Journal of Applied Studies in Language, Volume 9 Issue 1 (Jun 2025), p. 46-54
p-issn 2598-4101 e-issn 2615-4706 © Politeknik Negeri Bali
http://ojs.pnb.ac.id/index.php/JASL

Needs analysis of communication strategies in the Project-Based Learning Model

Diena San Fauziya[1], Ahmad Fuadin[2], Indra Permana[3]

Institut Keguruan dan Ilmu Pendidikan Siliwangi[1,3]
Universitas Pendidikan Indonesia[2]
Email corresponding: dienasanf@ikipsiliwangi.ac.id[1]

Abstract - This study analyzes the need for communication strategies in the Project-Based Learning (PjBL) model. As a transformative educational approach, PjBL emphasizes 21st-century skills, with communication playing a central role in ensuring effective collaboration and learning outcomes. Although PjBL encourages interaction and teamwork, significant communication challenges persist in its implementation, particularly in higher education settings. This research employs a mixed-methods approach with a parallel convergent design, integrating qualitative and quantitative data simultaneously. The study involved two universities in West Java, with data collected through interviews, surveys, and literature review. The findings reveal three essential communication strategies that are needed to support the implementation of the Project-Based Learning (PjBL) model effectively: (1) strategic use of technology as a communication medium, (2) regulated frequency of interaction to maintain group coherence, and (3) multimodal forms of communication, including verbal, nonverbal, and digital, tailored to project needs. These strategies are instrumental in enhancing collaboration, clarity, and efficiency throughout the project process. Results show that 35% of students have adequate digital literacy, 40% face difficulties using digital tools, and 25% express the need for additional training to improve their communication skills on digital platforms. Additionally, structured and scheduled communication significantly enhances group collaboration. This study highlights the importance of developing communication strategies that include digital literacy training and the optimal use of technology to support effective communication in PjBL. These findings provide a foundational insight for future research and policy development aimed at integrating targeted communication frameworks into innovative, student-centered pedagogies.

Keywords: Communication, Communication Frequency, Project-Based Learning, Technology

Journal of Applied Studies in Language, Volume 9 Issue 1 (Jun 2025), p. 46-54
p-issn 2598-4101 e-issn 2615-4706 © Politeknik Negeri Bali
http://ojs.pnb.ac.id/index.php/JASL

1. Introduction

Project-Based Learning (PjBL) has emerged as a transformative educational approach that emphasizes 21st-century skills such as critical thinking, creativity, collaboration, and communication. Among these skills, communication plays a central role in ensuring the effectiveness of project-based learning. As highlighted by Silva (2009), PjBL provides meaningful learning experiences that prepare students to tackle real-world challenges. In this context, communication involves not only the transmission of messages but also the negotiation of meaning, conflict resolution, and the establishment of shared understanding among group members (Mergendoller et al., 2006).

Although communication is widely recognized as a vital component of PjBL, several studies have identified significant challenges in its implementation. Ridwan, A., Rahmawati, Y., & Hadinugrahaningsih (2021) demonstrated that integrating the STEAM approach into PjBL enhances student motivation and learning outcomes through the resolution of authentic problems, which heavily relies on effective group communication. Furthermore, Hmelo-silver et al. (2007) emphasized the importance of directed communication strategies in optimizing the collaborative potential of PjBL.

However, a critical gap remains in understanding how communication can be systematically facilitated within PjBL, particularly in the context of language and literature education. Lestari & Andiansyah (2024) found that in Indonesian EFL settings, students often employed communication strategies such as code-switching and circumlocution during group interactions, yet these strategies have not been systematically integrated into project-based frameworks. This gap highlights the need for a more targeted and structured analysis of communication requirements in PjBL.Beyond group member interactions, educators' role in guiding communication processes within projects is often insufficient. Trisdiono (2019) indicated that while multidisciplinary approaches in PjBL can enhance critical thinking, their success largely depends on clear and structured communication. In many instances, the absence of communication guidelines leads to misunderstandings about project goals and methodologies (Fitriani et al., 2023).

