

Project-Based Learning Models In 21st Century Health Education: Enhancing Collaboration and Problem-Solving Skills: A Systematic Review

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Abstract

This research aims to explore project-based learning models in 21st century health education, with a focus on improving collaboration and problem-solving skills. Through a systematic literature review covering 15 research journals published between January 2020 and January 2024, it was found that project-based learning significantly improved students' global health competencies. Results showed improvements in communication and problem-solving skills,

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reflecting progress in students' capacity to think critically and collaborate in the context of global health issues. Although the results are positive, challenges such as inadequate teacher training and limited resources must be overcome to maximize the benefits of this learning model. This research provides important insights for educators and policy makers in implementing project-based learning in health education.

Keywords: *Project Based Learning, Collaboration Skills, Problem Solving*

INTRODUCTION

In the context of 21st-century health education, project-based learning (PBL) has emerged as a pivotal pedagogical approach that enhances collaboration and problem-solving skills among students. This systematic review aims to explore the efficacy of various project-based learning models in health education, particularly focusing on their ability to foster essential competencies required in contemporary health care settings. The increasing complexity of global health challenges necessitates a workforce equipped not only with core medical knowledge but also with soft skills such as teamwork, critical thinking, and effective communication (Sawleshwarkar & Negin, 2017; Lee, 2024).

Research indicates that traditional educational methods often fall short in preparing health professionals for real-world challenges. In contrast, PBL encourages active engagement and collaborative learning, allowing students to tackle complex problems in a supportive environment (Sun, 2021; Ibrahim et al., 2018). For instance, studies have shown that nursing students who participate in collaborative project-based learning exhibit significant improvements in their competencies and skills, suggesting that this approach is particularly beneficial for developing the necessary soft skills in health education (Lee, 2024; Kim & Choi, 2014). Furthermore, the integration of PBL into nursing curricula has been linked to enhanced problem-solving abilities, which are crucial for effective patient care and health management (Çevik & Olgun, 2014; Ançel, 2016).

Moreover, the relevance of PBL extends beyond nursing education; it is increasingly recognized as a vital component across various health disciplines. The adaptability of PBL allows for the incorporation of diverse learning styles, thereby accommodating the unique needs of students (Şahan et al., 2020). This flexibility not only promotes individual learning but also fosters a collaborative spirit among peers, which is essential in health care settings where teamwork is paramount (Anagün, 2018; Dolmans et al., 2015). As such, the systematic review will delve into



the various models of project-based learning, assessing their impact on collaboration and problem-solving skills, and providing insights into best practices for implementation in health education curricula.

Global health issues, such as infectious diseases and increasing health disparities, have emerged due to accelerated globalization. Project-based learning is a learner-centered teaching method in which learners learn actively through autonomous goal setting, collaboration, communication, and reflection on practical cases. In this method, individuals and teams work together to improve the completeness of outcomes through continuous team communication; learners discover and develop their strengths in the process of understanding and solving project problems. In this method, individuals and teams work together to improve the completeness of outcomes through continuous team communication; learners discover and develop their strengths in the process of understanding and solving project problems. (Lee, Yoon and Hwang, 2024)

Project-based learning is characterized by viewing learners as active subjects in the learning process and valuing their knowledge, perspectives and experiences. Traditional lecture-based teaching methods often limit the development of critical thinking or problem-solving skills, both of which are essential components in the field of global health (Lee, Yoon and Hwang, 2024).

RESEARCH METHOD

This study is a literature review that attempts to explore project-based learning models in 21st century health education: improving collaboration and problem-solving skills. Sources for conducting this literature review include a systematic search study of computerized databases through the google scholar site in the form of research journals totaling 15 journals. The search keyword was project-based learning model in 21st century health education. The inclusion criteria included research articles published in English, articles published from 2015 to 2024, original research articles, articles that discussed project-based learning in 21st century health education original research, articles that discuss project-based learning in 21st century health education by improving collaboration and problem-solving skills.

