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A Systematic Literature Review at Integrating Ethnomedicine into Project-Based Learning: Enhancing Higher-Order Thinking Skills in Pharmaceutical Education

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Abstract: Project-Based Learning (PjBL) is an innovative pedagogical approach that fosters Higher-Order Thinking Skills (HOTS), including critical thinking, creativity, and problem-solving, essential for 21st-century education which are crucial for success in 21st-century education. This systematic literature review explores the integration of ethnomedicine into PjBL frameworks, focusing on pharmaceutical education. Using PRISMA guidelines and bibliometric analysis with VOSviewer, 6,499 documents from Scopus were screened, resulting in seven key studies. Findings reveal that combining ethnomedicine with PjBL enhances culturally relevant learning, bridging traditional medicinal practices with modern education. This interdisciplinary approach improves cognitive skills, contextual learning, and cultural preservation, but challenges such as institutional readiness and knowledge variability persist variability in knowledge remain. The study underscores the need for further research and policy support to optimize this promising educational model.

Keywords: Cultural Contextualization; Ethnomedicine; Higher-Order Thinking Skills; Interdisciplinary Learning; Pharmaceutical Education; Project-Based Learning.

Introduction

Project-Based Learning (PjBL) has emerged as a transformative educational framework, equipping students with Higher-Order Thinking Skills (HOTS) such as critical thinking, creativity, and problem-solving. These competencies are essential for navigating the complexities of the 21st century, particularly in STEM and pharmaceutical education (Arya, 2023; Hastuti et al., 2023; Sadrina & Mustapha, 2016). Research by Hujjatusnaini et al., (2022) has further emphasized that blended PjBL significantly enhances HOTS, especially in practical applications such as protein-based supplementation. Similarly, Moreover, Rati et al., (2023) highlighted that PjBL fosters critical and creative thinking, aligning with the broader goals of educational innovation. Comparative studies have also demonstrated PjBL's superiority over traditional methods, with Sofiyan et al., (2020) demonstrating significant gains in HOTS through PjBL and Handayani et al., (2023) revealing its enhancement of cognitive abilities and problem-solving skills when integrated with metacognitive strategies.* as evidenced by Sofiyan et al., (2020), who reported significant gains in HOTS,

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and by Handayani et al., (2023), who documented improvements in cognitive abilities and problem-solving skills through the integration of metacognitive strategies.

The integration of ethnomedicine into pharmaceutical education represents an innovative contextualization of PjBL. Ethnomedicine encompasses traditional healthcare practices and indigenous knowledge of medicinal plants, offering a culturally relevant framework for applying theoretical concepts. This approach This integration not only enriches student engagement but also fosters not only enhances student engagement but also cultivates a deeper appreciation for cultural heritage (Chandra, 2023; Farahdiba et al., 2019). For instance, studies in Southeast Asia and Africa highlight how traditional medicine serves as a cornerstone of community health, blending cultural traditions with modern scientific education (Amalia & Sunarya, 2020; Fujita, 2023). Additionally, Bhutan's So-wa-rig-pa system and Indonesia's ethnobotanical initiatives illustrate the role of traditional knowledge in enhancing educational outcomes and cultural competencies(Wangchuk & Tashi, 2016; Prasetyo, 2024).

Despite these promising outcomes, PjBL applications often prioritize skill development over cultural contextualization. This oversight neglects the potential enrichment that culturally relevant frameworks, such as ethnomedicine, can bring to learning environments (Chandra, 2023; Huzairin et al., 2018). Research by Amalia & Sunarya (2020) and Sari et al., (2023) has revealed that most PjBL studies focus on generic methodologies, overlooking the impact of cultural knowledge integration on student outcomes. Moreover, challenges such as disparities in students' prior knowledge and institutional readiness have further hindered further hinder the systematic adoption of ethnomedicine-integrated PjBL (Hujjatusnaini et al., 2022).

The interdisciplinary potential of integrating PjBL with ethnoscience and ethnobotany offers a promising avenue for bridging indigenous healthcare practices with modern scientific inquiry. For example, Rao et al., (2022) have demonstrated demonstrate how traditional knowledge of medicinal plants aligns with the objectives of pharmaceutical education, fostering a balance between global competencies and cultural preservation. Similarly, culturally responsive teaching strategies, including Content and Language Integrated Learning (CLIL), emphasize the importance of embedding local knowledge into science curricula, enhancing both cognitive and cultural competencies (Huzairin et al., 2018; Rinto, 2023).

This systematic literature review explores how integrating ethnomedicine into PjBL can enhance both cognitive and cultural competencies in pharmaceutical education. By synthesizing findings through PRISMA guidelines and bibliometric analysis, this study identifies research gaps and provides recommendations for scaling these approaches across diverse educational contexts (Parmiti et al., 2021). Challenges such as curriculum standardization, educator training, and institutional preparedness are addressed to ensure meaningful integration (González et al., 2017; Yulhendri, 2023; Azura et al., 2022). to facilitate effective integration ((González et al., 2017; Yulhendri, 2023; Azura et al., 2022). The outcomes aim to inspire broader interdisciplinary applications, fostering inclusive and culturally enriched learning environments that prepare students for both global and local healthcare challenges.

