THE JOURNAL OF IJETZ
(International Journal of Education and Teaching Zone)
P-ISSN: 2963-7899 I E-ISSN: 2830-7925
jurnal.yayasannurulyakin.sch.id/index.php/ijetz

Collaborative and Reflective Learning Approaches in Biology Teacher Preparation: Emerging Insights and Future Directions

Reni Marina[1]*, Chokchai Yuenyong[2], Hamdani[1], Rahmania Pamungkas[3], Aminah Zb[4]
[1]Faculty of Teacher Training and Education, Tanjungpura University, Pontianak, Indonesia
[2]Science Education Program, Khon Kaen University, Khon Kaen, Thailand
[3]Department of Biology, Yogyakarta State University, Yogyakarta, Indonesia
[4]Faculty of Tarbiyah and Teacher Training, UIN Sulthan Thaha Saifuddin Jambi, Indonesia

*Correspondence Author:
reni.marlina@fkip.untan.ac.id

Abstract: This study aims to analyze research trends and characteristics related to collaborative reflective learning in educational contexts, particularly among pre-service biology teachers, and to recommend courses that align with this strategy. The method used in this study was a Systematic Literature Review (SLR). The researchers reviewed 33 scientific articles selected based on the criteria of being in English, published in reputable journals indexed by Scopus, and published between 2000 and 2025. The results revealed a significant increase in publications on this topic since 2018, with a peak in 2020 and 2024, which may have been influenced by the COVID-19 pandemic and the application of technology in online learning. The results also revealed that the concept of "collaborative" is often associated with professional identity, teaching and learning processes, and teacher competency development. Overall, research trends indicate that collaborative reflective learning is a strategic approach to professional development and pedagogical innovation. These strategies are crucial for preparing pre-service biology teachers who are adaptive and competent. This approach not only deepens understanding of biological concepts but also enhances critical thinking, problem-solving, and reflective skills. Through the implementation of this strategy, prospective teachers are expected to develop strong pedagogical competencies and be ready to face the challenges of 21st century education.

INTRODUCTION

Reflective and collaborative learning approaches are increasingly emphasized in teacher education, as they are believed to enhance the professional competence, critical thinking, and pedagogical skills of prospective teachers (Sinusi et al., 2024; Yaacob et al., 2021). Reflection plays a crucial role in empowering prospective teachers to learn independently (Bassachs et al., 2020). It not only trains them to integrate theoretical concepts and apply them in everyday life but also encourages openness to new ideas and the ability to adapt to evolving challenges (Slepcevic-Zach & Stock, 2018a). Through reflective thinking, prospective teachers gain insights from their experiences and develop problem-solving skills that contribute to their professional growth (Daniëls et al., 2020).

Moreover, for prospective biology teachers, mastery of both theoretical and applied knowledge is essential for developing innovations in biology education. This can be fostered through collaborative learning (Faisal et al., 2013).

The concept of reflection was introduced by Dewey (1933) as the deliberate, structured examination of beliefs, knowledge, and practices, using current information and understanding to solve problems. This concept was further developed by Schön (1983), who used it as the foundation for reflective practice in his work *The Reflective Practitioner: How Professionals Think in Action* (Bunt & Gouws, 2020; Nurhayati et al., 2023; Yaacob et al., 2021). Both theories emphasize that this approach can improve the quality of learning by encouraging collaboration and generating diverse ideas. Collaborative learning is an effective approach for increasing motivation and focus on a problem. This is crucial for prospective teachers, especially biology teachers, as it helps them build strong social and professional relationships within a team. Globally, learning through reflective and collaborative approaches is a key focus in teacher education reform (Assalihee et al., 2024; Machost & Stains, 2023; Nganga & Kambutu, 2024). In Indonesia, despite efforts to enhance teacher quality through the Merdeka Belajar and Kampus Merdeka programs (Daga, 2022; Manurung, 2022), reflective and collaborative learning practices have not yet been fully integrated into the teacher education curriculum (Berutu, 2025; Putra, 2024). Bunt & Gouws (2020) also note that, although this approach is part of the teacher education curriculum, prospective teachers still do not effectively reflect on their learning processes or teaching practices. This lack of reflection leads to complacency and egocentric beliefs, which can hinder their professional development. Therefore, more in-depth and transformative strategies are needed to ensure that reflective attitudes become a natural part of the professional identity formation for prospective teachers (Daniëls et al., 2020; Sinusi et al., 2024; Yaacob et al., 2021). Consequently, a systematic review is necessary to explore how this approach has been applied and studied in various contexts.

Trained teachers who are reflective and collaborative are believed to be better prepared to design meaningful and adaptive learning experiences tailored to students' needs (Fernández-Morante et al., 2021). Therefore, relevant research is essential to support the development of learning models that can enhance the quality of biology education graduates. Academically, this study contributes to expanding knowledge about effective and practical pedagogical approaches. The findings can serve as a reference for lecturers or institutions with a similar focus in designing teacher education curricula that are more responsive to change. Based on the initial review conducted, several gaps in the literature have been identified. There is still a lack of systematic studies specifically discussing the implementation and effectiveness of reflective collaborative learning for biology teacher candidates. Additionally, existing studies tend to be localized and have not identified broader patterns or trends, further emphasizing the urgency of this research.

Previous research has primarily consisted of case studies and experimental studies. This study differs in that it employs a Systematic Literature Review (SLR) approach, which will offer a more comprehensive analysis of existing research. Through this approach, the study aims to identify publication trends related to collaborative reflective learning, analyze the methodological and thematic characteristics of previous studies, uncover gaps

(IJETZ) | International Journal of Education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025)

Page 460

in the literature that can serve as a foundation for future research, and provide recommendations for the development of collaborative reflective learning within the context of biology teacher education.

THEORETICAL SUPPORT
The Conceptual and Empirical Foundations of Reflective Collaboration

Reflective collaboration emerged as a distinct construct by integrating Dewey and Schön's principles of individual reflection, which emphasize critical reflection on experiences, beliefs, and actions, with the concept of collaboration, which focuses on collaborative work, professional dialogue, and the exchange of perspectives (Kuh, 2016; Parsons & Stephenson, 2005; Romeu et al., 2016). When these two theories are combined, reflection is no longer understood as a solitary, introspective process but rather becomes a social activity involving shared analysis, mutual feedback, and the construction of collective understanding. This integration produces a new form of practice in which teachers or professionals examine experiences in a structured manner through discussion, interpret findings collaboratively, and formulate improvement measures cooperatively. Thus, reflective collaboration stands out as a distinct construct because it combines the depth of reflection with the power of dialogue and diverse perspectives to continuously improve the quality of practice.

