing, with significant results in thesis-oriented topics. After the intervention, participants did better in structuring arguments, using related words throughout, choosing advanced vocabulary and listing reliable citations—all areas largely ignored in standard-form exercises. The results support what constructivism and TAM say, showing that writing is not just a language skill but also a social and technological practice in changing digital and interactional environments.

From the findings, it is clear that teaching EFL learners how to write well should go beyond teaching grammar by text and instead support ongoing, genuine interaction using complicated methods such as problem-solving. Online tools supported us as much as they instructed our understanding, supporting our work with writing and ideas. In addition, digital literacy appearing as a mediating factor

worsened differences in what learners achieved, so now technological skills are necessary for academic involvement and dialogue.

The results have important uses for those involved in designing curricula, training teachers and teaching English as a foreign language. At first, teaching writing should follow a framework that ties course activities together by placing projects at the heart of what is taught. Second, students need to work together using review, team authoring and holding each other accountable for their writing. Third, teachers need to focus on teaching students to use citation managers, collaborate on projects and benefit from automated feedback in their assignments. Making these changes would give EFL writers more independence, stronger critical skills and an improved ability to use language well.

According to the data, the study recommends that academic writing courses use a combination of three approaches: (1) long-term project-based work, (2) group projects guided by fellow students and (3) reliance on technology when producing assignments. For such a change to happen, institutions are required to improve technology systems and train their teachers appropriately. Researchers should now use longitudinal strategies to check retention and transfer, in addition to analysing learner accounts through qualitative methods. Pedagogical equity should be maintained by giving different technology support to students at different levels of access and proficiency.

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