Method

This systematic literature review (SLR) adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework, which is recognized for its transparency and methodological rigor in systematic reviews. PRISMA's structured approach facilitates the definition definition of inclusion and exclusion criteria, quality assessment, and synthesis of findings, of criteria for inclusion and exclusion, assessing quality, and synthesizing findings, thereby ensuring the reliability and reproducibility of the review process (Fitriani, 2023; Mite et al., 2021; Naviri et al., 2021; Rahmatika, 2024; Tulungagung, 2023). This framework is particularly beneficial for interdisciplinary research, such as ethnomedicine-integrated Project-Based Learning (PjBL), because it enhances the synthesis of diverse methodologies and educational outcomes (Malapane et al., 2022). Complementary to PRISMA, bibliometric tools like VOSviewer were utilized were used to visualize research trends and thematic clusters, offering insights into the intellectual structure of this field (Jumini et al., 2022).

The Scopus database was selected for its extensive coverage of high-quality peer-reviewed publications, particularly in interdisciplinary topics like pharmaceutical education. Boolean operators and a combination of keywords, such as "Project-Based Learning," "ethnomedicine," "Higher-Order Thinking Skills," and "pharmaceutical education," were applied to were applied to retrieve relevant studies. search and retrieve relevant studies. An initial search yielded 6,499 documents across all fields. A publication year filter narrowed the results to articles from 2014–2024, resulting in 5,626 documents. Screening for direct relevance to ethnomedicine-integrated PjBL and pharmaceutical education refined the dataset to 1,589 documents. Applying rigorous inclusion criteria reduced the dataset to 68 studies, of which 13 were

shortlisted. from which 13 were shortlisted. After further analysis, 7 studies were selected for qualitative and quantitative evaluation.

The review prioritized studies examining ethnomedicine's integration within PjBL frameworks and its impact on outcomes such as critical thinking, creativity, and problem-solving. Exclusion criteria were implemented to remove removed studies with insufficient methodological transparency or limited relevance to pharmaceutical education. The Cochrane Risk of Bias assessment tool was employed employed to evaluate study quality and minimize bias, to assess study quality and mitigate bias, ensuring the conclusions were robust and valid (Fitriani, 2023; Rahmatika, 2024; Tulungagung, 2023).

Bibliometric analysis using VOSviewer highlighted keyword co-occurrence and thematic clusters, revealing five dominant themes: active learning strategies, advanced technologies in pharmaceutical education, clinical outcomes, biomedical sciences, and niche fields such as chronic pain and endocrinology (Jumini et al., 2022; Yulhendri, 2023). Despite its strengths, VOSviewer has certain limitations, has limitations, such as reliance on input data quality and interpretive complexity (Malapane et al., 2022). including dependence on the quality of input data and challenges in interpretation (Malapane et al., 2022). To address these issues, the analysis was supplemented with Bibliometrix to provide enhanced metrics and more comprehensive insights (Athayde et al., 2017; Berezowski et al., 2021).

Narrative and bibliometric methods were employed to synthesize synthesized insights from selected studies, findings from the selected studies, identifying themes, trends, and gaps. The findings validated the integration of ethnomedicine into PjBL as effective in fostering culturally relevant education, enhancing higher-order thinking skills, and preserving traditional knowledge. However, barriers such as like institutional readiness, resource limitations, and variability in students' prior knowledge were noted (Badriah et al., 2023; Redhana et al., 2021). Further research is needed to address these challenges and optimize PjBL frameworks for diverse educational contexts (Hujjatusnaini et al., 2022; Zuma et al., 2016).

This SLR, combining PRISMA and advanced bibliometric tools, established establishes a robust foundation for evaluating the potential of ethnomedicine-integrated PjBL frameworks to transform pharmaceutical education. ethnomedicine-integrated PjBL frameworks' potential to transform pharmaceutical education. Bridging traditional knowledge with modern pedagogical practices, this approach promotes cultural relevance and critical skills essential for 21st-century learners, while offering solutions to address persistent gaps in the field (Delpero & Volpato, 2022; Prinsloo, 2023).

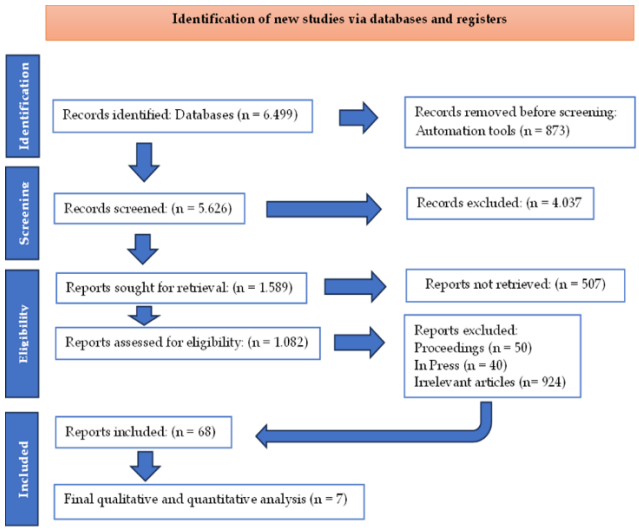

Figure 1. Prism Model Graph

Result and Discussion

The systematic literature review revealed significant insights into the integration of Project-Based Learning (PjBL) Project-Based Learning (PjBL) with ethnomedicine within pharmaceutical education. Starting from an initial dataset of 6,499 documents, a rigorous filtering process narrowed the selection to seven studies closely aligned with the objectives of the review. These studies examined examined the educational benefits of combining ethnomedicine and PjBL frameworks, focused on the benefits of integrating ethnomedicine and PjBL frameworks, particularly in fostering critical competencies such as higher-order thinking skills. This combination demonstrated the ability demonstrates the ability of PjBL to enrich learning experiences by bridging traditional and modern educational practices, aligning with broader educational goals (Fitriani, 2023; Mite et al., 2021; Naviri et al., 2021; Tulungagung, 2023). They has shown potential for enriching learning experiences by linking traditional and modern educational practices to broader educational objectives (Fitriani, 2023; Mite et al., 2021); Naviri et al., 2021; Tulungagung, 2023).