The concept of reflective collaboration goes beyond simply working together physically; it involves sharing insights, experiences, and critical thinking to enhance understanding and practice (Brown et al., 2021; Kamali & Javahery, 2025). Reflective collaboration is grounded in the belief that knowledge and skills are best developed through social interaction. Albert Bandura, in his Social Learning Theory, emphasized that learning occurs not only through personal experience but also through observation and interaction with others. Reflective collaboration acts as a mechanism that enables groups to better understand how they work together, identify existing barriers, and devise solutions to improve team effectiveness. This process allows individuals to tap into collective intellectual resources, collaborate to solve problems, and enhance team outcomes through deep reflective discussions. Collaboration also fosters the development of social, communication, and negotiation skills, all of which are essential for group decision-making and team success (Clarà et al., 2019; Zhou et al., 2025).

Empirical research supporting reflective collaboration demonstrates tangible benefits in both educational and professional contexts. Several studies have shown that reflective collaboration enhances the quality of learning, team performance, and professional development. One of the key benefits of reflective collaboration is the improvement in learning quality. Johnson and Johnson (1999) found that collaborative learning enhances conceptual understanding and critical thinking skills among students. By encouraging students to discuss, provide feedback, and reflect on their experiences, learning becomes more meaningful and deeper. Li, Tsai, & Liao (2013) discovered that, in the educational context, reflective collaboration through group projects can improve problem-solving skills and the achievement of shared goals. Their study also indicated that

International Journal of education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025) | **(IJETZ)**

Page 461

reflective collaboration deepens students' understanding of the subject matter and enhances their practical skills. Additionally, Dillenbourg (1999) argued that reflective collaboration allows group members to address errors collectively and develop a better understanding of the concepts being studied. This makes reflective collaboration highly valuable in education, as it helps students cultivate critical thinking and analytical skills.

The reflective process also encourages students to learn from their experiences and from their peers, making them more active participants in the learning process. Research has also shown that reflective collaboration improves team performance and leadership. Wylie and Nilsen (2012) found that in various professional contexts, teams actively engaged in joint reflection are better able to improve their performance. This collaborative reflection process enables teams to evaluate how they work, recognize their strengths and weaknesses, and develop strategies for future improvement. Additionally, research indicates that reflective collaboration strengthens relationships between team members, helping them work more harmoniously while boosting motivation and commitment to shared goals. Leadership also benefits from reflective collaboration. A study by Ng & Tan (2007) revealed that joint reflection enhances leadership skills by allowing leaders and team members to share feedback and develop new approaches to leadership and teamwork. This process also strengthens participatory leadership, where each team member feels involved in decision-making and takes responsibility for the final outcomes.

METHOD

This study employs a Systematic Literature Review (SLR) approach to analyze the development and trends in research related to collaborative reflective learning from 2000 to 2025. The review was conducted systematically and structurally to gather comprehensive and objective data from relevant literature. The process began with the establishment of criteria, which included English-language scientific articles indexed in the Scopus database, as well as the use of related keywords such as "collaborative," "learning," and "reflective" in the title. Data collection was carried out through searches in the Scopus database.

The research questions for this SLR were formulated based on the focus of the selected topic. The research question is: What are the publication trends related to the theme of "reflective collaboration for biology teachers" in Scopus-indexed journals? We used the keywords "reflective AND collaboration learning" in the search menu of the Scopus database. Using these keywords and search patterns, we found 512 articles. The data obtained was stored in *RIS* format. This study followed the concept of a systematic literature review in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) standards, which ensure that the data collection and analysis processes are transparent and reproducible, as referenced in the study by Marlina et al. (2024). This approach is grounded in content analysis theory and data visualization to facilitate the interpretation of trends and relationships between variables. Through this method, the study aims to provide a comprehensive overview of trends and characteristics of research in the field of collaborative and reflective learning, while also laying the groundwork for further studies in this area. The PRISMA standards serve as

(IJETZ) | International Journal of Education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025)

Page 462

tools and guidelines used to evaluate systematic reviews and/or meta-analyses. The key inclusion criteria for this SLR are as follows: (1) articles published between January 2000 and June 2025 (the past 25 years); (2) only open-access articles; (3) publications must be research/original articles; (4) the subject area of the article is social sciences; and (5) the article is published in English and pertains to research on "reflective and collaborative learning." The inclusion and exclusion process we followed is shown in Figure 1.
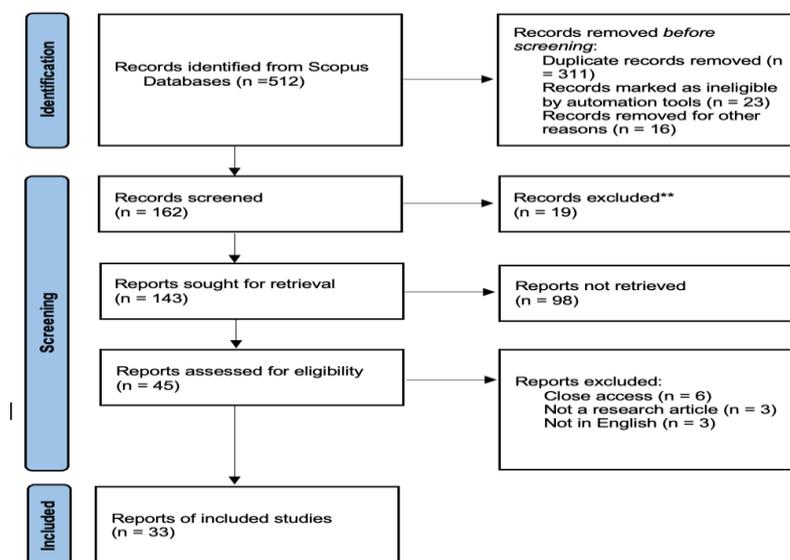
Figure 1. Systematic Review Flow Diagram of Reflective and Collaborative Learning

As shown in Figure 1, we initially identified 512 articles. We then selected only those articles where the participants were teachers and students in schools and universities, resulting in 162 articles that met the criteria, meaning 350 articles were excluded. Next, we refined the search to include only articles published in journals, which yielded 143 articles, excluding 19 based on this criterion. We further narrowed our selection by focusing on articles that applied or implemented educational practices, resulting in 45 articles that met the criteria, meaning 98 articles were excluded. The search was then limited to articles published between January 2000 and June 2025, open access, in English, and within the social sciences subject area. This resulted in 33 articles meeting the criteria, with 12 articles falling outside the specified period. We then applied the inclusion criterion of the field of study or subject area as "social sciences," resulting in 98 articles that met the criteria, meaning 12 articles were excluded. We excluded document types that did not align with the criteria, such as book chapters, conference papers, reviews, notes, editorials, short surveys, and letters. Ultimately, 33 documents met the inclusion criteria. These documents were coded and classified based on field of study, country of origin of the authors, institution, year of publication, and main keywords. The analysis was conducted descriptively using statistical techniques to identify the distribution and patterns of the collected data, supported by data visualizations such as word clouds, treemaps, Sankey diagrams, and distribution graphs.