The dynamics of group work in PjBL can also trigger interpersonal conflicts among students. Sulastri et al., (2023) asserted that collaborative skills, including the ability to manage group dynamics effectively, are critical for project success. Additionally, Hasan et al. (2023) highlighted the importance of experiential learning models in developing collaborative competencies, which are fundamentally rooted in interpersonal communication skills. The role of technology in supporting communication in PjBL settings cannot be overlooked. The integration of digital tools, such as online collaboration platforms, can significantly enhance project communication (Hsu et al., 2014). However, the effectiveness of these tools is contingent upon students' digital literacy. From a psychological perspective, communication barriers in PjBL may result in anxiety, fear of judgment, and reluctance to share ideas, thus stifling creativity and collaboration. Mulyadi (2023) emphasized the importance of creating safe and supportive environments where students feel encouraged to communicate openly and constructively.

Given these challenges, it is necessary to integrate a coherent communication framework within PjBL. One relevant approach is pedagogical communication theory, which stresses the importance of message clarity, constructive feedback, and meaning negotiation within educational settings (Chen et al., 2021). This theoretical lens offers a foundation for developing communication strategies that are responsive to students' needs and project complexities.

This study also aims to provide an initial overview of the analysis of communication needs in the PjBL model. Recent studies and educational practices indicate that the effective implementation of Project-Based Learning (PjBL) depends heavily on how communication is managed within the learning process. Key areas that often present challenges include the use of technology to facilitate interaction, the regulation of communication frequency among team members, and the selection of appropriate communication forms (verbal, nonverbal, or digital). These aspects raise questions about which communication strategies are most needed to support successful collaboration and learning outcomes in PjBL settings. This study is expected to be the basis for future development research and contribute to the development of educational policies, especially in promoting the integration of PjBL as an innovative pedagogical approach that is responsive to communication needs.

The novelty of this research lies in its integrative approach, which operationalizes communication theory, needs analysis methodology, and project-based learning (PjBL) principles to develop a targeted communication strategy framework. This integration was realized in three key stages: (1) communication theory was used to define and categorize the types and functions of communication relevant in collaborative learning; (2) a needs analysis was conducted to systematically identify students' perceived

communication challenges and expectations in PjBL environments; and (3) the pedagogical characteristics of PjBL informed the contextual adaptation of communication strategies, ensuring alignment with collaborative, inquiry-based, and outcome-driven learning processes.

Based on this integrative framework, the findings identified three strategic communication dimensions: technological mediation, regulated interaction frequency, and multimodal expression; that reflect both theoretical constructs and contextual needs. To the best of the author's knowledge, no prior studies have comprehensively synthesized these three domains in formulating communication strategies for PjBL, particularly within language and literature education in higher education settings. This study thus contributes both to theory-building and to the pedagogical design of communication interventions that are contextually responsive and practically applicable.

This study, aims not only to contribute to the development of communication theory within pedagogical settings but also to provide a foundation for designing effective, pedagogically grounded communication strategies that can be integrated into higher education curricula, particularly in the context of language and literature education. In line with this aim, the study seeks to explore several key questions: how communication is facilitated through technological tools in the implementation of PjBL; the frequency and quality of communication that occurs among students during PjBL activities; the predominant forms of communication (verbal, nonverbal, and digital) used in PjBL and their influence on project outcomes; and the specific communication needs and challenges encountered by both students and educators in executing PjBL effectively.

2. Method

This study adopts a mixed methods approach using a convergent parallel design to investigate communication needs within the context of Project-Based Learning (PjBL) in language and literature education. This methodological approach is chosen to leverage the complementary strengths of both qualitative and quantitative data, enabling a deeper and more comprehensive understanding of the complex communication dynamics in PjBL (Creswell & Plano Clark, 2021).

Data were collected using three main techniques: in-depth interviews, surveys, and literature review. In-depth interviews were conducted with lecturers who have experience implementing PjBL. This qualitative method aimed to explore their perceptions, communication challenges, and instructional strategies in designing and facilitating project-based learning. The interviews provided rich, detailed narratives essential for capturing nuanced insights (Brinkmann, 2020). Meanwhile, surveys were administered to students involved in PjBL to capture their experiences related to communication during group collaboration and project execution, including interactions with peers and instructors. These surveys focused on identifying the frequency, mode, and barriers to communication in project settings.

