

EXPLORING THE ROLE OF DIGITAL PLATFORMS IN SUPPORTING PROJECT-BASED LEARNING IN HIGHER EDUCATION

Aulia Rahmawati^{1*}, Rizky Aditya Pratama², Nabila Putri Maharani³

^{1,2,3} Universitas Lambung Mangkurat, Indonesia

*Corresponding author: rahmawatiul04@gmail.com

Abstract - This study explored the role of digital platforms in supporting project-based learning (PjBL) in higher education. A qualitative descriptive design was employed involving lecturers and undergraduate students with experience in digitally supported project-based learning. Data were collected through semi-structured interviews, classroom observations, and document analysis, and were analyzed using thematic analysis and data triangulation. The findings revealed five major roles of digital platforms: facilitating access to project resources and instructions, strengthening communication and collaboration, supporting project management and monitoring, promoting student engagement and autonomy, and enabling formative feedback and revision. Classroom observations showed that students used digital platforms for task distribution, information searching, collaborative production, project consultation, and submission. However, several challenges emerged, including unequal participation, differences in digital competence, unstable internet connectivity, and difficulties in handling large files. The study concludes that digital platforms are most effective when integrated with clear project structures, lecturer scaffolding, collaborative tasks, and continuous assessment rather than being used merely as repositories for learning materials. The findings highlight the importance of pedagogy-centered technology integration in maximizing the potential of PjBL in higher education.

Keywords: Digital platforms; project-based learning; higher education; student engagement; digital collaboration.

1. INTRODUCTION

Higher education is increasingly expected to provide learning experiences that prepare students to respond to complex academic, professional, and societal demands. Beyond acquiring disciplinary knowledge, university students need opportunities to develop collaboration, communication, critical thinking, creativity, problem-solving, and digital competencies. These expectations have encouraged lecturers to reconsider conventional instructional practices and adopt more active, collaborative, and student-centered learning approaches (Bond et al., 2020; Nkomo et al., 2021). In this context, digital platforms have become increasingly relevant to higher education because they provide spaces for communication, resource sharing, collaborative work, feedback, and interaction beyond conventional classroom boundaries. Learning management systems, cloud-based applications, collaborative documents, discussion platforms, and video-conferencing tools can facilitate students' participation in learning activities and support different forms of academic collaboration (Martin et al., 2020; Oyarzun & Martin, 2023). However, the educational contribution of these platforms depends largely on how they are integrated into meaningful pedagogical activities rather than simply on their technological availability (Nkomo et al., 2021).

Project-Based Learning (PBL) represents one pedagogical approach that can benefit from such technological support. PBL engages students in sustained inquiry, authentic tasks, collaboration, decision-making, and the creation of meaningful products or outcomes (Kokotsaki et al., 2016). Its emphasis on active participation and real-world problem solving

History:

Received : 14 August 2026
Revised : 27 August 2026
Accepted : 1 September 2026
Published : 4 September 2026

Publisher: Universitas PGRI Palembang

Licensed: This work is licensed under
a Creative Commons Attribution 4.0 License



makes PBL particularly relevant to higher education, where students are expected to connect theoretical knowledge with practical situations. Previous research has shown that PBL can contribute to students' academic achievement, critical thinking, engagement, and other learning outcomes (Zhang & Ma, 2023; Umam et al., 2022). In Indonesian higher education, PBL has also been reported as a potentially meaningful approach for promoting student participation and developing competencies relevant to academic and professional contexts (Nasution et al., 2022; Riyanti, 2023). Nevertheless, successful implementation requires effective coordination among students, continuous communication, access to learning resources, monitoring of project progress, and opportunities for feedback.

Digital platforms can provide important support for these processes by connecting the different stages of project-based learning. Students can use digital environments to distribute responsibilities, communicate with group members, search for information, develop shared documents, monitor project progress, present their work, and receive feedback from lecturers and peers. Research on technology-enhanced PBL suggests that digital tools can contribute to students' motivation, engagement, skill development, and learning performance when they are appropriately aligned with instructional objectives (Misra et al., 2024; Warman et al., 2025b). Digital collaborative learning research similarly highlights the potential of technology to facilitate interaction and knowledge construction, although its effectiveness is influenced by instructional design, facilitation, students' digital competencies, and the quality of collaboration (Oyarzun & Martin, 2023; Xiaodi et al., 2024). Consequently, digital platforms should not be viewed merely as technical tools but as learning environments that can shape how students communicate, collaborate, and construct knowledge during project activities.