International Journal of education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025) | **(IJETZ)**

Page 463

RESULT AND DISCUSSION

From the analysis of 33 indexed scientific articles in the Scopus database on "Collaborative and Reflective Learning" from 2000 to 2025, various patterns and trends were identified, highlighting developments and key characteristics of research in this field.
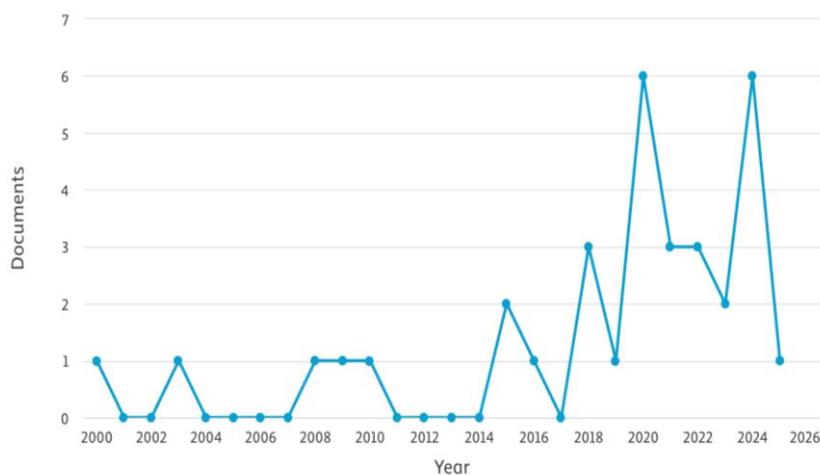
Figure 2. Scopus Document Analyzer From 2000 to 2025

The distribution of publication years shows a significant increase in academic interest in the topic of collaborative reflective learning starting in 2018, with peaks in 2020 and 2024, each having six scientific articles. Prior to these years, the number of publications was relatively low and inconsistent. This surge suggests that the topic is gaining increasing attention in academic research. Since 2018, academic attention to reflective and collaborative learning has seen a significant increase. The temporal visualization reveals a sharp rise in publications in 2020, followed by another increase in 2024. This growth can be attributed to changes in learning needs due to the COVID-19 pandemic, which accelerated the use of online learning technologies and highlighted the importance of collaborative and reflective approaches in supporting adaptive learning processes (Hasibuan et al., 2025; Juliati et al., 2021; Rahayu et al., 2024). The urgency of this approach has gained increasing attention as it is seen to foster effective learning by encouraging creativity and critical thinking skills among prospective teachers (Lubis, 2023; Vuopala et al., 2016; Wawan & Setiawan, 2021; Zainuddin et al., 2019). Additionally, contributing factors to this trend include the growing need for the development of 21st-century skills—critical thinking, collaboration, reflection, interdisciplinary integration, and the application of these skills in the learning process (Anchunda & Kaewurai, 2025; Marlina et al., 2025). The independent curriculum aligns with global educational demands, fostering more student-centered learning and encouraging the exploration of learning models that emphasize active learning experiences (Heriyati, 2022; Indarta et al., 2022). The increase in publications also indicates that the academic community is increasingly aware of the importance of collaborative approaches in knowledge building and reflection as key components of professional identity formation (Branch & George, 2017; Johnson & Chauvin, 2016). In the current educational landscape, reflective and collaborative approaches are becoming increasingly relevant for preparing

(IJETZ) | International Journal of Education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025)

Page 464

professional teacher candidates. Amid global challenges such as technological disruption and evolving social dynamics, reflective-collaborative learning has become an approach that not only promotes academic success but also supports the personal and social development of prospective teachers (DeLuca et al., 2023; Prayoga et al., 2024). Therefore, the rise in publications underscores the significance of this issue in addressing contemporary educational needs.
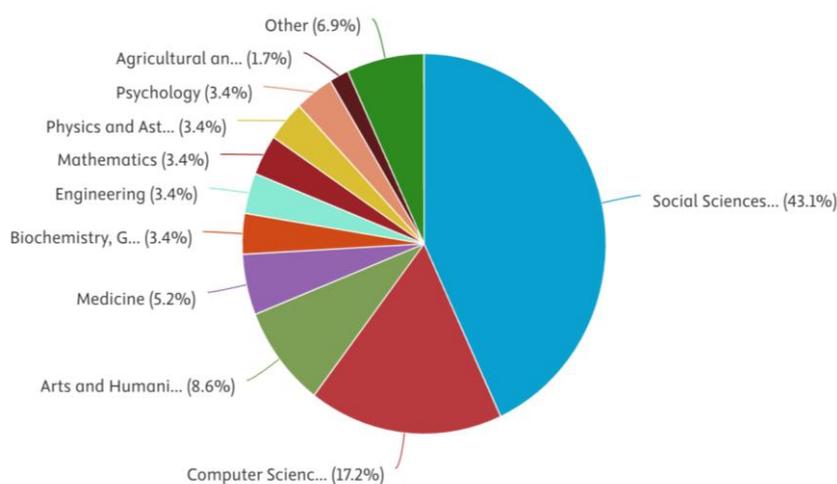
Figure 3. Distribution of Documents by Field of Study

Based on the distribution above, it can be concluded that the collaborative and reflective learning approach is most prominent in the social sciences. Its application extends beyond education to professional training and scientific development, emphasizing reflective practice and collaboration. Thematic findings such as the importance of structured reflection, the need for professional collaboration, the role of peer feedback, and the use of evidence from teaching practices directly support the study's goal of strengthening prospective biology teachers' pedagogical and professional competencies. Structured reflection helps prospective teachers connect biology teaching experiences with pedagogical concepts and scientific content, thereby improving the quality of instructional decision-making (Tobin et al., 2024; Xiaodi et al., 2024). Professional collaboration through discussions, lesson studies, or video analysis of teaching provides diverse perspectives that enrich prospective teachers' understanding of students' difficulties in learning abstract biological concepts. Peer feedback and data-driven analysis strengthen prospective teachers' abilities to design inquiry-based learning, experiments, and authentic biological contexts. Thus, each thematic finding not only illustrates the dynamics of the learning process but also directly contributes to achieving the study's primary goal: developing prospective biology teachers who are reflective, adaptive, and possess strong pedagogical sensitivity to navigate the complexities of science learning in the classroom (Daniëls et al., 2020; Rahayu et al., 2024).