The participants of this study included lecturers and undergraduate students from the Indonesian Language and Literature Education Study Program at two higher education institutions one public and one private both of which have adopted PjBL in their curriculum. A total of five lecturers participated, all of whom had a minimum of three years of experience implementing PjBL. Meanwhile, student participants consisted of 255 respondents, purposively sampled from eight different classes. Among them, approximately 68% were female and 32% male, with ages ranging from 19 to 23 years. Most students were in their fifth or seventh semester. In terms of language proficiency, all participants had completed foundational academic Indonesian language courses, and their self-reported proficiency levels were predominantly in the intermediate to upper-intermediate range.

The student survey instrument consisted of a structured questionnaire specifically designed for this study. It was developed based on a synthesis of communication frameworks in collaborative learning (Hmelo-silver et al., 2007; Mergendoller et al., 2006) and adapted to the context of PjBL in language and literature education. The questionnaire underwent expert validation by two educational researchers to ensure content relevance and clarity. A pilot test was conducted with 30 students from a similar cohort, resulting in a Cronbach's alpha score of 0.83, indicating acceptable internal consistency and reliability.

Data analysis followed a convergent parallel mixed methods procedure, in which qualitative and quantitative data were analyzed separately and then integrated to provide comprehensive insights. Quantitative survey data were processed using descriptive statistics to examine frequencies, trends, and perceived communication needs and challenges. Qualitative data from interviews and document analysis (including student reflections and communication artifacts) were analyzed thematically following Braun & Clarke (2024) procedure, which included coding, categorization, and interpretation of recurring themes related to communication strategies and barriers. Findings from the literature review were used to enrich the interpretation and contribute to a stronger conceptual foundation. In the final stage, results

from both data strands were compared and triangulated to identify areas of convergence and divergence, validate findings, and formulate pedagogical recommendations for more effective communication in PjBL.

3. Results and Discussion

This study successfully identified three critical communication needs that influence the successful implementation of Project-Based Learning (PjBL): the use of technology, communication frequency, and forms of communication (verbal, nonverbal, and digital). These findings were derived from data analysis collected through interviews with lecturers and student surveys and supported by relevant literature reviews.

3.1. Use of Technology

The results show that using technology in PjBL is crucial in supporting coordination and communication, particularly in project management. Various technologies were already being utilized in the implementation of PjBL at the two universities involved as research subjects. The tools used by lecturers and students for communication included Google Classroom, SPADA, and Zoom, designed to facilitate task management, document sharing, and real-time communication.

As shown in Table 1, students' digital readiness for utilizing communication tools in PjBL is varied. While only 35% of students self-reported having adequate digital literacy, a larger proportion (40%) experienced difficulties in using technology: particularly due to unfamiliarity with application features. Additionally, 25% expressed a need for further training. These findings suggest a substantial gap in digital competence that could hinder effective communication and collaboration in PjBL settings. Addressing this gap through targeted digital literacy interventions may enhance students' ability to engage meaningfully in project-based tasks.

Table 1. Use of Technology in PjBL

No	Category	Percentage (%)
1	Adequate Digital Literacy	35 %
2	Difficulty with Technology	40 %
3	Need for Training	25 %

One of the educators interviewed stated, "*Learning Management System technologies like SPADA help with project coordination, but students often don't understand how to use them efficiently*." This highlights that while technology offers significant potential, it is not yet fully utilized by students due to limited digital literacy. This lack of skill can lead to poor time management, confusion in task allocation, and inefficiency in team communication. For example, in projects involving multiple documents or tasks, students unfamiliar with digital tools often spend more time figuring out technical mechanisms than focusing on the project's content.

Shows the findings that show the diversity of student competencies in utilizing technology for the communication process during project learning. Only 35% of students admitted that they had adequate digital literacy competencies, 40% admitted that they still had difficulties and 25% admitted that they needed training and mentoring.