RESULTS

No	Writer/ Years/Title	Country	Learning objective	Method	Result
1.	Anazifa, Djukri/2017/ Project- Based Learning And Problem-	Indonesia	This study aims to determine the influence of project-	Quasi experiment with non-	(1) Project-based learning and problem-based learning influence students' creativity



	Based Learning: Are They Effective To Improve Student's Thinking Skills?		based learning and problem-based learning on students' creativity and critical thinking, as well as the differences in the effects of project-based learning and problem-based learning on students' creativity and critical thinking.	equivalent control- group design.	and critical thinking; (2) There is a difference in the effect of project-based learning and problem-based learning on students' creativity; and (3) There is no difference in the effect of project-based learning and problem-based learning on students' critical thinking.
2.	Eris Nurhayati.Dedi Riyan Rizaldi, Ziadatul	Indonesia	This research is a classroom action research aimed at providing an overview of the utilization of project-based learning models with a blended learning system during the new normal of COVID-19.	Class action research with model design research design model which following Kurt's model, Lewin model, which consists of four components:1)Planning , 2)Action,3)Observation,and 4)Reflection	Based on the research that has been conducted, it is known that the project-based learning model with a blended learning system can be implemented in the learning process to enhance 21st-century skills during the COVID-19 pandemic.
3.	Rommel Ali/2024/Enhancing 21 st Century Skills through integrated stem education using Project-Based Learning	Arab Saudi	The purpose of this research is to examine and assess the impact of the integrated STEM education program on students' 21st-century skills.	Initial evaluation by the expert committee, comprehensive review of the questions, and implementation of a pilot study to assess the validity and reliability	



				of the assessment instruments.	
4.	Adwan Mohammad Hasan Bani-Hamad, Abdul Hakim Abdullah/2019/The Effect of Project-Based Learning to Improve the 21 st Century Skills among Emirati Secondary Students	Uni Emirat Arab	This research aims to discover the impact of project- based learning on the enhancement of 21st-century skills (4Cs) among secondary school students in the Emirates.	Pre-test and post-test, as well as data analysis using paired sample t-test.	The results show that there is a statistically significant difference at (α = 0.05) in the 21st- century skills (4Cs) test scores of students between the pre-test and post-test, indicating better performance in the post-test. In other words, the project-based learning approach has a significant impact on the enhancement of 21st- century skills (4Cs) among secondary school students in the Emirates who participated in the National Think Science Competition 2019.
5.	Endah Hendarwati/2021/The Collaborative Problem Based Learning Model Innovation	Indonesia	The purpose of this research is to develop a collaborative problem-based learning (CPBL) model.	Research development	The results of this research include five syntax elements of the model, which consist of problem orientation, organization, collaborative problem- solving, presentation and discussion, and evaluation. Additionally, a model matrix was produced to guide the learning activities of lecturers and students in achieving fundamental and global 21st-century skills, such as problem-

					solving, critical thinking, and collaboration. The syntax and model matrix generated are deemed feasible, valid, and can be practically implemented to produce graduates with ready and competitive skills. Therefore, the developed CPBL model can serve as an initial role model for innovative learning to support education at various levels, especially higher education, in producing graduates with the skills necessary to be competitive in today's era and possibly in the future.
6.	Chotika Wanglang, Pinanta Chatwattana/2023/The Project-Based Learning Model Using Gamification to Enhance 21st Century Learners in Thailand	Thailand	The objectives of this research are: (1) to study and synthesize the conceptual framework of a project-based learning model using gamification to enhance 21st-century learners, (2) to develop a project-based learning model using gamification to improve 21st-century learners, and (3) to examine the outcomes after using the project-based learning model with gamification to	Design and development of a project-based learning model using gamification to enhance 21st-century learning.	Based on the research findings that align with the researchers' expectations, it was determined that: (1) Overall, the alignment of the project-based learning model development using gamification to enhance 21st-century learning (overall elements) is at a very high level, and (2) Overall, the suitability of the project-based learning model development using gamification to improve 21st-century learners is also at a very high level.