The application of VOSviewer facilitated a bibliometric co-occurrence analysis, which identified five dominant thematic clusters in the reviewed literature. These included educational methodologies highlighting the efficacy of PjBL in enhancing critical thinking and problem-solving skills; the integration of advanced technologies like artificial intelligence in pharmaceutical education; clinical applications aimed at improving healthcare outcomes; biomedical sciences; and specialized topics such as chronic pain and

endocrinology. These clusters reflect reflect the interdisciplinary reach of PjBL, offering a multifaceted understanding of its impact on pharmaceutical education the broad interdisciplinary scope of PjBL, providing a nuanced perspective on its influence in pharmaceutical education (Arya, 2023; Chandra, 2023; Hastuti et al., 2023; Rahmatika, 2024).

Ethnomedicine's inclusion within PjBL was shown to enhance educational engagement by connecting culturally relevant materials with pharmaceutical knowledge. Studies indicated indicated significant improvements in critical thinking, creativity, and student engagement when curricula incorporated local medicinal practices and dilemma-based learning contexts. revealed notable gains in critical thinking, creativity, and student engagement when curricula included local medicinal practices and dilemma-based learning contexts. These findings align with constructivist pedagogical principles, emphasizing contextualized learning and the integration of traditional and innovative educational practices (Sari et al., 2023; Barrett, 2018; Riley et al., 2015).

Despite these promising results, challenges such as institutional readiness, variability in student knowledge of ethnomedicine, and the balancing of cultural relevance with scientific rigor were frequently reported. These barriers underline the need for targeted faculty training, robust policy support, and well-structured curriculum development. persist. These challenges underscore the importance of targeted faculty training, robust policy support, and thoughtful curriculum development. Addressing these challenges could enhance enhance the scalability and effectiveness of ethnomedicine-integrated PjBL frameworks across diverse educational settings, is essential to improving the scalability and effectiveness of ethnomedicine-integrated PjBL frameworks in diverse contexts, ensuring their transformative potential is fully realized (Chandra, 2023; Hujjatusnaini et al., 2022; Rahmawati et al., 2021).

The reviewed studies underscored underscored the transformative potential of PjBL frameworks that integrate ethnomedicine in pharmaceutical education. highlighted PjBL frameworks' transformative potential when ethnomedicine is integrated into pharmaceutical education. This approach promotes higher-order thinking skills, including critical thinking and creativity, while preserving cultural heritage and fostering interdisciplinary collaboration. For instance, local knowledge integrated into the curriculum enriched students' understanding of ecological practices and improved their engagement with culturally relevant themes. This dual focus on global competencies and local relevance highlights the importance of culturally responsive education (Parmiti et al., 2021; Yulhendri, 2023; Rinto, 2023).

Visualizations generated from bibliometric analyses further supported these findings, showcasing the intellectual landscape of PjBL and its intersection with ethnomedicine. Emerging trends in the data revealed increasing interest in themes such as sustainability, digital literacy, and the integration of indigenous knowledge within pharmaceutical education. These insights align with global shifts toward holistic, patient-centered approaches in healthcare education (Agarwal, 2020; Malapane et al., 2022).

Advanced technologies, such as gamified platforms and AI-driven tools, offer significant potential for enhancing ethnomedicine-integrated PjBL. These innovations create create interactive simulations that bridge traditional medicinal knowledge with modern pharmaceutical frameworks. enable interactive simulations that merge traditional medicinal knowledge with contemporary pharmaceutical frameworks. Furthermore, hybrid or blended learning models were identified as effective effective in increasing accessibility and fostering interdisciplinary skills, especially in geographically dispersed regions (Athayde et al., 2017; Amalia & Sunarya, 2020). proved effective in increasing accessibility and building interdisciplinary skills, particularly in geographically dispersed regions (Athayde et al., 2017; Amalia & Sunarya, 2020).

Despite its promise, the implementation of ethnomedicine-integrated PjBL requires ongoing research. Longitudinal studies employing mixed methodologies are essential to evaluate its sustained impact on higher-order thinking skills and practical applications in pharmaceutical education. Policymakers should emphasize supporting culturally responsive pedagogies through funding, resources, and partnerships with local communities to maximize the framework's educational potential (Badriah et al., 2023; Prinsloo, 2023).

The synthesis of findings highlights the necessity of balancing tradition and innovation to prepare culturally sensitive and globally competent graduates. By integrating local medicinal practices into modern education, PjBL frameworks offer a transformative pathway to address the complexities of healthcare in the 21st century. Such interdisciplinary approaches not only preserve not only preserve cultural heritage but also equip students with the critical skills required for professional success in an increasingly globalized world (Kwame, 2021; Dewi, 2023). The preserve cultural heritage while equipping students with critical skills needed for professional success in a globalized world (Kwame, 2021; Dewi, 2023).