International Journal of education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025) | **(IJETZ)**

Page 465
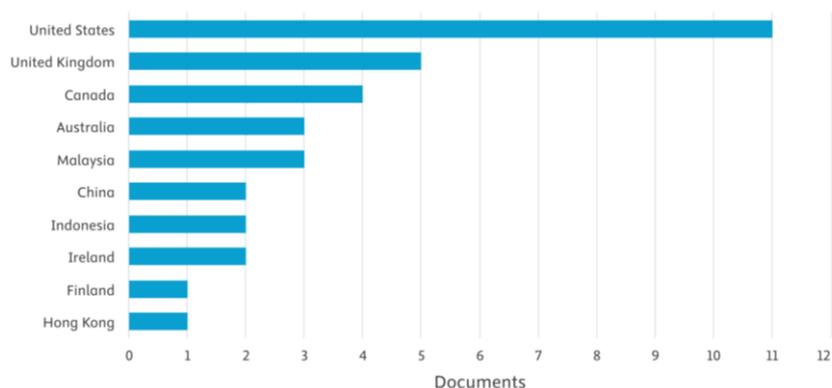
Figure 4. Distribution of Articles Based on the Author's Country of Origin

The distribution above shows that the collaborative and reflective learning approach is recognized globally, with the highest prevalence in North America and Western Europe. The involvement of Asian countries suggests that this approach is beginning to gain recognition and is being applied in the context of education and research in Asia, particularly in higher education and professional training.
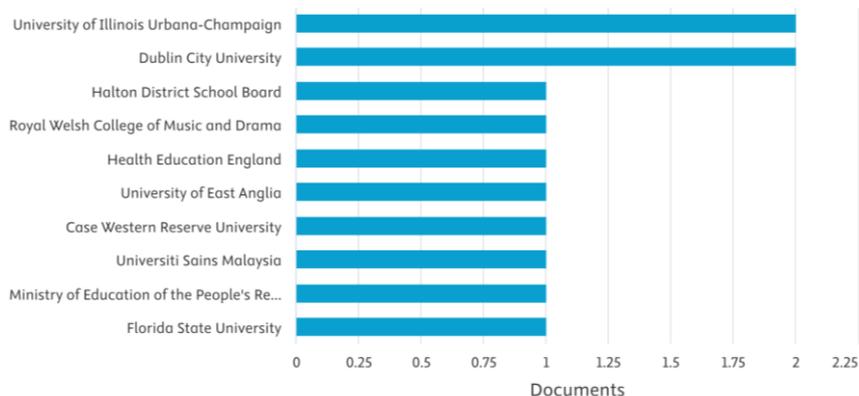
Figure 5. Distribution of Articles Based on Institution

This distribution indicates that research on collaborative and reflective learning can be applied across various sectors, including academia and government, making it a multidisciplinary topic.
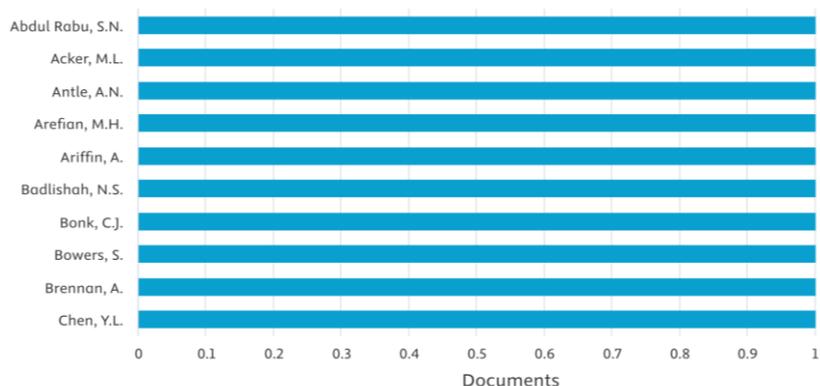
Figure 6. Authors Contributing to the Academic Topic of Collaborative Reflective Learning

(IJETZ) | International Journal of Education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025)

Page 466

This distribution shows that research on collaborative and reflective learning is not concentrated within one or two academic circles, but is widely dispersed. The diversity of backgrounds among researchers interested in this approach will further broaden and enrich perspectives and practices in the field.
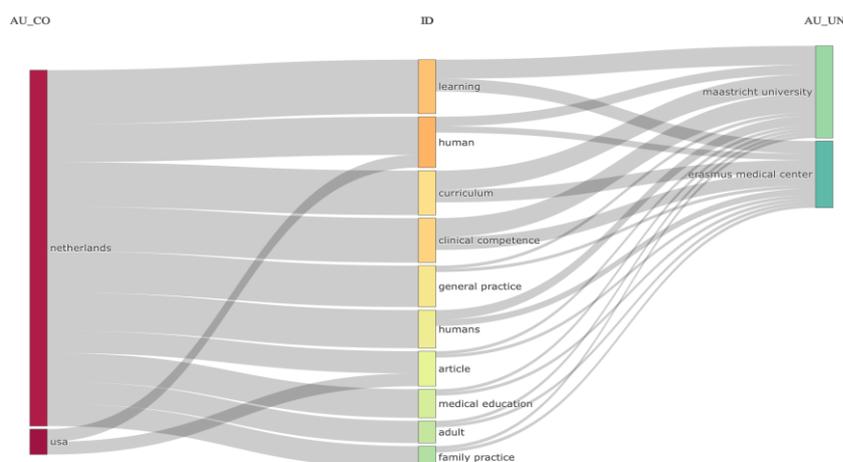
Figure 7. Sankey Diagram, Showing the Relationship Between the Authors' Countries of Origin, the Topics Discussed, and The Authors' Institutions

The concept of "professional identity" is also clearly reflected in the Sankey diagram, which illustrates the connections between the researchers' countries of origin, fields of study, and research focus. The Netherlands stands out as the largest contributor to studies on collaborative and reflective learning, particularly in the field of medical education. This reflects the strong tradition of medical education in Europe, which emphasizes reflective and practice-based approaches in professional training. Additionally, other European countries are also actively contributing to this field, highlighting global recognition of the importance of this approach. These findings suggest a significant opportunity to develop similar research to support education reform and teacher training by adapting the reflective-collaborative approach to Indonesia's local culture and needs.

Research on reflective and collaborative learning is most prevalent in the social sciences, particularly in education (Charalambous & Praetorius, 2022; Marlina, Hamdani, et al., 2023). This aligns with the multidisciplinary nature of the approach, which integrates learning theories, educational psychology, and theories of identity and professional practice. The dominance of the social sciences highlights that this issue is more frequently studied in the context of training and human resource development. Geographically, the majority of publications come from North America and Western Europe, reflecting the concentration of research resources and knowledge in these regions. This may be attributed to strong educational policy support, research funding, and the presence of higher education institutions that are pioneers in developing innovative learning approaches (Charalambous & Praetorius, 2022; Mandikonza, 2022; Marlina, Suwono, Yuenyong, Ibrohim, Mahanal, Saefi, et al., 2023). The contributions from these developed countries significantly shape the standards and direction of global literature on reflective and collaborative learning. However, this distribution also reveals disparities in representation.

International Journal of education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025) | **(IJETZ)**

Page 467

The lack of publications from developing countries reflects challenges in accessing research and developing new learning models. Therefore, it is essential for countries such as Indonesia to increase their involvement in international research to adapt learning practices to the local context and broaden their contribution to global literature.

This data shows that research on collaborative and reflective learning is most advanced in the Netherlands, particularly in the context of medical education and the development of clinical competencies. In the word cloud, the most frequently used keywords, such as "collaborative," "learning," "pembelajaran," and "praktik reflektif," dominate, highlighting that collaborative and reflective approaches are central to discussions across various sources. The prominence of the words "learning" and "praktik" further emphasizes the literature's focus on teaching processes and strategies, rather than solely on theory. These keywords illustrate that the primary focus of the research is on exploring how collaborative learning can support reflection in professional contexts, particularly in teacher training and other professional fields. Terms like "identity," "experience," and "development" also appear, suggesting that the research not only evaluates the effectiveness of methods but also investigates the personal and professional development aspects of learners or trainees. The interconnection between these keywords reflects key themes in the literature, such as the integration of theory and practice, the enhancement of professional competencies through reflection, and the use of collaboration as a pedagogical approach. This provides a strong foundation for designing a learning model that systematically combines these elements, especially in teacher training or vocational higher education (Charalambous et al., 2021; Marlina, Suwono, Yuenyong, et al., 2024).

