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Project-Based Learning to Promote EFL Students' Self-oriented and Collaborative Skills Within Education for Sustainable Development

Ridho Praja Dinata | Universitas Negeri Malang, Indonesia
Utami Widiati * | Universitas Negeri Malang, Indonesia
Efa Silfia | Universitas Batanghari, Indonesia
Mutia Hasymi | Universitas Negeri Malang, Indonesia
Mala Rovikasari | Universitas Negeri Malang, Indonesia
Trishna Nanda Barianti | Universitas Negeri Malang, Indonesia

Abstract

This study aims to explore the integration of Project-based Learning (PjBL) in English as a Foreign Language (EFL) classrooms to promote self-oriented and collaborative skills while aligning with the principles of Education for Sustainable Development (ESD). This study employed a phenomenological approach, focusing on the experiences of students who participated in a PjBL. The participants included four EFL students from a state university in Indonesia who experienced the PjBL in promoting ESD during their learning process. The data collection method included semi-structured interviews, which were analysed using thematic analysis to identify key skills and their relevance to ESD. The findings indicate that PjBL effectively promotes self-

* Corresponding author:
Utami Widiati, Email: utami.widiati.fs@um.ac.id

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oriented skills including self-regulation, reflective thinking, adaptability, and digital literacy, thereby developing collaborative skills including communication, interpersonal problem-solving, and responsibility. This study suggests that PjBL be considered as an alternative effective pedagogical approach for integrating ESD into EFL instruction through meaningful, contextually grounded learning activities in higher education.

Keywords: Project-based Learning; Self-oriented skills; Collaborative skills, Education for sustainable development

Introduction

One of the Sustainable Development Goals (SDGs) is quality education, which delivers an agenda for global educational changes and mobilises the world's educational resources to assist a more sustainable future (UNESCO, 2020). To enhance the quality of education globally, UNESCO introduced Education for Sustainable Development (ESD) with the aim of equipping learners with the competencies to think and act sustainably (Araneo, 2024; Caputo et al., 2021). To address this issue, it is suggested that students be provided with the opportunity to enhance their life skills, such as self-oriented and collaborative skills (Dias-Oliveira et al., 2024; Wu, 2024). One of the significant strategies to realise the suggestion is project-based learning (PjBL). Self-oriented and collaborative skills are crucial in preparing students to address complex global challenges. In particular, PjBL has been linked to ESD, equipping students with the competencies necessary to contribute to achieving the SDGs (Yu et al., 2024). PjBL is increasingly recognised as an instructional approach that aligns with ESD goals, particularly within the contexts of English as a Foreign Language (EFL) (Almulla, 2020; Mitchell & Tilley, 2024).

Over the past decade, a growing body of research has highlighted the effectiveness of PjBL as an instructional approach for enhancing student engagement, critical thinking, and real-world application of knowledge across educational settings (Aisyah & Novita, 2025; Sun & Zhu, 2023). In EFL classrooms, PjBL has been linked to improvements in language acquisition, learner autonomy, and task-based communication skills, demonstrating its value beyond traditional rote learning (Al-Busaidi & Al-Seyabi, 2021; Chimwayange, 2024; Suwannaphima & Vibulphol, 2023). Recent studies have explored how PjBL can support life skills development, including self-management and reflective learning, essential competencies in the 21st century (Fortune et al., 2018; Guo et al., 2020; Shi et al., 2024). At the same time, global educational priorities have increasingly emphasised the integration of ESD into curricula, promoting competencies such as critical thinking, problem-solving,

and active citizenship (Arslan & Curle, 2021; González-Salamanca et al., 2020; Hays & Reinders, 2020).

The convergence between PjBL and ESD highlights the potential for project-based tasks to promote student engagement with sustainability-related content and real-world problem-solving (Wahbeh et al., 2021; Wróblewska & Okraszewska, 2020). These studies underscore that PjBL can serve as a platform for fostering language and life skills within sustainability education. However, despite the evident potential, limited empirical studies have examined how PjBL promotes self-oriented and collaborative life skills within the framework of ESD in EFL contexts. While existing studies support the general value of PjBL in building life skills, there remains limited attention on how these competencies develop in tandem with ESD principles in language learning environments. Moreover, research on unpacking students' lived experiences in PjBL purposefully designed to meet ESD goals is still scarce.