The data trends and insights, as illustrated in Figures 2–4, demonstrate demonstrate the yearly

distribution of publications, thematic clusters identified via VOSviewer, and subject-specific focuses within the studies. highlight the yearly distribution of publications, thematic clusters from VOSviewer, and specific subjects within the studies. Table 1 provides a comprehensive summary of the validated studies, including methodologies, key findings, and conclusions. For example, Rahmawati et al. (2021) demonstrated that integrating dilemma-based contexts within PjBL enhanced critical engagement, while Hujjatusnaini et al., (2022) reported significant improvements in higher-order thinking skills through blended learning approaches. These findings collectively underscore the educational value of ethnomedicine-integrated PjBL frameworks.

By combining bibliometric insights with qualitative analyses, this review establishes a foundation for advancing the integration of traditional knowledge into pharmaceutical education, reinforcing its relevance and potential in modern pedagogical practices.

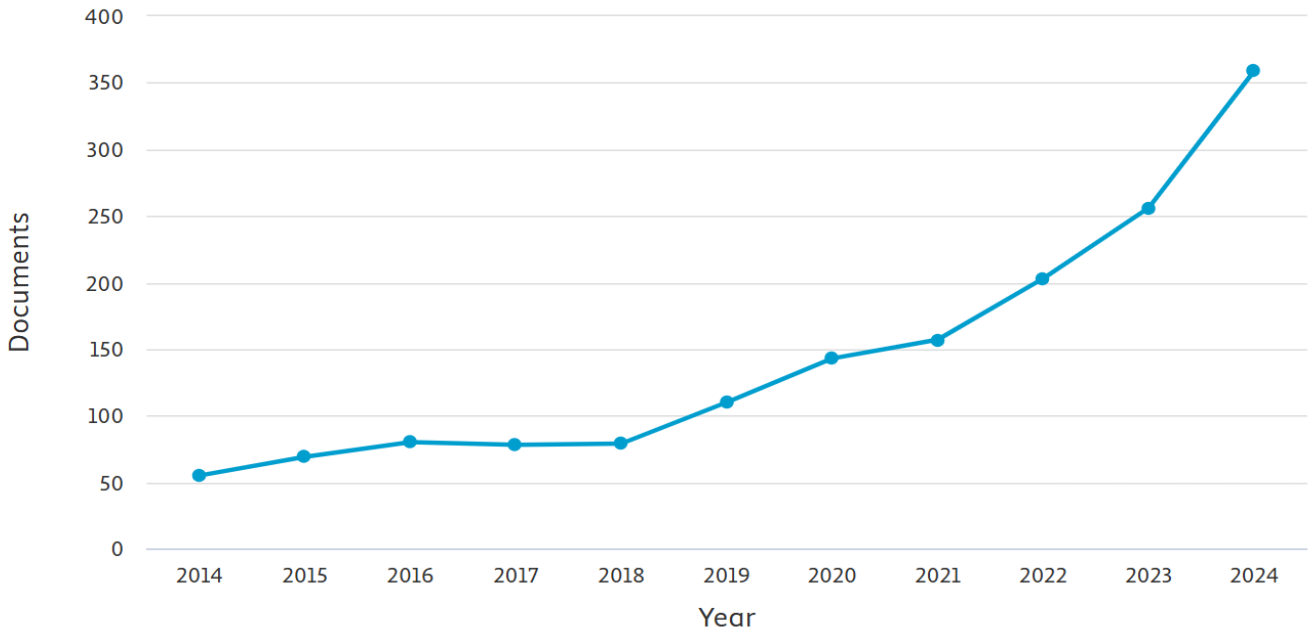

Figure 2. Document by years

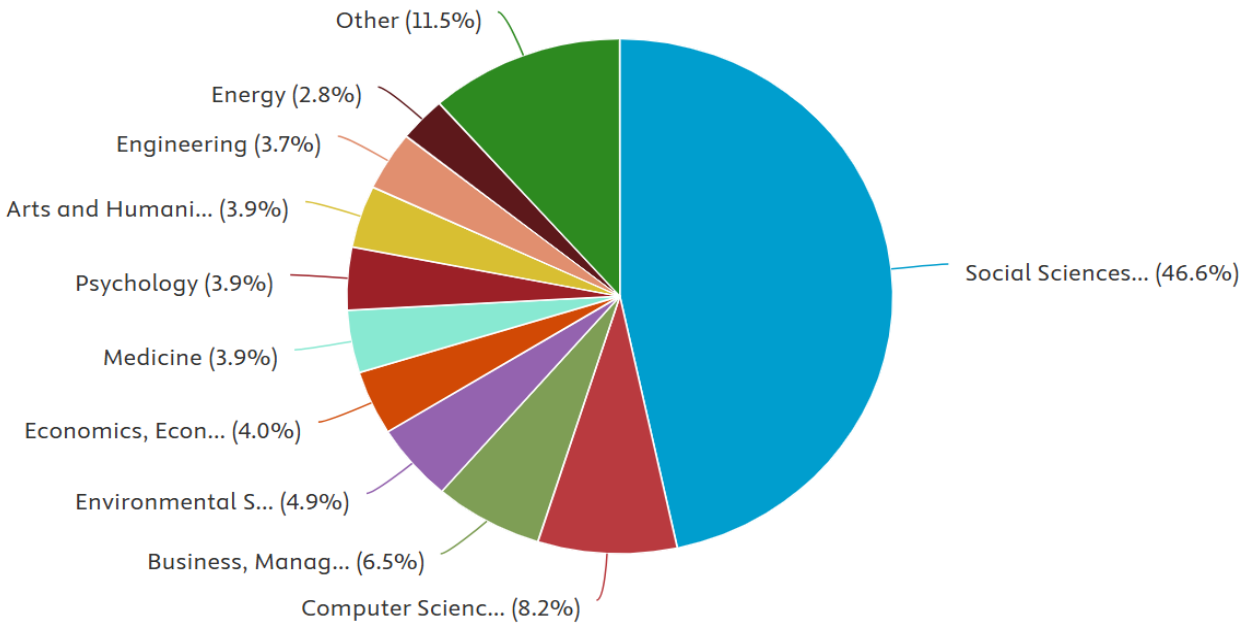

Figure 3. Documents by subject area

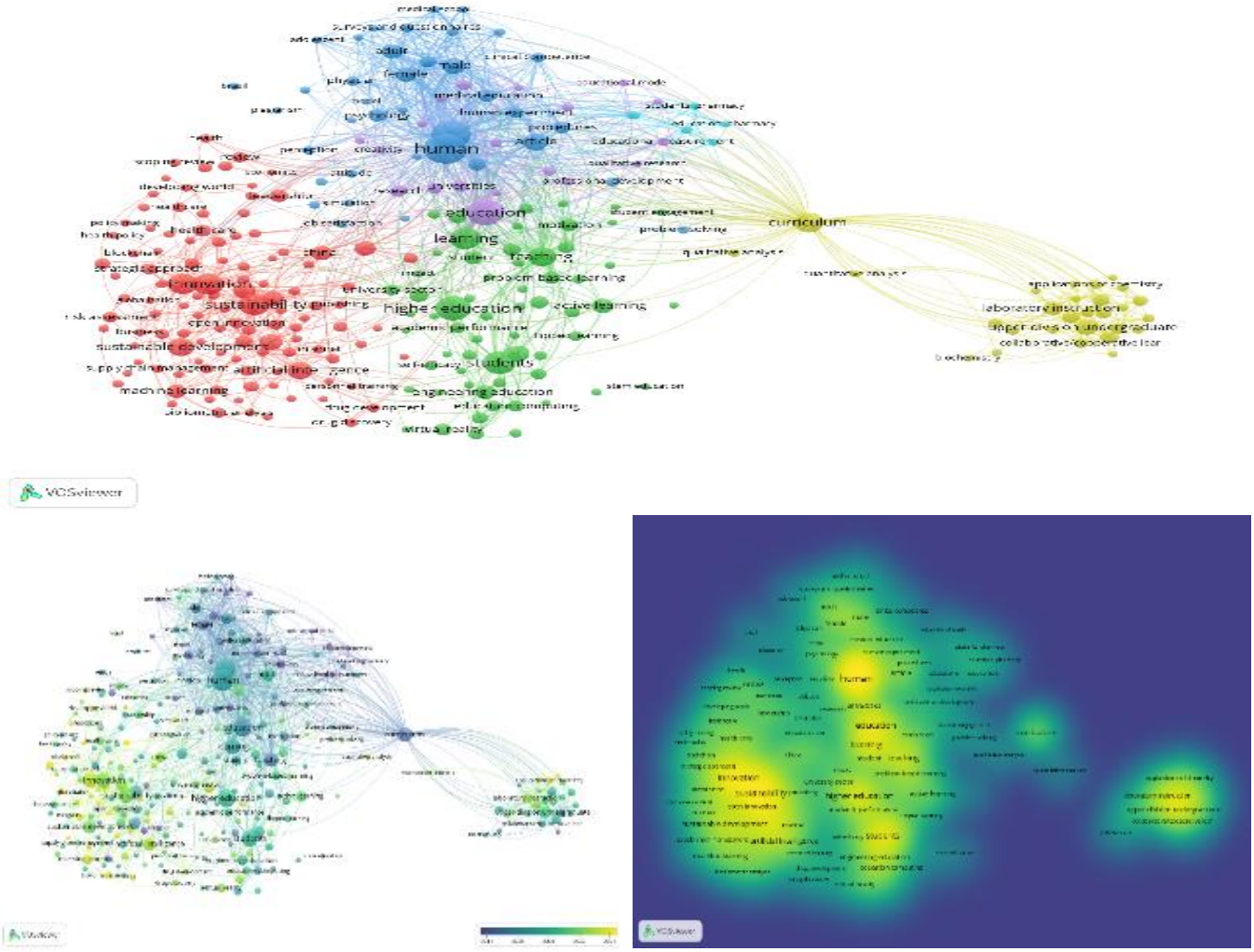

Figure 4. Result of Vosviewer analysis

Table 1. Final analysis that containing all documents validated for inclusion after re-screening