Despite the growing integration of digital technologies into higher education, questions remain regarding how students actually experience digital platforms when participating in project-based learning. Existing studies have frequently focused on measurable learning outcomes, technology adoption, or the general effectiveness of PBL, while students' experiences of using digital platforms throughout the project process require further attention. A qualitative investigation can provide a deeper understanding of how students perceive the usefulness of digital platforms, how these platforms influence collaboration and task management, and what difficulties emerge during their use. Such an approach is particularly important because technological integration may generate both opportunities and challenges, including unequal participation, communication problems, technical limitations, information overload, and differences in students' digital skills (Bond et al., 2020; Nkomo et al., 2021). Understanding these experiences can therefore provide a more contextualized account of the relationship between digital platforms and project-based learning.

Therefore, this study explores the role of digital platforms in supporting Project-Based Learning in higher education. The study focuses on students' experiences of using digital platforms during project activities, particularly in relation to communication, collaboration, access to resources, task coordination, feedback, and project completion. By examining these experiences qualitatively, the study seeks to identify the ways in which digital platforms support PBL as well as the challenges that may limit their effective use. The findings are expected to provide practical insights for lecturers and higher education institutions in designing technology-supported PBL activities that are more collaborative, flexible, and responsive to students' learning needs.

2. METHOD

2.1 Research Design

This study employed a qualitative descriptive research design to explore the role of digital platforms in supporting project-based learning (PjBL) in higher education. A qualitative descriptive design is appropriate when researchers aim to provide a comprehensive account of a phenomenon using participants' everyday experiences and language without imposing an overly abstract theoretical interpretation (Sandelowski, 2000). The approach was therefore selected to obtain an in-depth understanding of how digital platforms are integrated into project-based learning activities, how lecturers and students use these platforms, and the challenges and benefits experienced during the learning process. This orientation is consistent with previous research showing that qualitative inquiry is useful for examining participants' experiences, perceptions, interactions, and learning processes in higher education (Creswell & Poth, 2018; Tisdell et al., 2025). The focus on digitally supported PjBL is also relevant because technology can facilitate collaboration, communication, project management, and access to learning resources, while online project work may create challenges related to participation, communication, and coordination (Guo et al., 2020; Donelan & Kear, 2024).

2.2 Research Setting and Participants

The study was conducted in a higher education context involving lecturers and undergraduate students who had experience participating in project-based learning activities supported by digital platforms. Participants were selected using purposive sampling based on their direct involvement in PjBL and their experience using digital platforms for learning activities. Purposive sampling allows researchers to deliberately select information-rich participants who can provide data relevant to the research objectives (Etikan et al., 2018; Patton, 2020). The participants were expected to have sufficient experience with project-based activities and digital learning environments to describe the phenomenon meaningfully.

2.3 Data Collection

Data were collected through semi-structured interviews, classroom observations, and document analysis. These complementary techniques were selected to capture both participants' accounts and the practices occurring during project (Creswell & Poth, 2018; Tisdell et al., 2025). The interviews explored participants' experiences, perceptions, and practices related to the use of digital platforms, while observations focused on the implementation of project activities, collaboration, communication, and student engagement. Relevant learning materials, project instructions, students' project outputs, and digital interaction records were also examined as supporting documents. The use of interviews, observations, and project artifacts is consistent with research on PjBL in higher education, where perceptions, engagement, learning processes, and project products can be examined through multiple forms of evidence (Guo et al., 2020). In addition, research on online group projects indicates that participation, communication, project preparation, and group relationships are important dimensions to observe when digital technologies mediate collaborative project work (Donelan & Kear, 2024).