This study focuses on the integration of PjBL with ESD principles to promote students' skills in EFL settings. By exploring how PjBL can be integrated with ESD principles to support the development of self-oriented skills such as self-regulated learning, adaptability, and reflective thinking, and that of collaborative skills including communication, interpersonal sensitivity, and shared responsibility. Furthermore, this study seeks to provide insights into how teachers can implement PjBL to support language achievement by assisting students' self-orientation and collaborative skills to become proactive contributors to sustainable development. In other words, this study aims to explore the PjBL initiatives and the institutional context of quality education, hence providing essential skills and experience-based activities in sustainability programs elsewhere. In short, this study was led by these research questions:

1. How does project-based learning promote EFL students' self-oriented skills for education for sustainable development?
2. How does project-based learning promote EFL students' collaborative skills for education for sustainable development?

Project-based learning (PjBL)

Dewey (1987), with his works focusing on learning by doing, is considered by certain scholars to be the pioneer of PjBL (Wahbeh et al., 2021). His educational theories promoted a lifelong learning perspective, emphasising that learning occurs through student interactions during authentic activities. Further, PjBL is a collection of significant learning activities in a social context that concentrates on a particular subject matter or a theme (Aisyah & Novita, 2025; Al-Busaidi & Al-Seyabi, 2021; Fortune et al., 2018). Consequently, PjBL emphasises learning through action, experimentation, problem-solving, and collaboration. These

insights support that Dewey significantly transformed education. Nevertheless, this does not deny the role of Vygotsky's (in Akpan et al., 2020) contribution as the founder of social constructivist theory in promoting PjBL within educational institutions. The social constructivist theory posits that engaging in educational initiatives allows students to collaborate with their peers and share ideas, assisting them in enhancing their skills and acquiring new knowledge.

PjBL is an essential approach that reflects key principles of social constructivist theory, particularly collaborative learning and the support provided by teachers. PjBL engages students in real-world projects to develop deeper skills, emphasising student-centred inquiry, critical thinking, and problem-solving over rote memorisation (Mitchell & Tilley, 2024; Shi et al., 2024). Key characteristics of PjBL include a strong connection to real-world problems, which enhances the relevance and applicability of learning. It fosters student autonomy by allowing learners to exercise choice and control over their projects, boosting engagement and motivation (Suwannaphima & Vibulphol, 2023). Furthermore, the literature identifies three factors that contribute to students' learning, particularly their independence and freedom to learn, plan their education, and explore the content. Therefore, this present study focuses on how these three elements highlight project-based learning as a component of sustainable education since they contribute to the enhancement of students' self-oriented and collaborative skills.

PjBL as a facilitating factor of self-oriented and collaborative skills

PjBL extends beyond the acquisition of academic knowledge by fostering the development of critical self-oriented and collaborative skills. Rooted in constructivist theory, PjBL emphasises that students actively construct knowledge through guided inquiry and social interaction. Educators play a facilitative role, creating learning environments where learners assume responsibility for their learning. These settings empower them to engage in projects that cultivate self-oriented and collaborative skills crucial for personal and professional growth (Almulla, 2020).

The collaborative nature of PjBL encourages students to work in teams, promoting social interaction as they communicate and collaborate to solve complex problems. This process not only promotes teamwork but also develops essential life skills, including interpersonal communication, critical thinking, and adaptability (Wróblewska & Okraszewska, 2020**).** Collaborative skills flourish in these dynamic social contexts, where students take full ownership of their educational journeys and bridge the gap between theoretical knowledge and practical competencies (Kemaloglu-Er & Sahin, 2022). This transformative learning approach aligns with the principles of sustainable education,

preparing students to actively contribute to democratic societies through continuous self-improvement and engagement.

Moreover, PjBL promotes self-oriented skills by encouraging students to take ownership of their learning processes, engage in self-reflection, and set personal goals. Through project execution, students develop numerous essential metacognitive abilities, such as planning, monitoring, and evaluating their progress, crucial for independent problem-solving and decision-making (Chen & Yang, 2019). These activities require students to manage their time effectively, adapt to challenges, and take initiative in exploring solutions, enhancing their autonomy and self-regulation (Gras-Velázquez, 2020). By accommodating diverse learning styles, PjBL enables students to build self-oriented skills while engaging collaboratively in both academic and real-world contexts. Through learning practices and team-based problem-solving, students learn to take initiative, improve their creativity, and develop the interpersonal skills necessary for success in an interconnected world (Saenz et al., 2018). These attributes are connected to transformative education, underscoring PjBL's role in preparing students for lifelong learning.