Author(s) & Year	Study Title	Methodology	Key Findings	Conclusions
Sari et al. (2023)	Quantitative PjBL Using Local Materials	Quasi-experimental with pre-test/post-test design	PjBL using local materials significantly improved creative thinking skills, with an N-gain of 0.32 in the experimental group.	PjBL leveraging local materials fosters creativity and theoretical knowledge application in practical settings.
Rahardjanto et al. (2019)	Hybrid-PjBL and Learning Outcomes	Quasi-experimental with ANCOVA analysis	Hybrid-PjBL significantly enhanced learning outcomes (mean gain 58%) and creative thinking skills (N-gain 23%).	Hybrid-PjBL is effective for fostering 21st-century competencies, including cognitive engagement and motivation.
Rahmawati et al. (2021)	STEM-PBL with Dilemma Stories	Qualitative approach using reflective journals, interviews, and tests	Integration of dilemma stories in STEM-PBL improved critical thinking and argumentation, aligning challenges with real-world issues.	STEM-PBL contextualized with dilemmas stories enhances students' critical engagement with scientific and societal issues.
Hujjatusnaini et al. (2022)	Blended PjBL and 21st-Century Skills	Mixed-methods approach with experimental research	Blended PjBL increased higher-order thinking skills (HOTS), with mean N-gain	Blended PjBL effectively supports critical thinking

