

Innovative pedagogy in interior design: a systematic review of problem-based learning effects

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ABSTRACT

In response to the evolving demands of interior design education, this study aims to explore innovative pedagogical approaches that can better equip students for the complexities of professional practice. The primary focus is on problem-based learning (PBL), a method that promotes critical thinking, creativity, and real-world problem-solving. The study systematically reviews the effects of PBL as an innovative pedagogy within the context of interior design education. The study conducts a systematic review of 21 articles to analyze the impact of PBL on students' academic performance, engagement, and readiness to face industry challenges. The review process involves a comprehensive examination of existing literature to assess the effectiveness of PBL in fostering critical skills and applying theoretical knowledge to practical situations. The findings indicate that PBL significantly enhances students' ability to apply theoretical concepts to real-world scenarios, increases student engagement, and develops essential skills such as communication and teamwork. Despite these benefits, the study also identifies challenges in implementing PBL, including the need for adequate resources and effective assessment methods. The results underscore the importance of incorporating PBL into interior design curricula while also highlighting the limitations posed by the limited data available.

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1. INTRODUCTION

Translating learning experiences into real-world design challenges presents a significant difficulty for interior design students [1]. Design embodies creative solutions that address the needs of communities [2]. The quality of a design is largely determined by the designer's ability to accurately translate these needs and effectively communicate ideas to all stakeholders involved. Designers cultivate problem-solving strategies by optimizing functionality while prioritizing safety, security, health, comfort, and aesthetics for both individuals and their environments [3]. In the current era of rapid technological advancement, design and technology innovation are increasingly intertwined, with sophisticated tools enabling the realization of even the most abstract ideas [3]. According to Wardani *et al.* [3], designers must continuously innovate and stay abreast of technological developments to remain relevant. Moreover, as responsible citizens, designers should cultivate the ability to collaborate with diverse stakeholders to address the increasingly complex socio-cultural challenges faced by society.

Asojo and Vo [4] opined that a prevalent approach in design education involves students developing solutions for open-ended problems through hand sketches and digital renderings. Typically, these challenges are hypothetical interior design scenarios for existing buildings with imagined clients. As such, students are seldom given the chance to validate their solutions with actual clients or in real-world use cases [4]. The absence of hands-on involvement could result in misinterpretations of the needs of the clients and challenges in formulating the problem and foreseeing possible roadblocks. The suggested solutions might look good and follow the rules, but they might not truly address the needs of actual clients or work well in practical settings [4].

According to Han *et al.* [5], “learning by doing” is a common way to describe the benefits of experiential learning that involves hands-on activities that shape students’ understanding and stimulate their inherent curiosity. PBL is defined as “a systematic teaching method that engages students in acquiring knowledge and skills through an extended enquiry process centered around complex, authentic question” [5]. It is based on the social constructivist perspective on learning. With PBL, students can create knowledge by drawing from both their own experiences and the context of their immediate surroundings [6]. According to Papert and Harel [7], genuine learning can occur when students participate in hands-on learning as opposed to just passively absorbing knowledge. Problem-based learning (PBL) provides a pedagogical framework that fosters problem-solving by enabling students to develop reasoning skills and construct knowledge [6]. In contrast, design thinking serves as a pedagogical tool that directs students towards effective problem-solving solutions [8]. Fields characterised by ill-defined and complex problems, such as interior design, gain significant advantages from the educational applications of both PBL and design thinking [9]–[12].

PBL is a student-centered pedagogical approach widely adopted as a method of instruction in both secondary and higher education institutions. Rooted in foundational learning theories such as constructivism (Piaget) and constructionism (Papert), PBL emphasizes the development of self-directed learning skills, whereby learners actively construct new knowledge based on their existing cognitive frameworks [13]. This instructional model is instrumental in fostering students’ creative thinking, problem-solving, and communication skills [13]–[16].

In the 1980s, PBL began in the field of medical education when educators realized that diagnosing patients requires a cooperative team effort using inductive reasoning and specialized knowledge from several medical specialties [17], [18]. Since then, PBL has spread widely among medical schools and expanded its impact to other academic fields as well as K-12 education [19]. Three key elements set project-based learning (PjBL) apart from other instructional models, according to Savery [20]:

- The tutor’s function as an educational facilitator;
- The obligation for students to manage their own learning through self-regulation and direction;
- The design of ill-structured problems as essential elements that drive inquiry.