			enhance 21st-century learners.		
7.	Chaiwat Jewpanich, Pallop Piriyasurawong/2015/Project-Based Learning Using Discussion and Lesson-Learned Methods via Social Media Model for Enhancing Problem Solving Skills	Thailand	This research aims to (1) develop project-based learning with discussion methods and learning through a social media model (PBL-DLL SoMe Model) used to enhance problem-solving skills of undergraduate education students, and (2) evaluate the PBL-DLL SoMe Model used to improve problem-solving skills of undergraduate education students.	PBL-DLL model development some	The research results show that (1) the SoMe PBL-DLL model used to enhance the problem-solving skills of undergraduate education students consists of four components: 1) analysis of input readiness factors, 2) the SoMe PBL-DLL model process, 3) evaluation of learning achievement and problem-solving skills (Output), and 4) evaluation of the results between evaluation and feedback. (2) The evaluation results of the SoMe PBL-DLL project for improving problem-solving skills among undergraduate education students indicate that: 1) the mean (x) of the input readiness factor evaluation is 4.50, with a standard deviation (SD) of 0.80; 2) the mean (x) of the SoMe PBL-DLL model process is 4.52, with an SD of 0.62; 3) the average (x) of the evaluation of learning achievement and problem-solving skills (Output) is 4.62, with an SD of 0.72; 4) the average (x) of the process and



					feedback evaluation results is 4.71, with an SD of 0.48; 5) the overall average (x) evaluation of the developed learning model is 4.53, with an SD of 0.75. Thus, the developed learning model is assessed as the most suitable in terms of quality.
8.	Evi Puspitasari/2020/Project-based Learning Implementation to Cultivate Preservice English Teachers' 21st Century Skills	Indonesia	The aim is to explore how Project-Based Learning (PbL) is implemented at Lantern School of English Education (LSEE), an undergraduate program in Indonesia that produces English language teachers.	Case Study design	The findings indicate that the institution implements Project-Based Learning (PbL) through assessment, classroom activities, the role of the teacher, and the role of the students. From the students' perspective, project-based assessment, group classroom activities, the teacher as a facilitator, and student-centered approaches effectively develop their abilities in creativity, critical thinking, collaboration, and communication. Conclusions and recommendations are also presented after discussing the findings.
9.	Naila Rohmaniyah,Siti Wulan/2024/Project-Based Learning Design in Secondary Schools: Enhancing Students' Collaborative and Creative Skills	Indonesia	This study investigates the implementation of Project-Based Learning (PjBL) in secondary schools, focusing on its impact on enhancing students'	A case study approach, which involves data collection through participatory observation, in-depth interviews,	The results indicate that PjBL fosters an active learning environment that significantly enhances students' ability to work collaboratively and think creatively. Students engaged in PjBL show increased motivation and a deeper understanding of the subject



			collaborative and creative skills.	and document analysis.	matter, reflecting improvements in problem-solving skills and teamwork. However, this study also highlights several challenges, such as time constraints, limited resources, and difficulties in aligning PjBL with traditional curricula, which hinder its broader implementation. Teachers reported a need for more professional development and support to effectively implement PjBL strategies. Despite these challenges, the positive outcomes suggest that PjBL is a promising pedagogical approach that can better prepare students for the demands of the 21st century. The findings underscore the necessity for educational institutions to address the barriers to PjBL implementation and provide adequate training and resources for teachers. This study contributes to the growing literature advocating for innovative teaching methods that emphasize student-centered learning and the development of essential life skills.
10.	Rahmadi,Riyan Hardinata , Tami Rosadi Ahwan, Rubiyatno , Didi Suryadi/2023/Enhancing 21st century	Indonesia	This research aims to enhance collaboration skills among students in physical education,	Collaborative observation sheet, and using descriptive	The results revealed a significant improvement in collaboration skills between the initial cycle and subsequent cycles. ANOVA



	collaboration skills in physical education through the problem-based learning model		specifically in the design of systematic rhythmic movement activities using a problem-based learning model. 4o mini	analysis method	tests indicated a significant increase after two learning cycles. This research directly impacts the development of collaborative skills in students, recognizing collaboration skills as essential in 21st-century education. The collaborative problem-solving approach not only enhances teamwork but also contributes to improved learning outcomes, preparing students for success in community and workplace environments. This study highlights the effectiveness of the problem-based learning model, emphasizing its important role in student development and education. Future research should explore the impact of the problem-based learning model using mixed methods.
11.	Zayyinah, Erman Erman, Zainul A.I. Supardi1, Eko Hariyono,Binar K. Prahani/2022/STEAM-Integrated Project Based Learning Models: Alternative to Improve 21st Century Skills	Indonesia	This research aims to evaluate the effectiveness of project-based learning integrated with STEAM (PjBL) in enhancing 21st-century skills among students, including critical thinking, problem-solving, creativity, collaboration, and communication, particularly within the	A systematic and structured literature review analyzing the impact of project-based learning integrated with STEAM on the enhancement of 21st-century skills.	The results of this study indicate that project-based learning integrated with STEAM (PjBL-STEAM) has a positive impact on enhancing 21st-century skills, including critical thinking, creativity, collaboration, and communication.