Author(s) & Year	Study Title	Methodology	Key Findings	Conclusions
			of 0.55 for "evaluation" and 0.79 for "creation".	and problem-solving in biological education.
Sholahuddin et al. (2023)	PjBL-Flipped Classroom for Scientific Literacy	Quasi-experimental comparing flipped and traditional PjBL	Flipped PjBL improved scientific literacy with an N-gain of 0.7, enhancing engagement and efficiency.	Combining flipped classrooms with PjBL is a promising strategy for deeper learning and time-efficient outcomes.
Hariyadi et al. (2023)	PBL-PjBL Collaboration for 4C Competencies	Mixed methods with pre-test/post-test design	Collaboration of PBL and PjBL enhanced critical thinking, creativity, communication, and collaboration, with N-gains of 0.58 and 0.81 respectively.	Integrated models are highly effective in developing essential 21st-century skills for learners.
Rahmawati et al. (2021)	Dilemmas in STEM-PBL	Reflective qualitative research using Hess' Cognitive Rigor Matrix	STEM-PBL promoted critical thinking and practical problem-solving in chemistry education, especially in polymer topics.	STEM-PBL with dilemmas stories aligns well with Bloom's taxonomy for fostering higher-order cognitive abilities.

Conclusion

This study highlights the transformative potential of integrating ethnomedicine into Project-Based Learning (PjBL) Project-Based Learning (PjBL) frameworks within pharmaceutical education. By combining traditional medicinal knowledge with modern pedagogical approaches, this methodology fosters higher-order thinking skills such as critical thinking, creativity, and problem-solving, while also promoting cultural preservation and interdisciplinary learning. Despite challenges such as institutional readiness and variability in student knowledge, the findings underscore underscore the importance of culturally relevant education in preparing globally competent professionals. emphasize the critical role of culturally relevant education in shaping globally competent professionals. Future efforts should focus on addressing these barriers through tailored curriculum development, policy support, and educator training. This integrated approach provides a robust pathway provides a robust pathway for bridging cultural heritage with modern educational objectives, offers a comprehensive strategy for uniting cultural heritage with contemporary educational goals, equipping students to meet the multifaceted demands of 21st-century healthcare systems.

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Author Contributions

Faizul Bayani conceptualized the research framework, conducted the systematic review, and led the writing of the manuscript. Joni Rokhmat and Aliefman Hakim contributed to the development of the methodological approach, data analysis, and interpretation of the findings. AA Sukarso provided critical feedback on the integration of ethnomedicine into educational models and assisted in revising the manuscript. All authors reviewed and approved the final version of the manuscript, ensuring its accuracy and coherence.

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Conflicts of Interest

The authors declare no conflict of interest.

References

Agarwal, V. (2020). Patient Assessment and Chronic Pain Self-Management in Ethnomedicine: Seasonal and Ecosystemic Embodiment in Ayurvedic Patient-Centered Care. *International Journal of Environmental Research and Public Health*, *17*(8), 2842. https://doi.org/10.3390/ijerph17082842

Amalia, D. R., & Sunarya, I. K. (2020). *Batik as the Local Content Subject in Elementary Schools: Skills to*

Respond to Industry 4.0. https://doi.org/10.2991/assehr.k.200703.035

Arya, F. S. (2023). Description of Implementation of the Project-Based Learning Model in the Practical Activity of Writing Text of "Observation Result Reports" for Class VII Junior High School Students. *Asian Journal of Education and Social Studies*, *49*(4), 317–325. https://doi.org/10.9734/ajess/2023/v49i41210

Athayde, S., Silva-Lugo, J., Schmink, M., Kaiabi, A., & Heckenberger, M. (2017). Reconnecting Art and Science for Sustainability: Learning From Indigenous Knowledge Through Participatory Action-Research in the Amazon. *Ecology and Society*, *22*(2). https://doi.org/10.5751/es-09323-220236

Azura, W., Silalahi, A., Zubir, M. N. M., & Nurfajriani. (2022). The Science Environment Technology Society (SETS) Based E-Module Development With Project Based Learning Model in Colloidal Learning. *Journal of Physics Conference Series*, *2157*(1), 012046. https://doi.org/10.1088/1742-6596/2157/1/012046

Badriah, L., Mahanal, S., Lukiati, B., & Sari, M. S. (2023). Collaborative Mind Mapping-Assisted RICOSRE to Promote Students' Problem-Solving Skills. *Participatory Educational Research*, *10*(4), 166–180. https://doi.org/10.17275/per.23.65.10.4

Barrett, M. (2018). How Schools Can Promote the Intercultural Competence of Young People. *European Psychologist*, *23*(1), 93–104. https://doi.org/10.1027/1016-9040/a000308

Berezowski, J., Dürr, S., Falzon, L. C., Léchenne, M., Lushasi, K., Markosyan, T., Mbilo, C., Momanyi, K., Özçelik, R., Nambiar, P., Zinsstag, J., & Rüegg, S. R. (2021). System Thinking and Citizen Participation Is Still Missing in One Health Initiatives – Lessons From Fifteen Evaluations. *Frontiers in Public Health*, *9*. https://doi.org/10.3389/fpubh.2021.653398