2.4 Data Analysis

The collected data were analyzed using thematic analysis. Thematic analysis is a flexible qualitative method for identifying, organizing, analyzing, and reporting recurring patterns

within qualitative data (Braun & Clarke, 2019). Following (Braun & Clarke, 2013) framework and the trustworthiness-oriented procedures proposed by (Nowell et al., 2017), the analysis proceeded through familiarization with the data, generation of initial codes, searching for potential themes, reviewing themes, defining and naming themes, and producing the final report. Interview transcripts, observation notes, and documents were coded systematically, after which related codes were grouped into broader categories and themes. The analysis remained iterative, allowing the researcher to move between the coded data, emerging themes, and the complete dataset to ensure that interpretations remained grounded in the evidence (Braun & Clarke, 2013; Nowell et al., 2017). Data management and interpretation were further guided by the interactive model of qualitative data analysis, which emphasizes data condensation, data display, and conclusion drawing/verification as interconnected processes (Miles & Huberman, 2019). Interview and observation data were compared with relevant learning documents to strengthen the interpretation. Data triangulation was also applied by comparing information obtained from different participants and data sources, an approach recommended for increasing the credibility of qualitative interpretations (Amin et al., 2020). The findings were presented descriptively according to the main themes that emerged from the data, particularly platform use, collaboration and communication, student engagement, project management, learning processes and outcomes, and challenges in implementing PjBL through digital platforms. These dimensions reflect established concerns in technology-supported PjBL research, particularly collaboration, engagement, digital practices, and barriers to effective project implementation (Wood, 2022; Yusri et al., 2024).

2.5 Trustworthiness and Ethical Considerations

To ensure research trustworthiness, the study adopted the criteria of credibility, transferability, dependability, and confirmability proposed by (Guba & Lincoln, 1989). Credibility was strengthened through source and technique triangulation and repeated comparison between participants' statements, observations, and documentary evidence. Dependability was supported by maintaining a clear record of the data collection and coding procedures, while confirmability was addressed by grounding interpretations in the collected evidence and maintaining an analytic trail (Nowell et al., 2017). Transferability was supported by providing sufficient descriptions of the research context, participants, learning activities, and digital practices so that readers can assess the relevance of the findings to comparable higher education settings. These procedures are particularly important in qualitative research because methodological transparency and systematic documentation help readers assess the credibility and traceability of interpretations (Nowell et al., 2017). Ethical considerations were addressed by informing participants about the purpose of the study, obtaining their voluntary participation, and maintaining the confidentiality of their identities and responses.

3. RESULT AND DISCUSSION

The analysis of interview transcripts, classroom observations, and learning documents identified five major themes concerning the role of digital platforms in supporting project-based learning in higher education: (1) facilitating access to learning resources and project instructions, (2) strengthening communication and collaboration, (3) supporting project management and monitoring, (4) increasing student engagement and autonomy, and (5) creating challenges related to unequal participation, technical problems, and digital literacy. The themes were identified through repeated comparison of the data sources, allowing

participants' statements to be examined alongside observed classroom practices and project documentation.

3.1 Use of Digital Platforms for Project Activities

The findings indicated that digital platforms were used throughout different stages of PjBL, beginning with project orientation and resource sharing and continuing through group coordination, submission, feedback, and presentation. The lecturer primarily used the learning management platform to distribute project guidelines, deadlines, reference materials, and assessment criteria. Students subsequently used messaging and collaborative platforms to discuss task division, exchange files, develop project products, and monitor progress. This pattern suggests that digital platforms functioned not merely as repositories for learning materials but as an integrated environment for organizing project-based activities.

One student explained that the availability of project instructions and materials in a digital platform made the project process easier to follow: *“When the lecturer uploads the project instructions, examples, and assessment criteria in one place, we can check them again whenever we need them. I do not have to wait for the next class to ask about the task because my group can read the instructions together and discuss what we should complete first. It also helps us remember the deadline and divide the work according to each member’s responsibility.”* (Student 1, interview)

The lecturer similarly emphasized the organizational function of the platforms: *“The digital platform helps me organize the project from the beginning until the final submission because I can provide the instructions, learning resources, deadlines, and feedback in a structured way. Students can access the same information even when they are working outside the classroom, so the project does not stop when the face-to-face session ends. I can also monitor whether groups have submitted their progress and give comments before they submit the final product.”* (Lecturer, interview)

3.2 Classroom Observation of Digital Platform Use

Classroom observations showed that digital platforms were integrated into several PjBL activities, particularly project planning, group discussion, information searching, collaborative production, consultation, and presentation preparation. The observed activities are summarized in Table 1.