Figure 8. Word Cloud, A Visual Representation of Keyword Frequency

The dominance of keywords related to curriculum, competence, experiential learning, and technology indicates that current research prioritizes curriculum innovation

(IJETZ) | International Journal of Education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025)

Page 468

that integrates reflection, collaboration, and digital tools to enhance clinical competency through authentic, data-driven learning experiences. This pattern underscores the importance of situating learning in real-world contexts that encourage problem-solving, peer interaction, and guided feedback, reflecting an interdisciplinary convergence of education, health, technology, and psychology. Such a model can be adapted to biology teacher education by embedding structured reflection and collaborative activities such as lesson study, case-based discussions, video analysis, and reflective journals into coursework and teaching practica, enabling prospective teachers to engage in iterative plan teach, reflect, revise cycles supported by peers and supervisors. Its effectiveness can be empirically tested through mixed-methods research that measures gains in pedagogical competence, scientific argumentation, and instructional design using observation rubrics, surveys, performance assessments, interviews, reflective journals, and discussion analyses, with convergent evidence demonstrating strengthened metacognitive skills, analytical abilities, and professional growth.

The results of the visualization and analysis of research trends indicate that reflective and collaborative learning is an approach with great potential for application in teacher training. It addresses the challenges of developing pedagogical and professional competencies among prospective teachers and aligns with the direction of the Merdeka Curriculum, which emphasizes independent learning and reflection in Indonesia. A learning model that integrates collaboration and reflection can offer an innovative solution to improve the quality of science education in schools. Teachers can be encouraged to adopt an approach that emphasizes experiential learning, group discussions, and reflective assessment, which not only enhances content mastery but also fosters continuous professional growth. This is crucial in shaping teachers who are adaptive and capable of managing the complexity of heterogeneous classrooms, including inclusive classrooms (Marlina, Suwono, Yuenyong, Ibrohim, Mahanal, & Hamdani, 2023; Segura et al., 2023).
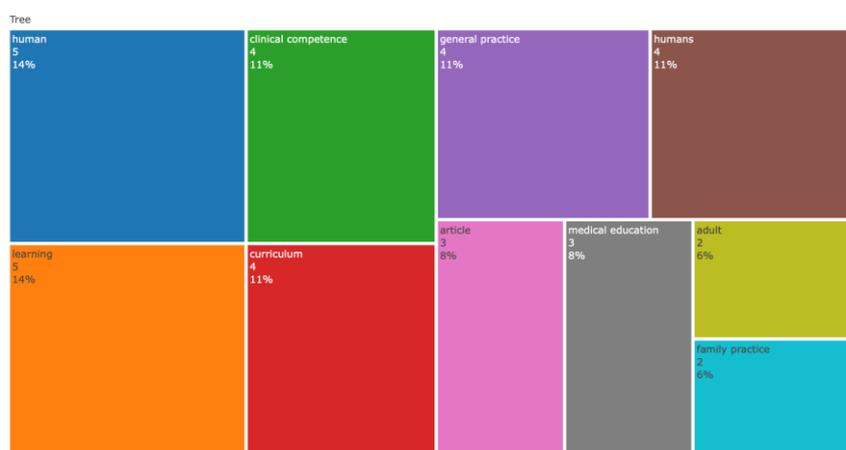
Figure 9. Treemap of Topic Proportions or Frequencies in the Dataset

Each box includes a percentage representing its proportion of the total analyzed data. The purpose of this visualization is to provide a quick and clear overview of the distribution of topics or themes that appear most frequently in a text corpus, such as scientific

International Journal of education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025) | **(IJETZ)**

Page 469

publications, medical articles, or research documents. According to Tobin et al. (2024), several strategies can be used to implement the collaborative-reflection approach. These include holding regular meetings at the end of each activity block to discuss learning experiences and plan future activities, thereby creating space for collective reflection. Collaborative reflective strategies also incorporate models such as John's model of reflection to guide the reflection process, although in practice, these models are adapted to suit the specific needs of the situation. This strategy is also believed to encourage open and respectful professional conversations among teachers, allowing them to share experiences of what worked well, challenges encountered, and ideas for improvement. Additionally, oral and natural reflection during classroom activities can be employed to ensure that reflection is continuous and not overlooked. Furthermore, the reflective collaboration strategy fosters a culture of trust and openness, enabling teachers to feel comfortable expressing differing viewpoints, asking questions, and exploring various perspectives. For effective implementation, this strategy requires sufficient time within the school schedule to be conducted thoroughly (both reflection-in-action and reflection-on-action), which strengthens the critical reflection process. It also ensures that all team members are involved in the inquiry and collaboration process, thereby building shared awareness and collective responsibility in the development of teaching practices (Sudirman et al., 2021; Yan & Goh, 2023).

Figure 10. Word Association Network with the Main Word "Collaborative"

Collaborative reflection emerges as a central node with high conceptual density, indicating that it is widely discussed both in research literature and in the context of teacher professional development. The network structure reflects two dominant thematic clusters. The first cluster is associated with academic research and reflective practice, where collaborative reflection serves as a methodological foundation for examining teachers' reasoning, pedagogical decisions, and construction of professional knowledge. The second cluster highlights its role in competency development, emphasizing how joint reflection supports skill enhancement, pedagogical adaptation, and responsiveness to diverse learners. The prominence of collaborative reflection within the co-occurrence network underscores its dual function: it operates as a theoretical construct that informs scholarly

(IJETZ) | International Journal of Education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025)

Page 470

inquiry and as a practical framework that strengthens reflective capacity, peer learning, and instructional quality in educational settings. This centrality demonstrates that collaboration is integral to advancing teacher professionalism, fostering evidence-based practice, and sustaining continuous improvement in teaching and learning processes..

Gambar 11. L Arge Co-Occurrence Network of Keywords in Scientific Articles or Journals

This visualization shows that collaborative reflection is a central and widely discussed concept, both in scientific research and teacher professional development. Two major focuses are evident: academic research and practice, as well as competency improvement in the field of education. While reflective collaboration offers many benefits, there are also challenges associated with its implementation. One common challenge is resistance to collaborative learning, particularly among students who are accustomed to traditional, lecture-based teaching methods. To overcome this, instructors can gradually introduce collaborative elements into the course, starting with small group activities and progressively increasing the complexity of the collaborative tasks. Another challenge is the time constraints inherent in a semester-based system, which may limit the time available for in-depth discussions and reflection. Instructors can address this issue by designing shorter, focused reflective activities and utilizing technology to facilitate asynchronous collaboration.