Chandra, Dr. V. (2023). *Diabetes and Ethnomedicine: A Comprehensive Review of Scientific Literature on Traditional Medical Practices*. https://doi.org/10.20944/preprints202308.1622.v1

Delpero, A., & Volpato, G. (2022). Integrated Pond Aquaculture and Regional Identity: Ethnobiology of the Golden Humped Tench of Poirino Highlands, Northwest Italy. *Journal of Ethnobiology and Ethnomedicine*, *18*(1). https://doi.org/10.1186/s13002-022-00529-5

Dewi, W. S. (2023). The Practicality of the Physics Module Based on the PjBL Model With a Portfolio Assessment to Improve Students' Critical Thinking Skills. *Journal of Physics Conference Series*, *2582*(1), 012054. https://doi.org/10.1088/1742-6596/2582/1/012054

Farahdiba, Saragih, A. H., & Simbolon, N. (2019). *The Use of Project Based Learning in Teaching French*. https://doi.org/10.2991/aisteel-19.2019.57

Fitriani, R. (2023). The Influence of Maritime Education Through Project Based Learning-a Review. *Bio Web of Conferences*, *79*, 02004. https://doi.org/10.1051/bioconf/20237902004

Fujita, T. (2023). Effects and Issues of Project Based Learning. *European Journal of Education Studies*, *10*(3). https://doi.org/10.46827/ejes.v10i3.4715

González, M., Gharzouzi, E., Santizo, D. O., Miranda, R. S., Ferro, A. I. A., Vides-Porras, A., Heinrich, M., Edwards, P., & Krütli, P. (2017). Patient-Centered Boundary Mechanisms to Foster Intercultural Partnerships in Health Care: A Case Study in Guatemala. *Journal of Ethnobiology and Ethnomedicine*, *13*(1). https://doi.org/10.1186/s13002-017-0170-y

Handayani, T., Saulon, B. O., & Maryani, I. (2023). Integrating Metacognitive Strategies Impact in Virtual Science Experiments for Undergraduate Students' HOTS. *Jurnal Cakrawala Pendidikan*, *42*(2). https://doi.org/10.21831/cp.v42i2.51752

Hariyadi, A., Dumiyati, Tukiyo, & Darmuki, A. (2023). The Effectiveness of PBL Collaborated with PjBL on Students' 4C in the Course of Basic Education. *International Journal of Instruction*, *16*(3), 897–914. https://doi.org/10.29333/iji.2023.16348a

Hastuti, Ambiyar, A., Jalinus, N., Syahril, S., & Syah, N. (2023). *Project-Based Learning to Enhance Creativity and Learning Outcomes*. 67–73. https://doi.org/10.2991/978-2-38476-050-3_8

Hujjatusnaini, N., Corebima, A. D., Prawiro, S. R., & Gofur, A. (2022). The Effect of Blended Project-Based Learning Integrated With 21st-Century Skills on Pre-Service Biology Teachers' Higher-Order Thinking Skills. *Jurnal Pendidikan Ipa Indonesia*, *11*(1), 104–118. https://doi.org/10.15294/jpii.v11i1.27148

Huzairin, Sudirman, S., & Hasan, B. (2018). Developing English Learning Model Project Based Content and Language Integrated Learning (Clil) for English at University Level in Indonesia. *Advances in Social Sciences Research Journal*, *5*(11). https://doi.org/10.14738/assrj.511.5525

Jumini, S., Madnasri, S., Cahyono, E., & Parmin, P. (2022). Article Review: Integration of Science, Technology, Entrepreneurship in Learning Science Through Bibliometric Analysis. *Journal of Turkish Science Education*, *19*(4), 1237–1253. https://doi.org/10.36681/tused.2022.172

Kwame, A. (2021). Integrating Traditional Medicine and Healing Into the Ghanaian Mainstream Health

System: Voices From Within. *Qualitative Health Research*, *31*(10), 1847–1860. https://doi.org/10.1177/10497323211008849

Malapane, O. L., Musakwa, W., Chanza, N., & Radinger-Peer, V. (2022). Bibliometric Analysis and Systematic Review of Indigenous Knowledge From a Comparative African Perspective: 1990–2020. *Land*, *11*(8), 1167. https://doi.org/10.3390/land11081167

Mite, A. D., Eveline, S., & Situmorang, R. (2021). Catholic Religious Learning With the Project Based Learning (PjBL) Approach: Validity and Feasibility. *Journal of Education Research and Evaluation*, *5*(2), 185. https://doi.org/10.23887/jere.v5i2.32300

Naviri, S., Sumaryanti, S., & Paryadi, P. (2021). Explanatory Learning Research: Problem-Based Learning or Project-Based Learning? *Acta Facultatis Educationis Physicae Universitatis Comenianae*, *61*(1), 107–121. https://doi.org/10.2478/afepuc-2021-0010

Parmiti, D. P., Rediani, N. N., Antara, I. G. W. S., & Jayadiningrat, M. G. (2021). The Effectiveness of Local Culture-Integrated Science Learning Through Project-Based Assessment on Scientific Attitudes and Science Process Skills of Elementary School Students. *Jurnal Pendidikan Ipa Indonesia*, *10*(3), 439–446. https://doi.org/10.15294/jpii.v10i3.31301