However, Savery [20] also notes that PBL is inherently challenging, requiring careful and thoughtful scaffolding to support students in developing problem-solving, self-regulation, and collaborative skills. Through the PBL process, students define their own learning objectives by responding to prompts from a given problem scenario. Four phases make up a typical PBL learning cycle: process evaluation, problem presentation, problem investigation, and problem solution [13]. Students frequently start out with little prior knowledge of the problem scenario [21]. Together with their peers, they strategize and plan a course of action based on what they know already and what they learn in the future. PBL uses properly ill-structured problems in addition to emphasizing problem-solving techniques to propel learning. PBL’s focus on group work makes it a popular small-group teaching approach that combines the development of higher-order problem-solving abilities with the acquisition of knowledge [13], [14], [22].

Indrapangastuti *et al.* [23] emphasize that enhancing students’ critical thinking skills requires a learning model that actively involves students, with teachers acting as facilitators. Wickramasinghe and Appiah [24] highlight that educational experiences failing to fully engage students’ cognitive abilities may result in insufficient development of critical thinking. Indrapangastuti *et al.* [23] point out that PBL is a widely recognized model for fostering critical thinking, as it engages students with real-world issues and promotes the development of knowledge through critical thinking and problem-solving. Given this context, the primary aim of this systematic review is to explore and synthesize existing research on the impact of PBL on pedagogy within the field of interior design. By doing so, this review seeks to address the gap in understanding the effect of PBL as an innovative pedagogical approach in interior design education, which remains underexplored in current literature. This review, therefore, aims to answer the following research questions:

- How effective is PBL in enhancing students’ creative and critical thinking skills in interior design education?
- How does PBL influence the overall learning experience and engagement of interior design students?
- In what ways does PBL prepare interior design students for industry challenges and expectations?
- What are the challenges and best practices in implementing PBL in interior design education?

2. METHOD

The goal of this study is to investigate how innovative pedagogy in the interior design field is impacted by PBL using a systematic literature review approach. As stated by [25]–[28], this review complies with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines. This qualitative approach is designed to comprehensively cover authoritative content from credible sources, as recommended by [29], [30]. The PRISMA framework offers several benefits, such as the ability to formulate research questions precisely, organize and streamline the process of conducting investigations, establish inclusion and exclusion criteria, and conduct a comprehensive review of the scientific literature in a timely manner.

The procedures for selecting and excluding articles are described in detail in the review using the PRISMA statement template. Qureshi *et al.* [31] have observed that following PRISMA improves the quality of systematic review reporting. This study is limited to published literature and employs a rigorous selection procedure that entails full-text analysis, identification, screening, and eligibility assessment of the articles. A thorough explanation of each step that establishes the scope of the research is given in the following sections.

2.1. Search strategy

The journals that investigate the effects of PBL on creative pedagogy in the interior design field are the main focus of this review. To ensure comprehensive coverage of research within this domain, published articles from 2010 to 2024 were considered. To find relevant articles on Scopus, search terms like “problem-based learning”, “PBL”, “interior design”, “interior styling”, “spatial design”, “PBL impact”, and “curriculum” were used. Additional sources were obtained from Google Scholar.

2.2. Eligibility criteria

To ensure the selection of studies aligned with the objectives of this research and to facilitate accurate data collection, inclusion and exclusion criteria were rigorously applied. Initially, the preset inclusion criteria were used to screen the titles and abstracts of the found publications. Duplicate publications, articles presenting results that were inconsistent with the research inquiries, and conference papers were eliminated during this screening process. A comprehensive full-text review was subsequently conducted on the remaining articles that satisfied the inclusion criteria. Furthermore, the research was limited to English-language publications in order to ensure uniformity across the assessment procedure. After this comprehensive procedure, a total of twenty-one publications were selected for inclusion in the review, based on their relevance to the research topics. Figure 1 displays the PRISMA flow diagram that explains the literature search procedure.