CONCLUSION

This study confirms that reflective and collaborative learning has increasingly become a focal point in educational literature since 2018, with a significant acceleration driven by the need for adaptation during the COVID-19 pandemic. This approach proves effective in strengthening the pedagogical and professional competencies of prospective teachers, as well as fostering the development of their professional identity and overall professionalism. The use of digital technology and data-driven collaborative models has emerged as a key strategy for enhancing the quality of science education in schools and teacher training programs. Consequently, developing learning models that integrate reflection and collaboration offers an innovative solution to address the challenges of

International Journal of education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025) | **(IJETZ)**

Page 471

modern education. The implementation of these strategies is crucial for preparing adaptive and competent biology teacher candidates in today's educational landscape. This approach not only promotes a deep understanding of biological concepts but also develops critical thinking skills, problem-solving abilities, and sustained reflective awareness.

REFERENCES

Anchunda, H. Y., & Kaewurai, W. (2025). An Instructional Model Development Based on Inquiry-Based and Problem-Based Approaches to Enhance Prospective Teachers' Teamwork and Collaborative Problem-Solving Competence. *Social Sciences & Humanities Open*, *11*, 101480. https://doi.org/10.1016/J.Ssaho.2025.101480

Assalihee, M., Bakoh, N., Boonsuk, Y., & Songmuang, J. (2024). Transforming Islamic Education Through Lesson Study (LS): A Classroom-Based Approach to Professional Development in Southern Thailand. *Education Sciences*, *14*(9), 1029. https://doi.org/10.3390/Educsci14091029

Bandura, A. (1977). Social Learning Theory. *Prentice Hall*

Bassachs, M., Cañabate, D., Nogué, L., Serra, T., Bubnys, R., & Colomer, J. (2020). Fostering Critical Reflection in Primary Education Through STEAM Approaches. *Education Sciences*, *10*(12), 384. https://doi.org/10.3390/Educsci10120384

Berutu, H. (2025). Islamic Religious Education Teacher Education for Critical and Reflective Religious Learning in Schools. *Jurnal Kualitas Pendidikan*, *3*(1), 13–21.

Branch, W. T., & George, M. (2017). Reflection-Based Learning for Professional Ethical Formation. *AMA Journal of Ethics*, *19*(4), 349–356. https://doi.org/10.1001/Journalofethics.2017.19.4.Medu1-1704

Brookfield, S. D. (2017). *Becoming a critically reflective teacher* (2nd ed.). Jossey-Bass.

Brown, C., Poortman, C., Gray, H., Ophoff, J. G., & Wharf, M. (2021). Facilitating Collaborative Reflective Inquiry Amongst Teachers: What Do We Currently Know? *International Journal of Educational Research, 105*, 101695. https://doi.org/10.1016/J.Ijer.2020.101695

Bunt, B., & Gouws, G. (2020). Using An Artificial Life Simulation to Enhance Reflective Critical Thinking Among Student Teachers. *Smart Learning Environments*, *7*(1), 12. https://doi.org/10.1186/S40561-020-00119-6

Charalambous, C. Y., & Praetorius, A.-K. (2022). Synthesizing Collaborative Reflections on Classroom Observation Frameworks and Reflecting on the Necessity of Synthesized Frameworks. *Studies In Educational Evaluation*, *75*, 101202. https://doi.org/10.1016/J.Stueduc.2022.101202

Charalambous, C. Y., Praetorius, A.-K., Sammons, P., Walkowiak, T., Jentsch, A., & Kyriakides, L. (2021). Working More Collaboratively to Better Understand Teaching and Its Quality: Challenges Faced and Possible Solutions. *Studies In Educational Evaluation*, *71*, 101092. https://doi.org/10.1016/J.Stueduc.2021.101092

Clarà, M., Mauri, T., Colomina, R., & Onrubia, J. (2019). Supporting Collaborative Reflection in Teacher Education: A Case Study. *European Journal of Teacher Education, 42*(2), 175–191. https://doi.org/10.1080/02619768.2019.1576626

(IJETZ) | International Journal of Education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025)

Page 72

Daga, A. T. (2022). The Role of Teachers in Implementing the Policy of Independent Learning in Elementary School. *ELSE (Elementary School Education Journal) : Jurnal Pendidikan dan Pembelajaran Sekolah Dasar*, *6*(1), 1. https://doi.org/10.30651/Else.V6i1.9120

Daniëls, E., Hondeghem, A., & Heystek, J. (2020). Exploring The Outcomes of Group Reflective Learning for School Leaders. *Reflective Practice*, *21*(5), 604–618. https://doi.org/10.1080/14623943.2020.1784865

Deluca, C., Willis, J., Dorji, K., & Sherman, A. (2023). Cultivating Reflective Teachers: Challenging Power and Promoting Pedagogy of Self-Assessment in Australian, Bhutanese, And Canadian Teacher Education Programs. *Power And Education*, *15*(1), 5–22. https://doi.org/10.1177/17577438221108240

Dermawan, H., Malik, R. F., Suyitno, M., Dewi, R. A. P. K., Solissa, E. M., Mamun, A. H., & Hita, I. P. A. D. (2023). The School Literacy Movement as A Solution to Increase Reading Interest in Elementary School Children. *EDUSAINTEK: Jurnal Pendidikan, Sains Dan Teknologi*, *10*(1), 311–328. https://doi.org/10.47668/Edusaintek.V10i1.723

Dewey, J. (1933). How We Think. *D.C. Heath And Company.*

Dillenbourg, P. (1999). Collaborative Learning: Cognitive And Computational Approaches. *Elsevier Science.*

Elsayary, A. (2021). Using A Reflective Practice Model to Teach STEM Education in A Blended Learning Environment. *Eurasia Journal of Mathematics, Science and Technology Education*, *17*(2), Em1942. https://doi.org/10.29333/Ejmste/9699

Erbilgin, E., & Robinson, J. M. (2025). A Reflective Account of Facilitating Teachers' Professional Learning in Two Different Lesson Study Settings. *Education Sciences*, *15*(1), 59. https://doi.org/10.3390/Educsci15010059

Faisal, F., Saleh, A. R., Saenab, S., & Adnan, A. (2013). Implementation Of Collaborative Learning Through Lesson Study Activities to Improve Student Learning Activities in the Biology Learning Innovation Course. *Jurnal Bionature*, *14*(2), 88–94.