The intersection of PjBL, self-oriented and collaborative skills, and ESD

The integration of PjBL with the development of self-oriented and collaborative skills represents a critical dimension of ESD. As Arbeiter and Bučar (2021) emphasise, access to transformative education is vital for addressing inequities and expanding opportunities for marginalised learners. Importantly, PjBL provides a dynamic environment for transformative learning, enabling students to articulate ideas, devise and implement plans, and engage in reflective practice to refine outcomes. This is aligned with the study by Sun and Zhu (2023), which highlights the value of interdisciplinary approaches in fostering sustainability education and ESD. PjBL, through its integrative nature, provides a robust platform for interdisciplinary learning, positioning it as a potent tool for advancing ESD. Öhman and Sund (2021) propose a comprehensive model of sustainability commitment that addresses intellectual and practical dimensions. PjBL aligns with this model by engaging students holistically, further linking it to sustainability commitment. Therefore, Fortune et al. (2018) demonstrate that PjBL creates opportunities for transformative learning among students in the educational context, enabling them to navigate learning experiences and gain new perspectives on their own and others' worldviews.

Beyond facilitating transformative education, PjBL also serves as a medium for cultivating essential life skills. Holdo (2023) identifies transformative learning as a driver of lifelong learning, which inherently intertwines with the development of core life competencies. Life-long learning fosters adaptability

and resilience, equipping individuals to navigate complex societal dynamics. González-Salamanca et al. (2020) emphasise that life skills education enhances individuals' ability to adopt behaviours that promote healthy societal functioning. Additionally, these studies underscore the critical role of PjBL in integrating self-oriented and collaborative skills into ESD. This approach is particularly impactful in education settings, where interdisciplinary and reflective practices enhance students' engagement with ESD themes while fostering significant competencies for personal and societal development.

Methodology

Research design and participants

This study employs a qualitative research design with a phenomenological approach to investigate how PjBL promotes the development of EFL students' self-oriented and collaborative skills in the context of ESD. A phenomenological approach allows for an in-depth investigation of participants' experiences (Creswell, 2012), understanding their subjective realities and interpretations of PjBL that promote self-oriented and collaborative skills in ESD.

This study involved four English education students from a state university in Indonesia. The participants were selected using a purposive sampling technique based on their experiences of PjBL. This sampling technique ensures that insights are drawn from students with the most relevant experiences (Nyimbili & Nyimbili, 2024). This study received ethical approval and consent forms; participants were given information regarding the purpose of the study, the privacy of their responses, and their willingness to share detailed experiences through interviews.

Research instruments

The research instrument for collecting data was semi-structured interviews. Semi-structured interviews collected the students' perceptions and challenges in experiencing PjBL in relation to self-oriented and collaborative skills that were adapted from Wahbeh et al. (2021). Semi-structured interviews permit participants to elaborate on their perspectives while allowing the study to delve deeper into emerging themes.

Data collection

The data were collected through semi-structured interviews to explore how PjBL can be used to promote skills development. The interview was conducted for 30 to 50 minutes and was recorded using the Zoom application. The students

shared their experiences and perspectives on skill development and ESD. Further, all interviews were audio-recorded with permission, transcribed verbatim, and anonymised using participant codes.

Data analysis

The data were analysed using thematic analysis following Braun and Clarke's (2006) phases. Thematic analysis involves systematically identifying as well as interpreting patterns and themes to understand how PjBL promotes skills development for ESD.

The analysis began with familiarisation, reviewing interview transcripts and becoming immersed in the data. In the second phase, generating initial codes, significant insights of data were highlighted and labelled according to their relevance to the research questions. This coding process involved identifying explicit ideas as well as implicit meanings derived from the context. For instance, statements related to planning, time management, and independent learning were coded as self-regulated. The data were coded iteratively across all transcripts, with codes being repeatedly reviewed and refined to maintain consistency. Emerging codes and themes were also discussed through peer debriefing to check the alignment between data extracts, codes, and themes. During the third phase, these codes were clustered and organised into broader themes. These categories were then refined during the reviewing themes phase, to ensure that each theme accurately represented the dataset and demonstrated internal coherence. In the defining and naming themes phase, related codes were consolidated into clearly articulated themes. The last phase is reflected in the presentation of findings, where themes are woven into an interpretation that synthesises how PjBL promotes self-oriented and collaborative skills and their implications for ESD.

This study emphasised trustworthiness, including credibility, transferability, dependability, and confirmability (Ary et al., 2018). To improve credibility, debriefing was conducted with an ELT professor, who reviewed selected data segments for thematic consistency. Member checking also validated themes with participants. Transferability is enhanced by providing a detailed description of the research context, participants, and processes. Dependability is maintained through a thorough documentation of the research design, data collection, and analysis procedures. Confirmability is ensured by maintaining reflexivity throughout the study, where the researcher acknowledges potential biases and ensures that interpretations are grounded in the data rather than personal assumptions.