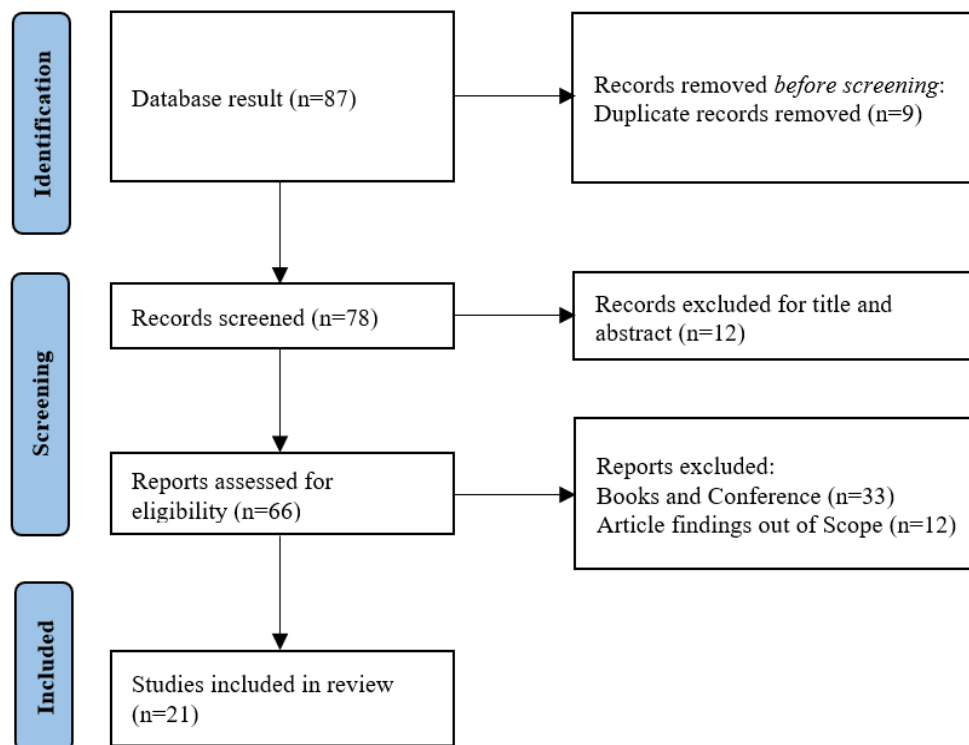


Figure 1. PRISMA flow diagram

3. RESULTS

Data extraction was done to speed up the evaluation process for the 21 papers that satisfied the study's inclusion criteria, as shown in Table 1. The extracted data contained crucial information like author names, publication years, study locations, methodological designs, and the journals in which each study was published.

Table 1. Data extraction table

S/N	Authors	Methodology	Country	Journal
1	[23]	Qualitative	Indonesia	AL-ISHLAH: Jurnal Pendidikan
2	[9]	Qualitative	USA	Interdisciplinary Journal of Problem-Based Learning
3	[4]	Qualitative	USA	International Journal of Designs for Learning
4	[32]	Qualitative	Ireland, USA	International Journal of Engineering Education
5	[33]	Qualitative	Egypt	International Journal of Architectural Research
6	[34]	Qualitative	Uganda	Africa Journal of Technical & Vocational Education & Training
7	[3]	Qualitative	Indonesia	Global Journal of Emerging Science, Engineering & Technology
8	[35]	Qualitative	South Africa	Journal of Educational Studies
9	[36]	Quantitative	Indonesia	Jurnal Penelitian Pendidikan IPA (Journal of Research in Science Education)
10	[37]	Qualitative	China	International Journal of Learning and Teaching
11	[38]	Qualitative	China	Journal of Educational Technology Systems
12	[39]	Quantitative	Indonesia	Esteem Journal of English Education Study Programme
13	[40]	Qualitative	South Korea	International Journal of Advanced Culture Technology
14	[41]	Qualitative	South Korea	Journal of Contemporary Educational Research
15	[42]	Qualitative	Bulgaria	European Journal of Engineering Education
16	[43]	Qualitative	USA	Interdisciplinary Journal of Problem-Based Learning
17	[44]	Mixed-Method	Taiwan	Cogent Education
18	[45]	Qualitative	Malaysia	International Journal of Technology and Design Education
19	[46]	Qualitative	Malaysia, Turkey	Journal of Cleaner Production
20	[47]	Qualitative	Indonesia	JPI (Jurnal Pendidikan Indonesia)
21	[48]	Quantitative	Kazakhstan	Frontiers in Education