Table 1. The Observed Activities

No.	Observed Activity	Evidence of Digital Platform Use	Student Response	Observation Interpretation
1	Project orientation	Lecturer shared project guidelines, examples, and assessment criteria through the LMS	Students accessed and discussed the materials in groups	The platform provided a common reference for project expectations
2	Project planning	Groups used digital documents and messaging applications to divide tasks and establish deadlines	Most students actively discussed task allocation	Digital tools supported coordination and planning
3	Information	Students searched online	Students	Platforms expanded

	searching	academic and multimedia resources using personal devices	compared sources and selected materials relevant to their projects	access to learning resources
4	Collaborative production	Students edited shared documents, presentations, or multimedia products collaboratively	Group members contributed materials and revisions	Digital tools facilitated collaborative knowledge construction
5	Lecturer consultation	Students submitted drafts and received feedback through the LMS or messaging platform	Groups revised their work based on lecturer comments	Digital communication supported formative feedback
6	Project presentation preparation	Groups used digital presentation and multimedia applications	Students rehearsed and revised presentation materials	Digital platforms supported preparation of project outputs
7	Project submission	Final products were uploaded to the LMS according to the stated deadline	Most groups submitted their products on time	The LMS facilitated centralized project submission and monitoring

The observations also revealed differences in the intensity of participation among group members. Most groups demonstrated active interaction during planning and production, but one or two students in several groups tended to remain less involved in discussion and depended on other members to complete technical or content-related tasks. This observation was consistent with interview data concerning unequal participation in digitally mediated group projects.

3.3 Collaboration and Communication

Collaboration emerged as one of the strongest roles of digital platforms. Students reported that group communication became more flexible because discussions could continue outside scheduled classroom hours. Shared documents and messaging applications enabled students to distribute responsibilities, exchange ideas, provide peer feedback, and revise project materials without being physically present in the same location.

Student 2 described the effect of digital communication on group collaboration: *“Our group usually continues the discussion after the class because not everyone has the same free time. We use the group chat to decide who will search for references, who will prepare the presentation, and who will edit the final product. Sometimes we also use a shared document so everyone can see the changes made by other members and correct the work without creating many different versions of the file.”* (Student 2, interview)

The observation data supported this finding because students were frequently seen consulting group chats, shared documents, and online resources while completing project tasks. The digital environment therefore extended collaboration beyond the physical classroom and allowed students to maintain communication during different stages of project development.

3.4 Student Engagement and Learning Autonomy

Another prominent finding was the increased opportunity for students to take responsibility for their own project progress. Students were required to search for information, select appropriate resources, determine task priorities, and revise their products based on feedback. Digital platforms provided relatively immediate access to resources and allowed students to work at different times according to their group schedules. These conditions encouraged students to become more independent in managing their learning activities.

One student stated: *“Working with digital platforms makes us more responsible because the lecturer does not explain every small step during the project. We have to search for information, compare the sources, decide what is useful, and make our own product. At first this was difficult, but after several stages I became more confident because I knew where to find the materials and how to check the progress of my work.”* (Student 3, interview)

Classroom observations also showed that students frequently initiated searches for additional information without waiting for direct instructions from the lecturer. Several groups independently explored examples and tutorials related to their project products. This behavior indicates that digital platforms supported learner autonomy by providing access to resources that students could use according to their immediate project needs.

3.5 Project Management and Lecturer Feedback

Digital platforms also played an important role in monitoring project progress. The lecturer used digital submission points and online communication to check drafts, identify incomplete work, and provide feedback. Students were able to receive comments before the final submission, which created opportunities for revision and improvement. Project documentation showed that groups generally followed a sequence of planning, drafting, consultation, revision, and final submission.

The lecturer noted: *“Before using the digital system, it was more difficult to monitor the progress of every group because students usually brought their work only when the project was almost finished. With the digital platform, I can ask them to submit a draft or progress report earlier. This gives me an opportunity to identify problems, provide feedback, and make sure that students are moving toward the project objectives rather than completing everything at the last minute.”* (Lecturer, interview)

This finding indicates that digital platforms strengthened formative monitoring within PjBL. Rather than functioning only as a final submission channel, the platforms enabled the lecturer to intervene during the project process and provide feedback when revisions were still possible.