Skills	Themes	Concise definition
Self-oriented	Self-regulated	The ability to plan, monitor, and evaluate learning.
	Adaptability	The ability to be flexible and resilient in changing circumstances
	Reflective thinking	The ability to assess personal strengths, weaknesses, and learning approaches
	Digital literacy	The ability to use digital tools to access and create content
Collaborative	Communication	The ability to use verbal strategies to convey ideas appropriately in diverse settings
	Interpersonal	The ability to build and maintain positive relationships
	Problem-solving	The ability to analyse situations, evaluate options, and collaboratively find solutions
	Responsibility	The ability to reliably manage tasks, commitments, and take ownership of actions

Table 1. Theme on self-oriented and collaborative skills.

Findings

This study demonstrates that the students experienced PjBL as supporting the development of self-oriented skills and collaborative skills among EFL students while fostering their understanding of ESD. These findings highlight PjBL's transformative potential as an instructional approach for equipping students with crucial life skills relevant to sustainability challenges.

Development of self-oriented skills

PjBL served as an effective approach for developing self-oriented skills, particularly self-regulated, adaptability, reflective thinking, and digital literacy. Students reported for becoming more proactive in planning and organising their learning processes. Self-regulation skills emerged as a critical skill, with students taking ownership of their schedules and tasks to meet project deadlines. For instance, students outlined detailed strategies for communicating with teachers, planning contingencies, and managing unexpected disruptions in project timelines. Below is the demonstration:

> From the beginning, I was definitely planning and organising the project. A bit more self-reflective, like how we manage our time, make our schedule, how my friend and I manage our time well, and how we evaluate our progress and work. (S1)

> I needed to manage my time, plan the tasks that needed to be done, and work independently to complete the assignments given to me by my team members. This made me more disciplined in organising my schedule and staying focused. (S2)

Reflective thinking skills were evident as students assessed their strengths and weaknesses, and delegated tasks based on individual competencies. Such self-awareness not only improved individual performance but also strengthened team dynamics. These are the demonstrations:

> It involves assessing my strengths and weaknesses, as well as my friends. We discussed our assigned roles related to the project, like my friend will cover my weaknesses. (S1)

> In the project, each member was assigned tasks based on their strengths to ensure effective collaboration. I learned to evaluate my progress to achieve my goals in a more organised way. (S2)

Adaptability was another essential skill, as students demonstrated adjusting to diverse stakeholders, unexpected schedule changes, and interpersonal challenges, demonstrating flexibility in navigating real-world complexities. These experiences underscored the importance of flexibility and problem-solving in completing the project. Below is the demonstration:

> Adapting to teachers, students, and company staff was a valuable experience gained through the implementation of PjBL. Adapting to new challenges during the project's completion process was a significant aspect for my learning experience. (S4)

> We have that experience, including adjusting to unexpected schedule changes, rescheduling meetings, or handling uncooperative group members. (S1)

PjBL also strengthened students' digital literacy skills. Students gained proficiency in using and teaching technological tools essential for project completion, deepened their understanding of various ICT platforms, and explored the use of AI-based applications like Scribo to enhance writing activities. Here is the demonstration:

> We developed the skills to use and teach the Scribo application for the writing activities required in the project. (S1)

> Digital literacy skills were enhanced through this PjBL. I learned to understand the characteristics of the various ICT platforms, the strengths and weaknesses. (S3)

Development of collaborative skills

The findings highlight that PjBL significantly enhances students' ability to collaborate effectively. Students reported improvements in communication, interpersonal relations, problem-solving, and responsibility, which are critical for effective collaboration. Communication skills emerged as a foundational competency, as students frequently interacted with teachers, students, and teammates to coordinate project tasks and clarify expectations. This process strengthened their ability to articulate ideas, listen actively, and maintain productive dialogue. This process further fostered self-initiative and strengthened students' ability to collaborate and achieve project goals. Here is the demonstration:

> We have to contact the teacher, which requires communication skills. It's very influential for the completion of the project. Because we need to communicate with other people, the teacher as well as the students. (S1)

> I learned several things, including how to communicate effectively. Through PjBL experience, I learned to clearly express my opinions and ideas while also listening to my teammates' points of view. (S2)

Moreover, interpersonal skills were developed as students navigated diverse perspectives within group settings. Students identified the significance of maintaining positive relationships with peers, teachers, and external stakeholders involved in the project. Here is the demonstration:

> Then, interpersonal skills also include communication skills to maintain a positive relationship. (S1)

> It is essential to maintain good relationships with various parties, such as teachers, students, lecturers, and everyone involved in the PjBL activities. (S4)