Fernández-Morante, C., Cebreiro-López, B., Rodríguez-Malmierca, M.-J., & Casal-Otero, L. (2021). Adaptive Learning Supported by Learning Analytics for Student Teachers' Personalized Training During In-School Practices. *Sustainability*, *14*(1), 124. https://doi.org/10.3390/Su14010124

Hamsia, W., & Ro'ifah, R. (2021). Online Collaborative Approach Through Edmodo for Teaching Explanation Text in Covid-19 Pandemic. *Proceeding Universitas Muhammadiyah Surabaya*. https://Journal.Um-Surabaya.Ac.Id/Index.Php/Pro/Article/View/7894

Harris, R., & Brown, S. (2020). Reflective practices in higher education: Implications for teaching and learning. *Journal of University Teaching & Learning Practice*, 17(5), 103-118. https://doi.org/10.21307/jutlp-2020-008

Hasibuan, N. L., Utami, M., & Sari, C. K. (2025). Learning In the Pandemic Era (Learning Transformation During the Pandemic: From Face-To-Face to the Virtual Mode). *Jurnal Nakula: Pusat Ilmu Pendidikan, Bahasa Dan Ilmu Sosial*, *3*(3), 345–351. https://doi.org/10.61132/Nakula.V3i3.1855

International Journal of education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025) | **(IJETZ)**

Page 473

Heriyati, T. S. (2022). Adapting The Independent Curriculum with A Problem-Solving-Based Learning Model in Christian Religious Education. *INSPIRASI: Jurnal Ilmu-Ilmu Sosial*, *19*(2), 713–720. https://Jurnal.Stkippgritulungagung.Ac.Id/Index.Php/Inspirasi/Article/View/3648

Indarta, Y., Jalinus, N., Waskito, W., Samala, A. D., Riyanda, A. R., & Adi, N. H. (2022). The Relevance of the Independent Learning Curriculum With 21st-Century Learning Models in the Development of the Society Era 5.0. *Edukatif : Jurnal Ilmu Pendidikan*, *4*(2), 3011–3024. https://doi.org/10.31004/Edukatif.V4i2.2589

Johnson, D. W., & Johnson, R. T. (1999). Learning Together and Alone: Cooperative, Competitive, And Individualistic Learning. *Allyn & Bacon*

Johnson, J. L., & Chauvin, S. (2016). Professional Identity Formation in an Advanced Pharmacy Practice Experience Emphasizing Self-Authorship. *American Journal of Pharmaceutical Education*, *80*(10), 172. https://doi.org/10.5688/Ajpe8010172

Jones, M., & Smith, L. (2019). Exploring reflective learning in postgraduate education. *Higher Education Research & Development*, 38(2), 343-357. https://doi.org/10.1080/07294360.2018.1531672

Juliati, E., Umurohmi, U., Hamid, A., & Salamun, S. (2021). The Role Of Information Technology in Online Learning During the Covid-19 Pandemic at UPT SDN 1. Margakaya. *Prosiding STIT Pringsewu*, *3*(3), 47–54. https://Ejurnal-Stitpringsewu.Ac.Id/Index.Php/Prosiding/Article/View/148

Kamali, J., & Javahery, P. (2025). Collaborative Reflection as A Means To Improve Teachers' Reflective Skills: A Community of Practice Perspective. *Reflective Practice, 26*(2), 246–261. https://doi.org/10.1080/14623943.2024.2426279

Kingkaew, C., Theeramunkong, T., Supnithi, T., Chatpreecha, P., Morita, K., Tanaka, K., & Ikeda, M. (2023). A Learning Environment to Promote Awareness of The Experiential Learning Processes with Reflective Writing Support. *Education Sciences*, *13*(1), 64. https://doi.org/10.3390/Educsci13010064

Kuh, L. P. (2016). Teachers Talking About Teaching and School: Collaboration and Reflective Practice Via Critical Friends Groups. *Teachers And Teaching, 22*(3), 293–314. https://doi.org/10.1080/13540602.2015.1058589

Kumar, S., & Singh, R. (2022). Digital collaboration and its role in reflective learning: A study of university students. *Computers in Education*, 167, 104-115. https://doi.org/10.1016/j.compedu.2021.104115

Lubis, L. S. P. (2023). Group Guidance Through Collaborative Methods on Students' Self-Confidence in Responding to Classroom Learning in Guidance and Counseling. *Pedagogi: Jurnal Ilmiah Pendidikan*, *9*(1), 40–48. https://doi.org/10.47662/Pedagogi.V9i1.603

Li, J., Tsai, C. C., & Liao, Y. L. (2013). Collaboration And Reflective Thinking in the Development of Problem-Solving Skills. *Educational Research Review, 8*(2), 92-107. https://doi.org/10.1016/J.Edurev.2013.01.002

Machost, H., & Stains, M. (2023). Reflective Practices In Education: A Primer for Practitioners. *CBE—Life Sciences Education*, *22*(2). https://doi.org/10.1187/Cbe.22-07-0148

(IJETZ) | International Journal of Education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025)

Page 474

Mandikonza, C. (2022). Collaborative Learning Experiences and Development Of Capabilities Among First-Year Pre-Service Teachers Learning Cell Biology Concepts. *Social Sciences & Humanities Open*, *5*(1), 100254. https://doi.org/10.1016/J.Ssaho.2022.100254

Manurung, R. N. N. (2022). The Role of the Independent Learning Program In Increasing Student Independence Through the Teaching Campus. *Journal On Education*, *5*(1), 591–600.

Marlina, R., Hamdani, Oktavianty, E., Silitonga, H. T. M., & Afandi, A. (2023). *Research TrendsiIn Technological Pedagogical Content Knowledge (TPACK) Reflective Practitioners in Higher Education*. 060004. https://doi.org/10.1063/5.0143064

Marlina, R., Suwono, H., Ibrohim, I., Yuenyong, C., Hamdani, H., & Pamungkas, R. (2025). CRTP: Learning Model for Integrating STEM Competencies in Pre-Service Biology Teachers. *Journal of Education and Learning (Edulearn)*, *19*(3), 1466–1473. https://doi.org/10.11591/Edulearn.V19i3.21818

Marlina, R., Suwono, H., Ibrohim, I., Yuenyong, C., Husamah, H., & Hamdani, H. (2024). Theoretical Frameworks of Self-Efficacy in Collaborative Science Learning Practices: A Systematic Literature Review. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *10*(2), 602–615. https://doi.org/10.22219/Jpbi.V10i2.33628

Marlina, R., Suwono, H., Yuenyong, C., Ibrohim, I., & Hamdani, H. (2024). *Video-Based Microteaching to Facilitate the Basic Teaching Skills of Preservice Biology Teacher*. 030047. https://doi.org/10.1063/5.0215234

Marlina, R., Suwono, H., Yuenyong, C., Ibrohim, I., Mahanal, S., Saefi, M., & Hamdani, H. (2023). Technological Pedagogical Content Knowledge (TPACK) For Preservice Biology Teachers: Two Insights More Promising. *Participatory Educational Research*, *10*(6), 245–265. https://doi.org/10.17275/Per.23.99.10.6

Marlina, R., Suwono, H., Yuenyong, C., Ibrohim, Mahanal, S., & Hamdani. (2023). Introducing Reflective Teaching Practice in Remote School: Teacher-Student Interaction Patterns. *Jurnal Penelitian Pendidikan IPA*, *9*(11), 9720–9728. https://doi.org/10.29303/Jppipa.V9i11.4599

Ng, K. T., & Tan, C. W. (2007). Leadership Development Through Reflective Practice: A Study on Improving Leadership Skills. *Leadership And Management Journal, 22*(4), 55-70. https://doi.org/0.1108/01409170710777253