3.6 Challenges in Using Digital Platforms

Despite the benefits, the findings revealed several challenges. The most frequently observed problems were unstable internet connections, differences in students' digital skills, unequal participation, and excessive dependence on messaging applications for project coordination. Technical problems occasionally interrupted access to shared files or online resources, while students with stronger digital skills tended to take responsibility for technically demanding tasks such as editing videos, designing presentations, or managing collaborative documents.

Student 4 explained: *“The platform is useful, but sometimes the internet connection makes the project slower, especially when we have to upload a large video or presentation file. Another problem is that not everyone in the group has the same digital skills, so students who are more familiar with editing applications often do most of the technical work. We try to divide the tasks fairly, but sometimes the final product still depends heavily on one or two members.”* (Student 4, interview)

The classroom observations confirmed these challenges. Students occasionally had to change platforms when files could not be uploaded or when internet connectivity became unstable. In addition, some students were more active in technical production, whereas other members contributed mainly through content searching or discussion. These findings suggest that digital platforms can support PjBL effectively only when students have adequate digital competence, reliable technological access, and clear mechanisms for distributing group responsibilities.

Overall, the findings demonstrate that digital platforms supported PjBL at three interconnected levels. First, they provided access and organization by centralizing project instructions, learning resources, deadlines, and submissions. Second, they facilitated interaction and collaboration through digital communication, shared documents, and collaborative production. Third, they strengthened monitoring and learner autonomy by enabling students to manage their project activities and allowing lecturers to provide feedback throughout the project cycle. However, these benefits were accompanied by challenges involving connectivity, digital competence, and unequal participation. The findings therefore indicate that the effectiveness of digital platforms in higher education PjBL depends not only on the availability of technology but also on pedagogical guidance, students' digital readiness, and effective group-management practices.

Discussion

The findings show that digital platforms functioned as an integrated organizational and pedagogical infrastructure rather than merely as repositories for learning materials. They connected project orientation, resource access, task distribution, collaboration, drafting, feedback, revision, and submission into a relatively continuous workflow. This finding is consistent with Guo et al. (2020), who emphasize that PjBL in higher education involves both project outputs and the learning processes surrounding them. Recent research likewise indicates that technology-enhanced PjBL is most beneficial when digital tools are aligned with collaborative and student-centered project structures rather than used only for content delivery.

Collaboration and student autonomy were also prominent outcomes. Students used messaging applications, shared documents, and online resources to divide responsibilities, exchange ideas, revise products, and continue working beyond classroom hours. This supports Sjølie et al. (2026), who identify student project collaboration as an important area of higher education research, and recent reviews showing that technology can facilitate resource sharing, communication, teamwork, and digital literacy. However, the findings also demonstrate that autonomy did not emerge from technology alone; it was supported by lecturer scaffolding through clear instructions, deadlines, and feedback.

Digital platforms further strengthened project monitoring and formative feedback because lecturers could review drafts, identify problems, and provide feedback before final submission. This process-oriented use is compatible with PjBL, where learning develops through planning, production, feedback, and revision (Warman et al., 2025a). Nevertheless, unequal participation, differences in digital competence, unstable internet connections, and difficulties with large-file uploads remained challenges. These findings are consistent with Farshad and Fortin (2026), who report uneven participation and coordination problems in online group projects. Therefore, effective technology-supported PjBL requires clear group roles, individual accountability, intermediate milestones, alternative submission procedures, and adequate digital support.

Overall, the findings suggest that the educational value of digital platforms depends less on the technology itself than on how it is pedagogically integrated into PjBL. Lecturers should select platforms according to the needs of each project phase for example, LMSs for instructions and assessment, collaborative documents for joint production, and communication applications for coordination. This pedagogy-centered approach can maintain a coherent project workflow while supporting collaboration, autonomy, and formative assessment. The findings also reinforce the importance of examining PjBL as a process, using students' perceptions, classroom observations, and project documentation together to understand how digital collaboration actually unfolds.