3.1. Publication year

This systematic review encompasses the years 2010 to 2024, enabling a comprehensive exploration of the subject. The years 2024 and 2023 yielded the most publications (4 articles each) out of the 21 articles that were examined. The next year, 2021, contributed three articles, while the years 2018, 2019, and 2022 each contributed two. Each of the subsequent years had a single article. Figure 2 is a visual representation of how these publications are distributed.

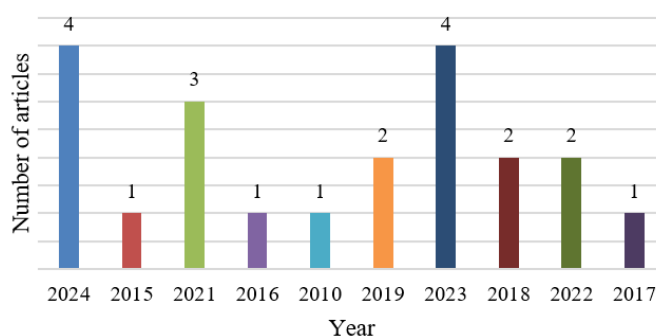


Figure 2. Publication by year

3.2. Methodology analysis

The reviews included in this systematic analysis of research encompass a wide range of research methodologies, such as qualitative, quantitative, and mixed-method approaches, which combine quantitative and qualitative techniques. The 21 articles were analyzed, and 1 study (or 5% of the total) used mixed methods. Out of all the methodologies, 3 articles (or 14% of the total) used quantitative methods, whereas 17 articles (81% of the reviewed studies) used qualitative methods, making up the majority of the approaches. Figure 3 is a graphic representation of this distribution.

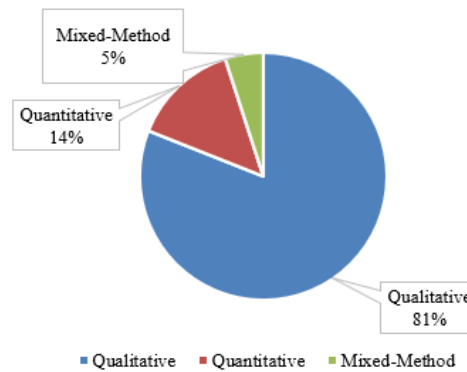


Figure 3. Methodology distribution

3.3. Research study country affiliation

The inclusion criteria for countries in this study reflect a global perspective, emphasizing the international significance of interior design. The reviewed articles include research from different countries, as shown in Figure 4, along with the total number of articles from each nation.

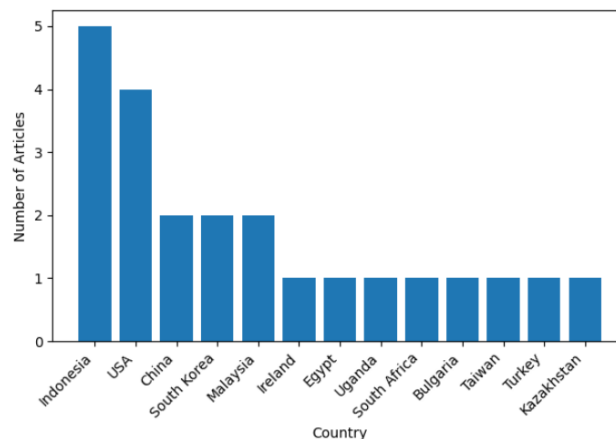


Figure 4. Country affiliation of reviewed articles

3.4. Author's affiliation

Figure 5 illustrates the affiliations of the articles reviewed, demonstrating the global scope of interior design. Indonesia leads with 20 authors, followed by the USA with 11 authors, and China with 7 authors. The contributions from other countries are detailed. Additional contributions were recorded from South Korea, Malaysia, Ireland, Egypt, Uganda, South Africa, Bulgaria, Turkey, Kazakhstan, and Taiwan, reflecting the international distribution of research on problem-based learning.