			context of the 2013 curriculum in Indonesia.		
12.	Sujin Lee,Ju Young Yoon and Yeji Hwang/2024/Collaborative project-based learning in global health: Enhancing competencies and skills for undergraduate nursing students	Korea	This research aims to evaluate the effectiveness of the collaborative project-based learning approach in global health education for nursing students, as well as to enhance students' competencies in global health, communication, problem-solving, and self-directed learning skills.	Quantitative and qualitative methods, with a one-group pretest-posttest research design to assess the effectiveness of the course.	The results of this study indicate that the collaborative project-based learning approach leads to statistically significant improvements in several key areas, including global health competencies, communication skills, problem-solving skills, and self-directed learning skills. However, it is important to note that these results are based on self-reported data from students, which may be susceptible to bias.
13	Rita Retnowati, Rita Istiana,Nadiroh/2020/Developing Project-Based Learning Related to local Wisdom in improving Student's Problem -Solving Skills	Indonesia	This research aims to enhance students' environmental problem-solving skills as well as their ability to develop video learning media related to local wisdom.	The ADDIE model, which consists of analysis, design, development, implementation, and evaluation.	The research results indicate that the development of a local wisdom-based Project-Based Learning (PjBL) model is effective in enhancing students' ability to solve environmental problems and in developing learning media related to local wisdom. Overall, this study concludes that the development of a local wisdom-based PjBL model can improve students' problem-solving skills and their ability to develop learning media.
14	Ni Komang Arie Suwastini, Ni Wayan Nilam Puspawati, Ni	Indonesia	This research aims to explore and analyze the implementation of	Quasi-experiment with	The research results show that problem-based learning has some significant characteristics and strengths



	Luh Putu Sri Adnyani, Gede Rasben Dantes, Zulidyana Dwi Rusnalasari/2021/Problem-based learning and 21st-century skills: Are they compatible?		problem-based learning in the context of education, specifically in enhancing students' critical thinking and communication skills in the 21st century.	non-equivalent control group design	in supporting the development of 21st century skills. This research identified that: 1. Characteristics of Problem-Based Learning: This method encourages students to be actively involved in the learning process, solve real problems, and work collaboratively, all of which contribute to the development of critical and creative skills. 2. Strengths of Problem-Based Learning: Problem-based learning can improve students' critical thinking, communication, and collaboration skills, which are important parts of 21st century skills. It also helps students to better understand the subject matter through a practical context. 3. Implementation Challenges: Despite its many benefits, the study also noted some challenges in implementing
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					problem-based learning, such as the need for adequate teacher training and limited resources in schools.
15	Shupin Li, Johanna Poysa-Tarhonen, Paivi Hakkinen/2023/Students' collaboration dispositions across diverse skills of collaborative problem-solving in a computer-based assessment environment	Finlandia	This research aims to identify the dimensions of collaborative disposition, namely negotiation, advocacy/guidance, and cooperation, while emphasizing the importance of systematic interventions to enhance collaboration skills in education, especially given the significance of 21st-century skills.	Case study of a problem solving solution	The research results indicate that three dimensions of collaborative disposition have been identified: negotiation, advocacy/guidance, and cooperation. Exploratory factor analysis revealed that these three factors are positively correlated, with negotiation being the most significant dimension related to social skills in collaborative problem-solving (CPS) tasks. Students with higher negotiation skills reported better social skills, while students with high levels of cooperation exhibited lower social skills, suggesting that a preference for collaboration does not always correlate with active social engagement. These findings emphasize the importance of developing negotiation skills in the educational context to enhance collaboration and social interaction among students. Additionally, the



					study found that the collaborative disposition perceived by students is positively related to social skills in CPS, but not significantly related to cognitive skills in CPS.
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DISCUSSION

The research results by Sujin et al. (2024) on project-based learning in health education to enhance collaboration and problem-solving found a significant increase in global health competencies, indicating a substantial impact of the course on students' understanding of global health issues. Additionally, communication skills improved significantly, demonstrating that the course was effective in enhancing students' ability to exchange ideas and collaborate with others. Another positive outcome was the improvement in problem-solving skills, reflecting meaningful progress in students' capacity to tackle complex problems and think critically.