At the same time, problem-solving skills are particularly significant when students address real-world challenges by thinking critically, making informed decisions, and finding effective solutions. Whether navigating scheduling conflicts, resolving issues collaboratively, or overcoming unexpected obstacles, these experiences highlighted the importance of problem-solving in achieving project success. As stated by the participants:

> We are forced to solve real problems through the project, including arranging meetings via Zoom during holidays and figuring out how to make it work. (S1)

> When I encountered problems, I thought critically and made the right decision to solve them. (S2)

Responsibility was another key competency cultivated through the project. Students learned to manage deadlines, fulfil assigned tasks, and contribute reliably to group outcomes. These experiences illustrate how PjBL reinforces accountability and ownership of work within collaborative settings. As the student described:

> After dividing tasks between teams and setting a deadline, I had to be responsible for the task given to me. (S2)

> Through this project, as a coordinator, I was responsible for summarising and reporting the progress of my peers' work to the lecturer. (S4)

Alignment with ESD

The findings demonstrate the strong alignment between PjBL and the principles of ESD. Students demonstrated that PjBL deepened their understanding of ESD by allowing them to engage directly with real-world environmental and social issues. They reported that authentic tasks made sustainability concepts more meaningful and helped them develop key competencies such as teamwork, problem-solving, and critical thinking. Students also became more aware of equity concerns, particularly the unequal access to technology among Indonesian teachers, which they viewed as an important aspect of sustainable education. Here is the demonstration:

> PjBL provides learning activities with real-world issues, helping me understand ESD better. It allows me to work on projects related to environmental and social challenges. (S1)

> PjBL shows how to build skills like teamwork and problem-solving. We can think critically and creatively, which will be useful for our future. (S2)

> This experience helped me realise the importance of integrating ESD and technological advancement to bridge the gap. (S3)

Beyond sustainability awareness, the skills developed through PjBL were viewed as transferable to academic and professional contexts. Students noted communication, teamwork, adaptability, and problem-solving as essential

competencies they could apply beyond the classroom. The findings demonstrate that skills developed through PjBL equip students for future academic and professional pursuits while simultaneously promoting the principles of ESD, preparing them to contribute meaningfully to a sustainable and inclusive future. Below are the demonstrations:

> The skills I gained, including communication, teamwork, and time management, will be beneficial outside the classroom or in the workplace. (S1)

> The problem-solving skills I have practised during PjBL will help me solve problems effectively in various situations, whether at work or in daily life. (S2)

> Communication skills are essential and highly applicable in the professional world. Thus, adaptability is also important, ensuring I am not overwhelmed when working with individuals from different backgrounds and fostering mutual respect. (S3)

Discussion

This study elucidates the significance of PjBL in developing self-oriented and collaborative skills while aligning with ESD principles. The findings underscore PjBL's transformative potential as an approach for equipping students with critical life skills and promoting their capacity to address sustainability challenges in educational and professional contexts (Wu, 2024; Yu et al., 2024). This study contributes to PjBL-ESD scholarship in EFL by examining a technology-mediated project in which students were engaged in pedagogical supports for in-service teachers across diverse Indonesian contexts through the adoption of the Scribo digital writing tool. This hands-on involvement provided invaluable experiences in providing feedback to teachers, assisting with the integration of new technology, and monitoring the progress of students' writing.

Moreover, the findings advance current understandings of how PjBL aligns with ESD by explicating the experiential mechanisms through which sustainability-related competencies are developed. This study highlights the development of self-oriented and collaborative skills enhanced through structured planning and sustained collaboration. By situating these processes within the ESD competency framework, this study offers a more conceptually grounded account of PjBL as a sustainability-oriented pedagogy, rather than merely a task-based instructional approach. Ultimately, it contributes to theoretical discussions by clarifying how PjBL supports the development of

specific life-skill competencies associated with sustainable learning in higher education. Drawing on curriculum-oriented perspectives, these competencies such as self-regulation, adaptability, collaboration, and problem-solving are widely recognised as foundational skills for sustainable learning and lifelong functioning (Mitchell & Tilley, 2024; Sun & Zhu, 2023).

To clarify the relationship, Figure 1 illustrates a proposed conceptual model presenting how PjBL in this study potentially promotes the development of self-oriented and collaborative skills, which eventually contribute to the attainment of ESD competencies.