Findings from Hastomo & Sutiyono (2022) highlight the importance of platforms such as Zoom in improving students' access to learning materials and facilitating communication during the COVID-19 pandemic. Their study revealed that 68.2% of students appreciated the ability to access learning resources at any time, emphasizing the potential of technology to support continuous learning (Hastomo & Sutiyono, 2022). However, this potential is improved when students need more skills to use these platforms effectively. Additionally, Prihantoro et al. (2022) examined the implementation of team teaching via Zoom and live-streaming technologies, emphasizing the importance of practical collaboration tools in virtual learning environments. Their findings suggest that although technology can facilitate real-time interaction, the effectiveness of these tools depends on students' familiarity with the technology. This aligns with observations that students unfamiliar with digital tools often spend more time addressing technical difficulties than focusing on the project's content. This misuse of time can lead to inefficiencies in task management and hinder overall project outcomes.

In language and literature learning, studied the impact of WhatsApp and Zoom on learning outcomes, revealing that mobile-based learning activities significantly help students overcome learning difficulties and build knowledge collaboratively (Handayani, 2020). The research underscores the importance of integrating communication tools that facilitate interaction and enhance students' understanding of learning materials. However, the effectiveness of these tools diminishes when students need more skills to use them optimally. Furthermore, Nuryanto et al. (2021) highlighted the role of synchronous learning strategies, such as those provided by Zoom, in enhancing students' motivation and engagement in English as a Foreign Language (EFL) learning. The study found that feedback in such learning environments helps students identify their strengths and weaknesses, improving their learning experiences. However, if students cannot interact effectively with the technology, the benefits of such feedback may not be fully realized.

In previous research, Fauziya et al. (2024) mentioned that one aspect of pedagogical communication that is needed is quality interaction whose indicators are communication supported by material aids and non-material means. Technology is one of the bridges to this aspect. Thus, the role of technology is very important in PjBL learning.

The challenges posed by varying levels of digital literacy among students are further compounded by "Zoom fatigue," as discussed by various researchers. Gajjar & Joshi (2010) noted that while Zoom facilitates communication, prolonged usage can lead to fatigue, negatively impacting student engagement and learning outcomes. This underscores the need for educators to provide access to technology and implement strategies to mitigate fatigue and encourage the effective use of digital tools.

While technology plays a crucial role in supporting communication and coordination in PjBL, the variation in digital literacy levels among students remains a significant challenge. The potential of platforms like Zoom and Google Classroom can only be fully realized when students possess the skills necessary to use these tools effectively. Thus, targeted training and support are essential to enhance students' digital literacy, ensuring they can engage with technology meaningfully and maximize their learning experiences in project-based environments.

At the same time, effective and regular communication is fundamental to the success of PjBL, as it fosters collaboration among students and enhances their understanding of project tasks. Data from the questionnaires revealed that 50% of students believe that regular communication greatly aids their understanding of project tasks. In contrast, 30% of students identified irregular communication as a significant barrier to their success, while 20% admitted to experiencing no communication within their groups. These differences highlight the critical role of communication in PjBL, as it facilitates task clarity and promotes group cooperation and collective problem-solving.

Based on qualitative data from the study of Google Classroom and SPADA documents as Learning Management System (LMS) used in PJBL, the effectiveness and efficiency of the use of this technology are still categorized as very weak. Written communication is not well established because the interaction between lecturers and students has not been seen as effective. LMS is only used as a medium for collecting projects, both project progress reports and final reports. Stimulus, feedback, and reinforcement from lecturers have not been seen for each student project report. In fact, the function of technology is very important in terms of monitoring this evaluation.

3.2. Communication Frequency

Meanwhile, effective and regular communication is fundamental to the success of Project-based Learning (PjBL) as it encourages collaboration among students and enhances their understanding of the project tasks. Table 2 illustrates a significant variation in students' communication frequency within PjBL groups. The data suggest that while regular communication is acknowledged as a key facilitator of project comprehension and coordination, a considerable portion of students still encounter communication-related challenges. A notable segment reported either infrequent or even absent group interaction, signaling potential risks to group cohesion, task clarity, and successful project execution. These findings underscore the essential need for structured and sustained communication practices to ensure equitable participation and collaborative efficiency in PjBL environments.