Prasetyo, B. D. (2024). Traditional Healing of Lio People in Flores, Indonesia: The Source of Knowledge. *Ethnobotany Research and Applications*, *28*. https://doi.org/10.32859/era.28.8.1-23

Prinsloo, K.-L. (2023). Medicinal Ethnobotanical Knowledge Across Urban Cultural Groups: A Case Study in a South African Township. *Ethnobotany Research and Applications*, *26*. https://doi.org/10.32859/era.27.5.1-10

Rahardjanto, A., Husamah, & Fauzi, A. (2019). Hybrid-PjBL: Learning outcomes, creative thinking skills, and learning motivation of preservice teacher. *International Journal of Instruction*, *12*(2), 179–192. https://doi.org/10.29333/iji.2019.12212a

Rahmatika, N. (2024). The Impact of Flipped Learning on Students` Critical Thinking; A Systematic Literature Review. *International Journal of Learning Teaching and Educational Research*, *23*(10), 180–206. https://doi.org/10.26803/ijlter.23.10.9

Rahmawati, Y., Afrizal, A., Astari, D. D., Mardiah, A., Utami, D. B., & Muhab, S. (2021). The integration of dilemmas stories with stem-project-based learning: Analyzing students' thinking skills using hess' cognitive rigor matrix. *Journal of Technology and Science Education*, *11*(2), 419–439. https://doi.org/10.3926/jotse.1292

Rao, N., Sreedevi, K., Padal, S. B., & Rao, D. A. (2022). Ethnomedicine of Primitive Khonds Tribe, Visakhapatnam District, Andhra Pradesh, India. *Ecology Environment and Conservation*, *28*(08), S334–S339. https://doi.org/10.53550/eec.2022.v28i08s.049

Rati, N. W., Arnyana, I. B. P., Dantes, G. R., & Dantes, N. (2023). HOTS-Oriented E-Project-Based Learning: Improving 4C Skills and Science Learning Outcome of Elementary School Students. *International Journal of Information and Education Technology*, *13*(6), 959–968. https://doi.org/10.18178/ijiet.2023.13.6.1892

Redhana, I. W., Widiastari, K., Samsudin, A., & Irwanto, I. (2021). Which Is More Effective, a Mind Map or a Concept Map Learning Strategy? *Jurnal Cakrawala Pendidikan*, *40*(2), 520–531. https://doi.org/10.21831/cp.v40i2.33031

Riley, L., Howard-Wagner, D., & Mooney, J. (2015). Kinship Online: Engaging 'Cultural Praxis' in a Teaching and Learning Framework for Cultural Competence. *The Australian Journal of Indigenous Education*, *44*(1), 70–84. https://doi.org/10.1017/jie.2015.13

Rinto, R. (2023). Bridging the Generational Gap: Exploring Youth Understanding on Ethnobotanical Knowledge and Its Integration in Higher Education Curricula. *Ethnobotany Research and Applications*, *26*. https://doi.org/10.32859/era.26.48.1-16

Sadrina, S., & Mustapha, R. (2016). Evaluation of Project-Based Learning at a Polytechnic in Malaysia: An Input Aspect Evaluation Research. *Circuit Jurnal Ilmiah Pendidikan Teknik Elektro*, *2*(1). https://doi.org/10.22373/crc.v2i1.759

Sari, F. P., Maryati, M., & Wilujeng, I. (2023). Ethnoscience Studies Analysis and Their Integration in Science Learning: Literature Review. *Jurnal Penelitian Pendidikan Ipa*, *9*(3), 1135–1142. https://doi.org/10.29303/jppipa.v9i3.2044

Sholahuddin, A., Anjuni, N., Leny, & Faikhamta, C. (2023). Project-Based and Flipped Learning in the Classroom: A Strategy for Enhancing Students' Scientific Literacy. *European Journal of Educational Research*, *12*(1), 239–251. https://doi.org/10.12973/eu-jer.12.1.239

Sofiyan, S., Amalia, R., & Suwardi, A. B. (2020). Development of Mathematical Teaching Materials Based on Project-Based Learning to Improve Students' HOTS and Character. *Journal of Physics Conference Series*, *1460*(1), 012006. https://doi.org/10.1088/1742-6596/1460/1/012006

Tulungagung, T. C. P. (2023). A SYSTEMATIC LITERATURE REVIEW: THE IMPACT OF

PROJECT-BASED LEARNING MODEL IMPLEMENTATION ON HIGH SCHOOL STUDENTS' LEARNING OUTCOMES ASSESSED THROUGH VOSViewer IN THE GOOGLE SCHOLAR DATABASE. *Jurnal Pelita Pendidikan*, *11*(1). https://doi.org/10.24114/jpp.v11i1.40656

Wangchuk, P., & Tashi, . (2016). Quality Assurance of the University Medical Education, Hospital Services and Traditional Pharmaceutical Products of the Bhutanese So-Wa-Rig-Pa Health Care System. *BMC Complementary and Alternative Medicine*, *16*(1). https://doi.org/10.1186/s12906-016-1270-2

Yulhendri, Y. (2023). Strategies for Project Based Learning During the Pandemic: The Benefits of Reflective Learning Approach. *Sage Open*, *13*(4). https://doi.org/10.1177/21582440231217885

Zuma, T., Wight, D., Rochat, T., & Moshabela, M. (2016). The Role of Traditional Health Practitioners in Rural KwaZulu-Natal, South Africa: Generic or Mode Specific? *BMC Complementary and Alternative Medicine*, *16*(1). https://doi.org/10.1186/s12906-016-1293-8