4. CONCLUSION

The study concludes that digital platforms play an important role in supporting project-based learning in higher education by connecting project planning, resource access, collaboration, monitoring, feedback, revision, and submission. The platforms also created opportunities for greater student engagement and autonomy by enabling learners to communicate, search for resources, manage tasks, and develop project outputs beyond classroom hours. However, their effectiveness depended on lecturer scaffolding, students' digital competence, reliable internet access, and fair distribution of group responsibilities.

These findings imply that lecturers should adopt a pedagogy-centered approach when integrating digital platforms into PjBL. Future research could examine the implementation of specific digital platforms across different disciplines and institutions, use longitudinal or mixed-method designs, and investigate how digital competence and individual accountability influence project outcomes.

Ethical considerations

Participants were informed about the study and participated voluntarily after providing informed consent. Participant confidentiality and anonymity were maintained throughout the research process, and the collected data were used solely for research purposes.

Use of Artificial Intelligence

AI tools were used only for limited language editing and manuscript refinement. AI was not used to generate, fabricate, manipulate, analyze, or interpret the research data. All data, findings, interpretations, and conclusions were derived from the actual interviews, observations, and documents collected by the researchers.

Conflict of Interest

The authors declare no conflicts of interest related to the research, authorship, or publication of this study.

Funding

This research did not receive any financial support or specific funding from any public, commercial, or non-profit organization.

5. REFERENCES

- Amin, M. E. K., Nørgaard, L. S., Cavaco, A. M., Witry, M. J., Hillman, L., Cernasev, A., & Desselle, S. P. (2020). Establishing trustworthiness and authenticity in qualitative pharmacy research. *Research in Social and Administrative Pharmacy*, 16(10), 1472–1482. <https://doi.org/10.1016/j.sapharm.2020.02.005>
- Bond, M., Bedenlier, S., Buntins, K., Kerres, M., & Zawacki-Richter, O. (2020). Facilitating student engagement in higher education through educational technology: A narrative systematic review in the field of education. *Contemporary Issues in Technology and Teacher Education*, 20(2), 315–368. <https://www.learntechlib.org/p/208718/>
- Braun, V., & Clarke, V. (2013). *Successful Qualitative Research*. SAGE.
- Braun, V., & Clarke, V. (2019). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/https://doi.org/10.1191/1478088706qp063oa>
- Creswell, J. W., & Poth, C. N. (2018). Qualitative Inquiry & Research Design : Choosing Among Five Approaches. In *SAGE Publications, Inc.* (Fourth, Vol. 44, Issue 4).
- Donelan, H., & Kear, K. (2024). Online group projects in higher education: Persistent challenges and implications for practice. *Journal of Computing in Higher Education*, 36(2), 435–468. <https://doi.org/10.1007/s12528-023-09360-7>
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2018). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1–4. <https://doi.org/10.11648/j.ajtas.20160501.11>
- Farshad, S., & Fortin, C. (2026). An umbrella review of meta-analyses on project-based learning: Effects on academic achievement, higher-order thinking, and 21st-century skills. *Educational Research Review*, 100809. <https://doi.org/10.1016/j.edurev.2026.100809>
- Guba, E. B., & Lincoln, Y. S. (1989). *Fourth generation evaluation*. Sage Publications.
- Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, 102, 101586. <https://doi.org/10.1016/j.ijer.2020.101586>
- Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Project-based learning: A review of the literature. *Improving Schools*, 19(3), 267–277. <https://doi.org/10.1177/1365480216659733>
- Martin, F., Sun, T., & Westine, C. D. (2020). A systematic review of research on online teaching and learning from 2009 to 2018. *Computers & Education*, 159, 104009. <https://doi.org/10.1016/j.compedu.2020.104009>