Table 2. Frequency of Communication in PjB

No	Category	Percentage (%)
1	Regular Communication	50 %

2	Infrequent Communication	30 %
3	No Communication	20 %

The importance of structured communication in PjBL was highlighted by a lecturer who stated, "Regular communication helps maintain students' focus." This view aligns with the findings of Cahya (2023), who noted that the stages of PjBL can enhance interaction and collaboration among students, improving cognitive learning outcomes. The structured nature of PjBL, which often involves multiple phases and tasks, requires ongoing dialogue and discussion among group members to ensure everyone stays aligned with the project goals and deadlines. Students need regular communication to coordinate tasks, leading to clarity and potential conflicts regarding task distribution.

Shows that the frequency of student communication in project learning is still diverse. As many as 50% of respondents admitted that their frequency of communication during project learning was sufficient. However, as many as 30% of respondents admitted that it was still rare, and 20% admitted that they were not even involved in communication during the project learning process. This diversity shows the need for alternative formulas that can increase the effectiveness and efficiency of communication frequency to support learning optimization.

The challenges posed by irregular communication manifest in various forms, including disagreements over responsibilities and difficulties in coordinating group activities. Cahya et al. (2023) further supports this perspective, emphasizing that PjBL fosters mutually beneficial student teamwork, which is crucial for effective collaboration. When communication is infrequent or ineffective, students find it easier to fulfill their roles within the group, reducing motivation and involvement. This is particularly detrimental to the project work process, as sustained focus and commitment are necessary to achieve the expected outcomes.

The significance of communication in PjBL is highlighted by Hidayah et al. (2022), who note that collaborative problem-based learning enhances metacognitive skills through effective communication and teamwork. Their research shows that when students engage in regular discussions and reflections, they are better prepared to manage their learning process and make meaningful contributions to the group project. This aligns with findings from the questionnaire, where students expressed that regular communication helped in understanding the project tasks and fostered a sense of responsibility among group members.

Furthermore, the lack of communication damages team dynamics, ultimately affecting overall performance. Win et al., (2015) observe that ineffective communication in a collaborative PjBL environment can lead students to take shortcuts or overlook essential elements in the learning process. This observation is highly relevant in the context of PjBL, where the emphasis on collaboration requires all group members to be actively involved and stay informed about the project's progress. When communication is hindered, students become disengaged, resulting in a decline in the quality of their contributions and the project's overall success.

In conclusion, the data obtained from the questionnaire underscores the importance of regular communication in the success of PjBL. Although many students acknowledge the significance of communication in PjBL, a substantial number still need help with irregular interactions during the learning process. By encouraging structured communication practices and providing the necessary support for students to engage effectively, educators can enhance the collaborative nature of PBL and improve overall learning outcomes.

3.3. Forms of Communication (Verbal, Nonverbal, and Digital)

As summarized in Table 3, students demonstrate a clear preference for verbal communication when engaging in PjBL group tasks. This tendency highlights the value of direct, synchronous interaction in fostering immediate feedback, shared understanding, and interpersonal rapport. While other modalities such as digital and nonverbal communication also play a role, the reliance on verbal exchange suggests that spoken interaction remains central to students' collaborative strategies. These findings imply that effective facilitation of PjBL should not only accommodate diverse communication channels but also prioritize opportunities for real-time verbal engagement to strengthen group cohesion and learning outcomes.

Table 3. Forms of Communication in PjBL

No	Category	Percentage (%)
1	Verbal	50 %
2	Nonverbal	20 %
3	Digital	30 %

Verbal communication is preferred in group discussions and learning because it provides direct feedback, clarifies ideas, and offers clear nonverbal cues such as tone of voice and body language. The ability to express thoughts verbally fosters deeper engagement with the material and creates a collaborative atmosphere where ideas can be exchanged freely.

Although students tend to prefer verbal communication, they also believe that digital communication can be used as a complementary form in PjBL. This finding aligns with previous research, which suggests that PjBL can enhance creativity and learning outcomes, especially when students are encouraged to utilize various communication methods (Hastuti, 2022). The integration of digital tools greatly facilitates collaboration, particularly in situations where face-to-face interaction is not possible. These two forms of communication provide students with the opportunity to leverage the strengths of both verbal and digital communication, thereby enhancing collaboration.