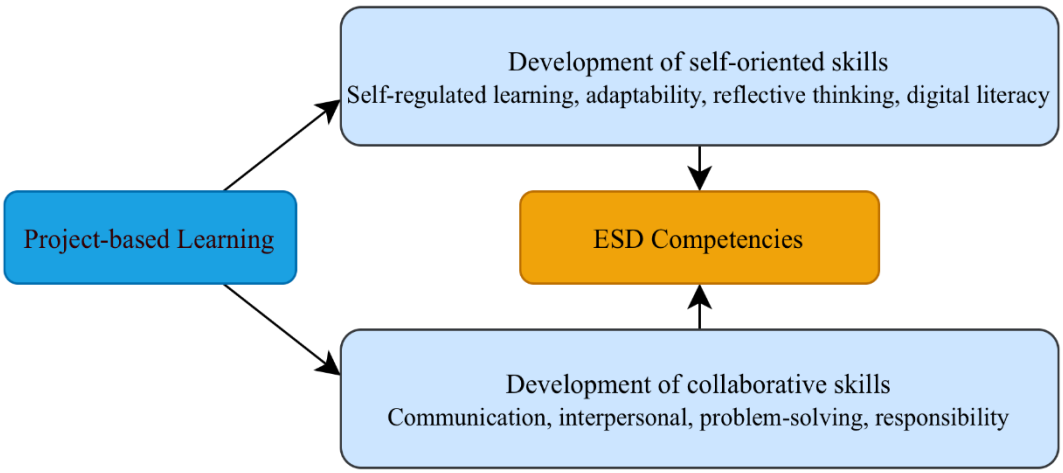

Figure 1. Conceptual alignment of PjBL, self-oriented and collaborative skills, and ESD.

Development of self-oriented skills

PjBL has emerged as a powerful pedagogical approach for fostering self-oriented skills such as self-regulation, adaptability, reflective thinking, and digital literacy. The students in this study demonstrated improved self-regulation capabilities by actively managing their learning activities, organising their schedules, and developing contingency plans to meet project deadlines. These findings align with self-regulated learning theory (Wu, 2024; Zimmerman, 1989), which emphasises students' active control over planning, monitoring, and evaluating their learning, suggesting that the structured and goal-oriented nature of PjBL creates conditions that support these regulatory processes. Similarly, self-regulated learning is significant for autonomous task completion and self-management, particularly in dynamic learning environments (Gras-Velázquez, 2020; Guo et al., 2020). Additionally, PjBL creates learning environments where student responsibility and collective engagement are mutually reinforced, thereby extending its impact beyond immediate academic achievement.

Furthermore, adaptability skills emerged as a critical skill developed through PjBL, enabling students to navigate the dynamic challenges inherent in project implementation. The participants adjusted to diverse stakeholders, such as teachers and company staff, and managed unexpected changes, including rescheduling meetings and resolving uncooperative team dynamics. These findings highlight students' capacity for responding constructively to challenges, adjusting strategies, and sustained improvement in learning practices over time. In line with this, Chen and Yang (2019) demonstrated that PjBL enhances students' ability to cope with unpredictable contexts. From an ESD perspective, adaptability reflects students' capacity to respond to uncertainty and complexity, a core sustainability competency developed through engagement with authentic and unpredictable project contexts. By addressing real-world complexities, students improve their adaptive skills when engaged in project-based language teaching, underscoring its relevance for sustainability-oriented education (Sun & Zhu, 2023).

Reflective thinking further enhanced the development of self-oriented skills as the participants assessed personal strengths and weaknesses while delegating tasks effectively within their teams. This critical self-awareness not only enhanced individual performance but also optimised team dynamics, reflecting Fischer et al.'s (2022) assertion that reflective practice is integral to achieving sustainable education outcomes. By intentionally reflecting on competencies, the students aligned their contributions with their strengths, ensuring a more organised and productive workflow. Fortune et al. (2018) show that PjBL experiences stimulate transformative reflection, illustrating how project-based tasks encourage students to critically evaluate their strengths and weaknesses and apply these insights to improve both individual and team outcomes. This reflective process resonates with Dewey's (1987) notion of learning through experience, where reflection enables students to make meaning from action and refine future decisions.

Likewise, this study revealed that PjBL significantly enhanced digital literacy, equipping the students with practical ICT skills for academic and professional contexts. They became more proficient in using and teaching technological tools, such as the AI-based application Scribo, which played a pivotal role in writing activities. These findings corroborate Nanni and Pusey's (2022) highlights of the necessity of digital literacy as a core competency in the 21st-century education context. By engaging with ICT platforms and understanding their functionality, the students bridged the gap between technological tools and pedagogical applications, thereby aligning with ESD's emphasis on integrating innovation into learning environments. These results align with Hays and Reinders (2020), who point out that sustainable learning is most effective when digital integration is embedded in practice. The responsibility of

higher education is to foster digital literacy as part of its contribution to achieving the SDGs (Caputo et al., 2021). Within ESD-oriented education, digital literacy functions not only as a technical skill but also as an enabler of participation, collaboration, and equitable access to learning opportunities.