- Miles, M. ., & Huberman, A. . (2019). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Sage Publications.
- Misra, G., Verma, R., Khan, I., & S, A. R. (2024). Impact of technology-enabled project-based learning on students' skill acquisition in higher education in view of NEP: An empirical study. *European Economic Letters*, 14(3), 102–107. <https://doi.org/10.52783/eel.v14i3.1754>
- Nasution, T., Ambiyar, A., & Wakhinuddin, W. (2022). Model project-based learning untuk meningkatkan hasil belajar di perguruan tinggi. *Edukasi: Jurnal Pendidikan*, 20(1), 152–165. <https://doi.org/10.31571/edukasi.v20i1.3675>
- Nkomo, L. M., Daniel, B. K., & Butson, R. J. (2021). Synthesis of student engagement with digital technologies: A systematic review of the literature. *International Journal of Educational Technology in Higher Education*, 18(1), 34. <https://doi.org/10.1186/s41239-021-00270-1>
- Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). *Thematic analysis : striving to meet the trustworthiness criteria*. 16, 1–13. <https://doi.org/10.1177/1609406917733847>
- Oyarzun, B., & Martin, F. (2023). A systematic review of research on online learner collaboration from 2012–21: Collaboration technologies, design, facilitation, and outcomes. *Online Learning*, 27(1), 71–106. <https://doi.org/10.24059/olj.v27i1.3407>
- Patton, M. . (2020). *Qualitative research & evaluation methods: Integrating theory and practice*. Sage Publications.
- Riyanti, D. (2023). The implementation of project-based learning in higher education: students and lecturers' perspectives. *English Language Teaching Educational Journal*, 6(3), 162–171. <https://doi.org/10.12928/eltej.v6i3.9012>
- Sandelowski, M. (2000). Whatever happened to qualitative description? *Research in Nursing & Health*, 23(4), 334–340. [https://doi.org/10.1002/1098-240X\(200008\)23:4<334::AID-NUR9>3.0.CO;2-G](https://doi.org/10.1002/1098-240X(200008)23:4<334::AID-NUR9>3.0.CO;2-G)
- Sjølie, E., Rødsjø, E., Skancke, L., Carvajal, P., Solhaug, S., Jensen, M. R., & Kaalvik, H. (2026). The empirical base of student project collaboration in higher education: A mapping review. *Review of Educational Research*, 00346543261435632. <https://doi.org/10.3102/00346543261435632>
- Tisdell, E. J., Merriam, S. B., & Struckey-Peyrot, H. L. (2025). *Qualitative research: A guide to design and implementation*. John Wiley & Sons.
- Umam, A., Fauziah, Z. N., Rahmawati, M. R., & Jaelani, A. (2022). Promoting students' critical thinking skills through project-based learning in Indonesian higher education. *JEES (Journal of English Educators Society)*, 7(1), 110–117. <https://doi.org/10.21070/jees.v7i1.1531>
- Warman, L. A. D., Hadriana, H., Purwanti, I. T., & Daud, A. (2025a). Implementation of technology-enhanced project-based learning to improve university students' English

- ability: A systematic literature review. *International Journal of Innovative Research and Scientific Studies*, 8(6), 3526–3542. <https://doi.org/10.53894/ijirss.v8i6.10706>
- Warman, L. A. D., Hadriana, H., Purwanti, I. T., & Daud, A. (2025b). mplementation of technology-enhanced project-based learning to improve university students' English ability: A systematic literature review. *International Journal of Innovative Research and Scientific Studies*, 8(6), 3526–3542. <https://ideas.repec.org/a/aac/ijirss/v8y2025i6p3526-3542id10706>
- Wood, R. (2022). A landscape review of the literature focusing upon the use of technology to support problem, case and project based learning in higher education STEM disciplines. In *SEFI 50th Annual Conference Proceedings*. <https://doi.org/10.5821/conference-9788412322262.1164>
- Xiaodi, Y., Yunus, M. M., & Rafiq, K. R. M. (2024). Digital collaborative learning in higher education: A systematic review. *International Journal of Academic Research in Progressive Education and Development*, 13(1), 1110–1122. <https://doi.org/10.46886/IJARPED/v13-i1/17970>
- Yusri, R., Yusof, A. M., & Sharina, A. (2024). A systematic literature review of project-based learning: Research trends, methods, elements, and frameworks. *International Journal of Evaluation and Research in Education*, 13(5), 3345–3359. https://www.academia.edu/download/122313762/54_27875.pdf
- Zhang, L., & Ma, Y. (2023). A study of the impact of project-based learning on student learning effects: A meta-analysis study. *Frontiers in Psychology*, 14, 1202728. <https://doi.org/10.3389/fpsyg.2023.1202728>