However, the use of digital communication presents its own challenges, particularly when text-based communication lacks speed and relies solely on verbal interaction. In this context, the role of nonverbal communication, although recognized by only 20% of students, plays a critical role. Hand gestures and facial expressions as forms of nonverbal communication are recognized as enhancing face-to-face discussions, providing context and emotional depth. In this regard, PjBL offers students the experience of understanding complex concepts more deeply, often facilitated by the rich interactions that occur in face-to-face settings (Merta et al., 2022). Thus, nonverbal communication plays an equally important role in interactions, helping convey enthusiasm, agreement, or confusion, which can guide the course of the discussion.

Based on the findings and discussion outlined, it can be concluded that effective communication is crucial in PjBL. While students show a preference for verbal communication, their choice of digital communication methods suggests the need for a balanced approach that combines both forms. As educators, instructors who design and facilitate learning should strive to create an environment that encourages verbal interaction while also equipping students with the necessary skills to effectively use digital communication tools. By doing so, they can enhance collaboration and ensure that all students are meaningfully engaged in the learning process.

4. Conclusion

This study identifies three critical communication needs in the implementation of the project-based learning (PjBL) model: the use of technology, communication frequency, and diverse communication forms (verbal, nonverbal, and digital). These elements are shown to be closely linked to the success of collaborative learning. Although digital tools facilitate coordination, approximately 40% of students face challenges in using them effectively, and about 25% express the need for further training highlighting the urgency of improving students' digital literacy. Moreover, structured and frequent communication reduces misunderstandings and improves teamwork, while students capable of engaging in varied communication forms tend to achieve deeper learning and project success. Theoretically, this research contributes by integrating pedagogical communication perspectives into the PjBL framework, positioning communication not merely as a supportive element but as a foundational pedagogical strategy that enhances collaborative learning in higher education.

Despite its contributions, this study has limitations, particularly in terms of scope and methodology. The focus on two institutions and reliance on self-reported data may affect the generalizability of the findings. Future research should include more diverse educational contexts, employ mixed methods, and explore longitudinal impacts of communication practices in PjBL. Studies linking communication patterns with concrete academic outcomes, as well as investigations into emotional intelligence, cultural communication styles, and conflict management in project teams, are highly recommended. Practically, this study encourages educators to develop targeted communication strategies, provide digital skills training, and foster open, inclusive communication environments. These steps will not only strengthen PjBL implementation but also contribute to more effective and meaningful student learning experiences.

Acknowledgements

We want to express our heartfelt gratitude to Institut Keguruan dan Ilmu Pendidikan (IKIP) Siliwangi and Universitas Pendidikan Indonesia (UPI) for their invaluable support and contributions to this research's success.

Financing

The study is funded by Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi Republik Indonesia through the 2024 BIMA Grant.

References

Braun, V., & Clarke, V. (2024). *Thematic Analysis: A Practical Guide Publishing* (Issue January). SAGE. https://doi.org/10.58837/CHULA.PPJ.39.8

Brinkmann, S. (2020). *Unstructured and Semistructured Interviewing. In The Oxford Handbook of Qualitative Research, edited by Patricia Leavy*. Oxford University Press.

Cahya, M. D., Priantari, I., Pamungkas, Y., Sri, N., Utami, A., & Hernowo, B. (2023). *Improving Collaboration and Cognitive Learning Outcomes of Biology Students using PBL through Lesson Study*. *2*(2), 386–393.

Chen, Y., Chuang, H., & Lacaste, A. (2021). *A pedagogical framework of cross-cultural online collaborative projects in English as Foreign Language (EFL) classrooms*. *15*(2), 223–233. https://doi.org/10.11591/edulearn.v15i2.19950

Creswell, J. W., & Plano Clark, V. L. (2021). *Designing and Conducting Mixed Methods Research (3rd ed.)*. SAGE Publications.

Fauziya, D. S., Mulyati, Y., Sastromiharjo, A., & Anshori, D. S. (2024). *Pedagogical Communication Analysis in Training Scientific Articles Writing*. *01*, 119–126.

Fitriani, R., Febriyani, S. D., Pratama, G., Andika, K., Aprilla, R., Nurfajrina, R., & Stivani, D. (2023). *The Influence Of Maritime Education Through Project Based Learning-A Review*. *02004*.