Development of collaborative skills

The collaborative skills of PjBL have been proven to significantly contribute to fostering students' interpersonal, communication, and problem-solving skills which are essential for effective teamwork in educational and professional settings. This study shows that communication skills were notably highlighted as the students interacted with their teachers, peers, and other stakeholders, necessitating them to express ideas clearly and listen actively. From a social constructivist perspective (Vygotsky, 1978), communication operates as a mediating tool through which students co-construct knowledge, negotiate meaning, and coordinate shared action in socially situated tasks. These experiences align with Dias-Oliveira et al. (2024), underscoring the importance of communication in fostering collaborative efficacy. In addition, PjBL enhances communication as a fundamental life skill, equipping students with the ability to articulate ideas effectively in diverse contexts (Wahbeh et al. 2021).

Interpersonal skills were also developed in this study as the students navigated diverse perspectives within team settings and maintained positive relationships with stakeholders. This finding supports the assertion by Sun and Zhu (2023) that fostering interpersonal competencies in PjBL enhances collaborative learning outcomes. The students emphasised relationship management, conflict resolution, and adaptability as critical to achieving success in group projects. This aligns with Almulla (2020), who demonstrated that PjBL fosters stronger social interaction and teamwork in higher education by improving empathy and relationship management in EFL contexts. Within ESD-oriented education, interpersonal skills are crucial for promoting cooperation and inclusiveness in addressing complex social challenges.

Moreover, problem-solving skills were equally significant as students confronted real-world challenges that required informed decision-making and innovative solutions. The students applied theoretical knowledge to practical scenarios by engaging with authentic tasks, fostering critical competencies as suggested by Chimwayange (2024). Similarly, Bekteshi and Xhaferi (2020) found that integrating SDGs into ELT projects enhances students' problem-solving competencies. PjBL further creates learning environment in which problem-solving skills develop through engagement with complexity, requiring students to apply existing knowledge and adapt their responses as situations evolve. These processes align with ESD's focus on cultivating critical

judgement and responsible decision-making in addressing sustainability-related issues (Arslan & Curle, 2021).

Responsibility also notably developed in this study as the students were held accountable for their tasks and outcomes. They demonstrated learning to manage deadlines, fulfil commitments, and take ownership of their contributions. These findings align with Fischer et al. (2022), who conceptualise transformative pedagogy as fostering responsibility through shared, relational learning process. Further, PjBL has been shown to cultivate accountability by positioning learners as active contributors rather than passive recipients of instruction (Aghayani & Hajmohammadi, 2019; Uggla & Soneryd, 2022). Within an ESD framework, responsibility functions as both an individual and collective competency that supports sustainable and ethical participation in learning and professional communities.

Alignment with ESD principles

This study underscores a strong alignment between PjBL and ESD principles, particularly in fostering the self-oriented and collaborative skills essential for addressing global sustainability challenges. By integrating real-world issues into project tasks, PjBL appears to bridge theoretical learning with practical actions, enabling students to engage meaningfully in sustainability challenges. These outcomes align with Araneo (2024) and Yu et al. (2024), who emphasise the importance of empowering students to address the SDGs through innovative and practical educational practices. The integration of technological tools, such as Scribo, has highlighted the synergy between innovations and sustainable education practices. The students in this study became more aware of the inequities in technological access among educators, particularly in the Indonesian context, which underscores the relevance of PjBL in addressing systemic disparities. By fostering awareness and practical solutions, PjBL supports ESD's aim of cultivating critical, creative, and socially responsible students equipped for global citizenship (Caputo et al., 2021).

A broader look at PjBL research in other higher-education contexts reinforces this study. Studies from Oman (Al-Busaidi & Al-Seyabi, 2021), Turkey (Kemaloglu-Er & Şahin, 2022), and China (Sun & Zhu, 2023) have shown that PjBL is effective in supporting collaboration and language development. However, these studies have rarely explored PjBL through an ESD lens or examined students' lived experiences with sustainability-focused tasks. The present study adds this perspective by showing how PjBL in the Indonesian EFL context nurtures both life skills and sustainability awareness. These outcomes may be shaped by institutional expectations, cultural practices, and differences in access to technology. This comparison highlights how

educational settings influence the way students internalise self-oriented and collaborative skills when project activities are intentionally aligned with ESD.