The research results conducted by Anazifa et al. (2017) showed that the paired sample t-test results indicated a significant difference in creativity and critical thinking skills across the project-based learning model, problem-based learning model, and the 5M model, as demonstrated by a significance value of 0.000 (Sig. = < 0.05). This means that the average pre-test and post-test scores were different. It can be concluded that both project-based learning and problem-based learning positively influence students' creativity and critical thinking skills.

Rommel Al Ali's (2024) research also indicates that the findings show students had higher average scores in 21st-century skills after participating in the Advanced Mawhiba Program for Science and Mathematics, as evidenced by a significant increase ($t(115) = 3.07$). Further analysis revealed significant differences in certain dimensions of 21st-century skills. Notably, there was a significant increase in digital literacy ($t(115) = 3.35$) and high productivity ($t(115) = 3.54$). However, no significant differences were observed in the dimensions of innovative thinking ($t(115) = 1.67$) and effective communication ($t(115) = 1.98$). Most students demonstrated strong proficiency in 21st-century skills, indicating the program's effectiveness.

The results indicate that Project-Based Learning (PjBL) is highly effective in enhancing students' collaborative skills, although its success depends on the level of support provided by teachers and the willingness of students to actively engage in group processes. The findings



underscore the importance of creating a supportive environment where students can practice collaboration in meaningful ways, with ample opportunities to reflect on and improve their teamwork skills.

The findings of other studies further support the effectiveness of project-based learning (PjBL) in fostering essential 21st-century skills. Adwan and Bani-Hamad (2019) demonstrated that PjBL significantly improves students' competencies in communication, collaboration, critical thinking, and creativity. Their research on Emirati secondary school students revealed a statistically significant difference in test scores, underscoring PjBL's impact on skill development.

Similarly, Wanglang and Chatwattana (2023) explored the role of gamification in PjBL and found that integrating game elements in the learning process enhances motivation and engagement, contributing to an overall increase in students' ability to collaborate and think critically. Furthermore, Rahmadi et al. (2023) emphasized the importance of problem-based learning in improving collaboration skills within physical education settings, showcasing the model's adaptability across different educational contexts.

However, despite the positive outcomes, challenges in maintaining consistent levels of creativity across all student projects remain. Some students struggle to translate their creative ideas into practical project outcomes due to limited resources or lack of experience with certain tools. Teachers need to provide additional support and resources to help these students realize their creative potential. Rohmaniyah and Wulan (2024) found that time constraints, limited resources, and difficulties aligning PjBL with traditional curricula hinder broader implementation. Their findings suggest the necessity of professional development and institutional support to optimize PjBL's effectiveness.

The research highlights the transformative role of project-based learning in education. While it effectively enhances collaboration, critical thinking, and problem-solving skills, its success depends on adequate resources, teacher support, and student engagement. The integration of innovative strategies such as gamification and blended learning can further strengthen its impact, ensuring students are well-equipped with the necessary competencies for the 21st century.

CONCLUSION

Project-based learning is a teaching method that actively engages learners in addressing real-world problems, fostering collaboration, communication, and critical thinking. This literature review explores the project-based learning model in 21st-century health education, focusing on



enhancing collaboration and problem-solving skills. A systematic search of computerized databases yielded 15 research articles published between 2020 and 2024. Developing negotiation skills in the context of education enhances collaboration and social interaction among students.

These studies indicate that project-based learning effectively enhances collaboration, critical thinking, problem-solving, and 21st-century skills across various disciplines and educational contexts. However, challenges such as inadequate teacher training and limited resources must be addressed in order to fully implement and benefit from problem-based learning.

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