Gajjar, P., & Joshi, M. (2010). *Zoom Based Super-Resolution : A Fast Approach Using Particle Swarm Optimization*. 63–70.

Handayani, D. (2020). *The Application of The PjBL Model uses WhatsApp and*. *4*(October). https://doi.org/10.20885/ijcer.vol

Hasan, M., Arisah, N., Ratnah, S., Ihsan, M., & Ahmad, S. (2023). *Experiential Learning Model for the Development of Collaborative Skills through Project Based Learning Practicum*. *12*(2), 340–349.

Hastomo, T., & Sutiyono, A. (2022). *Zoom Conference : A Study of Students ' Perception on the Academic Achievement during COVID-19 Pandemic*. *15*(March 2019), 193–205.

Hastuti, U. (2022). Musical colossal drama project-based learning to boost students' engagement in English language learning. *Erudita: Journal of English Language …*. https://e-journal.uingusdur.ac.id/erudita/article/view/682

Hidayah, R., Fajaroh, F., & Dasna, I. W. (2022). *Collaborative Problem Based Learning to Improve Metacognitive of Chemistry Students : Systematic Literature Review*. *14*, 6991–7000. https://doi.org/10.35445/alishlah.v14i4.1172

Hmelo-silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). *Scaffolding and Achievement in Problem-Based and Inquiry Learning : A Response to Kirschner , Sweller , and Clark (2006)*. *42*(2), 99–107.

Hsu, P., Dyke, M., Chen, Y., & Smith, T. (2014). The effect of a graph-oriented computer-assisted project-based learning environment on argumentation skills. *Journal of Computer Assisted Learning*, *31*(1), 32–58.

Lestari, I. W., & Andiansyah, M. (2024). *Navigating English-mediated online discourse : Communication strategies of Indonesian EFL learners in online discussions*. *8*(1), 1–10.

Mergendoller, J. R., Maxwell, N. L., & Bellisimo, Y. (2006). *The Effectiveness of Problem-Based Instruction : A Comparative Study of Instructional Methods and Student Characteristics*. *1*(2), 11–17.

Merta, I. W., Artayasa, I. P., & Juliastari, J. (2022). *The Effect of Project-Based Learning with the Science , Technology , and Society Approach on Digestive System Material Against the Concept Mastery*. *8*(6), 2879–2882. https://doi.org/10.29303/jppipa.v8i6.2406

Mulyadi, A. (2023). The effect of a project-based learning model on learning outcomes and collaboration skills. *Bioeduca Journal of Biology Education*, *5*(2), 65–78. https://doi.org/https://doi.org/10.21580/bioeduca.v5i2.16964

Nuryanto, M., Agama, I., Negeri, I., & Salatiga, I. (2021). Fostering Success and Motivating EFL Learners Using Zoom Meeting: A Synchronous Learning Strategy. *Anglophile Journal*, *1*(2), 1–12.

Prihantoro, E., Haryanti, D. A., & Ohorella, N. R. (2022). *Implementation of Team Teaching Learning through the Collaboration of Zoom Cloud Meeting and Live Broadcasting Technology during the Covid-19 Pandemic*. *7*(1), 1–7.

Ridwan, A., Rahmawati, Y., & Hadinugrahaningsih, T. (2021). Steam integration in chemistry learning for developing 21st century skills. *Mier Journal of Educational Studies Trends & Practices*, 184–194. https://doi.org/https://doi.org/10.52634/mier/2017/v7/i2/1420

Silva, E. (2009). Measuring Skills for 21st-Century Learning. *Phi Delta Kappan*, *90*(9), 630.

Sulastri, I. A., Tegeh, I. M., & Agustini, K. (2023). *Collaborative Project Based Blended Learning on Resilience and Student Learning Outcomes*. *7*(4), 698–706.

Trisdiono, H. (2019). *Multidisciplinary Integrated Project-based Learning to Improve Critical Thinking Skills and Collaboration*. *18*(1), 16–30.

Win, N. N., Nadarajah, V. D. V, & Win, D. K. (2015). The implementation of problem-based learning in collaborative groups in a chiropractic program in Malaysia. *Journal of Educational Evaluation for Health Professions*, *12*(17), 8–13.