Furthermore, PjBL serves as a robust approach promoting significant skills for academic and professional success, while also advancing the goals of ESD. PjBL fosters the development of critical skills such as communication, teamwork, and time management, as evidenced in multiple studies (Aghayani & Hajmohammadi, 2019; Aisyah & Novita, 2025). PjBL enhances problem-solving capabilities by encouraging students to engage with real-world problems, aligning with frameworks outlined by Bekteshi and Xhaferi (2020). PjBL nurtures adaptability and digital literacy, equipping students with the tools to navigate the complexities of modern, technologically driven environments. These skills are crucial to addressing global sustainability challenges, emphasising informed decision-making and collaborative problem-solving. Consistent with the principles of ESD, PjBL equips students for professional endeavours by cultivating a sense of responsibility toward sustainability (Uggla & Soneryd, 2022). This underscores the importance of expanding PjBL implementation within higher education to support the broader goals of sustainable development.

This study highlights significant contributions to the growing body of PjBL-ESD research in EFL settings. One meaningful addition lies in its Indonesian higher-education context, which remains largely overlooked in sustainability-oriented language learning research. By examining a project utilizing the Scribo digital writing tool, the study provides a concrete example of how technology-mediated PjBL can cultivate sustainability-aligned competencies. Importantly, the findings move beyond the outcome-focused discussions that dominate the literature by showing how skills such as self-regulation, reflective thinking, adaptability, and collaboration develop through students' day-to-day engagement in planning, negotiation, and problem-solving. By foregrounding students' lived experiences, the study offers a more grounded explanation of the processes that activate ESD-related life skills within authentic EFL learning environments, an aspect that has received limited attention in previous work.

Conclusions and recommendations

This study has shown that PjBL is an effective pedagogical approach for developing self-oriented and collaborative skills that are crucial for students' academic success, professional readiness, and capacity to address sustainability challenges. Through real-world projects, students are able to enhance crucial life skills such as critical thinking, problem-solving abilities, and adaptability, which are essential for the dynamic and evolving demands of the 21st century

(Fortune et al., 2018; Sun & Zhu, 2023; Yu et al., 2024). Therefore, PjBL aligns closely with the principles of ESD, which emphasise the cultivation of collaboration and responsible decision-making (Uggla & Soneryd, 2022; Wahbeh et al., 2021). Through technology integration and real-world engagement, PjBL has enabled students to develop crucial life skills while gaining insights into the complexities of sustainable education. This comprehensive approach encourages students to take ownership of their learning to become responsible global citizens. Ultimately, this study advances current PjBL scholarship by offering a mechanism-based explanation of how project work stimulates ESD-aligned competencies in EFL contexts. These contributions underscore the relevance of PjBL not only as a language-learning approach but also as a transformative model that strengthens ESD implementation in diverse educational systems.

This study highlights the need for deeper integration of PjBL in EFL education, as it effectively fosters self-oriented and collaborative skills. To maximise its impact, teachers can strengthen self-oriented and collaborative skills through PjBL by organising projects around clear stages such as planning, research, collaboration, and reflection. Deciding project topics that relate to local ESD issues can make learning more meaningful and help students develop linguistic competencies and the life skills needed for sustainable development. At the curriculum level, higher institutions should embed PjBL across programmes to ensure continuity and coherence in developing students' competencies. Policy makers and institutions should further support equal access to digital tools and provide sustained professional development so that teachers can facilitate PjBL effectively, enabling students to connect theoretical knowledge with sustainable practices for meaningful learning outcomes.

Limitations and ethical considerations

This study underscores several limitations that should be acknowledged. First, the findings arise from a single institutional context involving EFL students who experienced one PjBL project. This narrow setting limits the extent to which the results can be transferred to other institutions, regions, or disciplines. Second, this study involved a small sample of four participants, which restricts the breadth of perspectives represented and therefore limits generalisability. Third, the reliance on qualitative data, such as interviews, may have introduced subjective biases as the participants' responses were partly shaped by their perceptions and experiences.

These constraints highlight the need for future research that expands larger and diverse participant groups across multiple educational contexts to provide

broader insights into how PjBL supports ESD-related skill development. Further, incorporating broader comparative or longitudinal studies would help clarify how PjBL supports ESD-related skills in different EFL environments and strengthen the overall evidence base. Ethical considerations were carefully addressed throughout the study. The participants were informed of the study's purpose, and their consent was obtained before participation. Confidentiality and anonymity were ensured by assigning codes to participants and securely storing data. These procedures aimed to uphold the ethical standards of respect, fairness, and transparency in educational research.

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