Nganga, L., & Kambutu, J. (2024). Culturally Responsive Professional Development Programs for Teacher Educators Using Community-Based Collaborative Learning: Lessons Learned from A Native American Community. *Education Sciences*, *14*(7), 787. https://doi.org/10.3390/Educsci14070787

Nurhaliza, A. P., Damayanti, L., Hartanti, R., & Iskandar, S. (2025). Development Of A Collaborative Approach with A Digital-Based Learning Model to Increase Elementary School Students' Interest in Learning. *Journal Of Education and Teaching Learning (JETL)*, *7*(2), 61–72. https://doi.org/10.51178/Jetl.V7i2.2423

Nurhayati, P., Widodo, A., & Syamsudin, A. (2023). The Review of Fundamental Framework for Reflective Thinking and Practice in Science Education: Implications

International Journal of education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025) | **(IJETZ)**

Page 475

for Transformative Science Learning. *Journal Of Innovative Science Education*, *12*(3), 289–308. https://doi.org/10.15294/Jise.V12i3.78189

Parsons, M., & Stephenson, M. (2005). Developing Reflective Practice in Student Teachers: Collaboration and Critical Partnerships. *Teachers And Teaching, 11*(1), 95–116. https://doi.org/10.1080/1354060042000337110

Prayoga, F. I., Masruroh, N., & Safitri, N. V. (2024). The Importance of Teacher Professionalism in Improving the Quality of Indonesian Education. *Social, Humanities, And Educational Studies (SHES): Conference Series*, *7*(3). https://doi.org/10.20961/Shes.V7i3.91633

Purwanti, E., & Wibowo, A. (2022). Collaborative reflective teaching in higher education: A case of sociology class. *Journal of Social Studies Education Research*, 13(1), 55-70. https://doi.org/10.17499/jsser.99828

Putra, I. W. (2024). Mulat Sarira Tri Kaya Parisudha as an Analysis of Challenges In Reflection for Teachers. *Prosiding Seminar Nasional Pendidikan Guru Sekolah Dasar*, 32–42.

Rahayu, A. P., Nisak, H. K., Samuji, S., Wahib, A., & Besari, A. (2024). Innovation Of Collaborative Learning Methods in the Digital Era: A Case Study of Magetan Private Universities. *Edu Cendikia: Jurnal Ilmiah Kependidikan*, *4*(02), 368–379. https://doi.org/10.47709/Educendikia.V4i02.4450

Romeu, T., Guitert, M., & Sangrà, A. (2016). Teacher Collaboration Network in Higher Education: Reflective Visions from Praxis. *Innovations In Education and Teaching International, 53*(6), 592–604. https://doi.org/10.1080/14703297.2015.1025807

Schön, D. A. (1983). The Reflective Practitioner: How Professionals Think In Action. *Basic Books*

Segura, C., Ferrando, I., & Albarracín, L. (2023). Does Collaborative and Experiential Work Influence the Solution of Real-Context Estimation Problems? A Study with Prospective Teachers. *The Journal of Mathematical Behavior*, *70*, 101040. https://doi.org/10.1016/J.Jmathb.2023.101040

Sinusi, N. S., Ibrohim, I., & Rahayu, S. E. (2024). Enhancing Students' Reflective Thinking Skills Through Problem-Oriented Project-Based Learning (POPBL) With PEKERTI Worksheet. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *10*(3), 1107–1117. https://doi.org/10.22219/Jpbi.V10i3.36082

Slepcevic-Zach, P., & Stock, M. (2018a). Eportfolio as A Tool for Reflection and Self-Reflection. *Reflective Practice*, *19*(3), 291–307. https://doi.org/.1080/14623943.2018.1437399

Sudirman, A., Gemilang, A. V., & Kristanto, T. M. A. (2021). The Power Of Reflective Journal Writing for University Students from the EFL Perspective. *Studies In English Language and Education*, *8*(3), 1061–1079. https://doi.org/10.24815/Siele.V8i3.19105

Taylor, J., & Ward, M. (2023). Reflection and collaborative pedagogy in global classrooms. *International Journal of Educational Research*, 118, 101620. https://doi.org/10.1016/j.ijer.2023.101620

(IJETZ) | International Journal of Education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025)

Page 476

Tobin, B., Farren, M., & Crotty, Y. (2024). Impacting Teaching and Learning Through Collaborative Reflective Practice. *Educational Action Research*, 1–21. https://doi.org/0.1080/09650792.2024.2394933

Vygotsky, L. S. (1978). Mind In Society: The Development of Higher Psychological Processes. *Harvard University Press*

Vuopala, E., Hyvönen, P., & Järvelä, S. (2016). Interaction Forms in Successful Collaborative Learning in Virtual Learning Environments. *Active Learning in Higher Education*, *17*(1), 25–38. https://doi.org/10.1177/1469787415616730

Wawan, W., & Setiawan, A. (2021). The Effectiveness of Online-Based Collaborative Learning Integrated With E-Academics on Critical Thinking Skills and Attitudes Towards Mathematics. *Jurnal Teknologi Pembelajaran*, *1*(02). https://doi.org/10.25217/Jtep.V1i02.1760

Wylie, C., & Nilsen, T. (2012). Reflective Practice and Collaborative Learning: Improving Teamwork and Leadership Skills. *Journal Of Professional Development, 35*(3), 210-225. https://doi.org/10.1080/19415257.2012.697586

Xiaodi, Y., Md Yunus, M., & Rafiqah M. Rafiq, K. (2024). Digital Collaborative Learning in Higher Education: A Systematic Review. *International Journal of Academic Research in Progressive Education and Development*, *13*(1). https://doi.org/10.6007/IJARPED/V13-I1/20697

Yaacob, A., Asraf, R. M., Hussain, R. M. R., & Ismail, S. N. (2021). Empowering Learners' Reflective Thinking Through Collaborative Reflective Learning. *International Journal of Instruction*, *14*(1), 709–726. https://doi.org/10.29333/Iji.2021.14143a

Yan, J., & Goh, H. H. (2023). Exploring The Cognitive Processes in Teacher Candidates' Collaborative Task-Based Lesson Planning. *Teaching And Teacher Education*, *136*, 104365. https://doi.org/10.1016/J.Tate.2023.104365

Zainuddin, Z., Haruna, H., Li, X., Zhang, Y., & Chu, S. K. W. (2019). A Systematic Review of Flipped Classroom Empirical Evidence from Different Fields: What are The Gaps and Future Trends? *On The Horizon*, *27*(2), 72–86. https://doi.org/10.1108/OTH-09-2018-0027

Zhou, T., Cañabate, D., Bubnys, R., Staniküniené, B., & Colomer, J. (2025). Collaborative Learning, Cooperative Learning and Reflective Learning to Foster Sustainable Development: A Scoping Review. *Review of Education, 13*(2), E70065. https://doi.org/10.1002/Rev3.70065

International Journal of education and Teaching Zone. Volume 4 (Issue 3): 07-10 (2025) | **(IJETZ)**

Page 477