3.5. Cluster analysis

After data processing, cluster analysis, visualization, interpretation, and reporting were done following the methodology outlined in the literature before the results were discussed. Finding the main clusters of correlated patterns and shared trends within a keyword network was the goal of this phase [49], [50]. Then, as shown in Figure 6, a bibliometric analysis was conducted with the primary keywords to identify and analyze markers of the movement and development of scientific literature. VOSviewer software was used to assess the bibliometric analysis results.

The network of related keywords is shown in Figure 6, which makes it easier to understand how keywords are related in different scientific publications. This Figure 6 helps identify emerging trends for further research and provides insights into the topics analyzed within the study. Most nodes in the network are shown prominently in the Figure 6, with the size of each node indicating how frequently the keyword appears. The co-occurrence of keywords is represented by the connections between nodes, and the thickness

of each connection shows how frequently a keyword appears simultaneously. Thicker connections indicate more frequent co-occurrences of linked keywords, while larger nodes indicate more frequently occurring keywords. Each color in the Figure 6 represents a thematic cluster, with nodes and links within a cluster explaining its subject and illustrating the relationships among various topics.

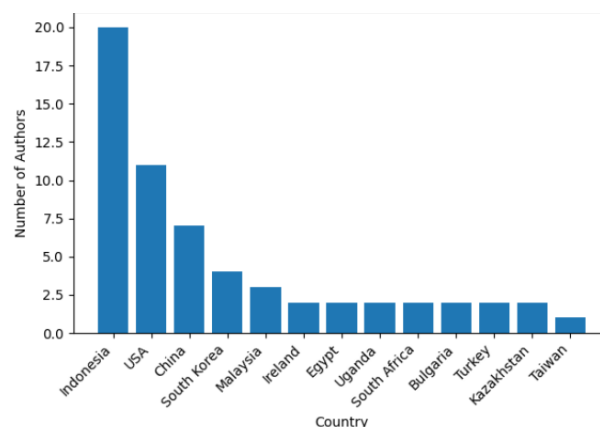


Figure 5. Authors' country affiliation of reviewed articles

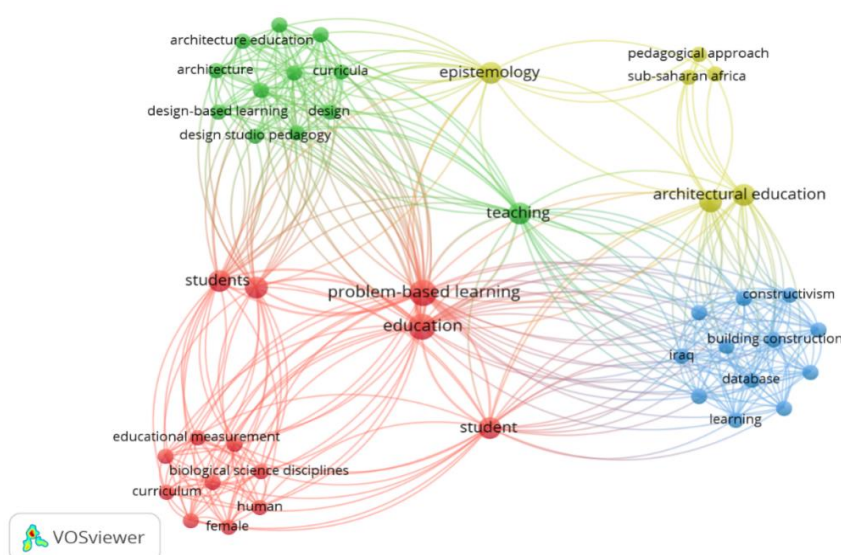


Figure 6. Keywords network

The VOSviewer keyword development map outputs revealed four primary term clusters related to the themes of PBL in creative pedagogy in interior design. These clusters, which summarized the main discussions that came out of the review, were chosen from the keyword map. The effectiveness cluster discusses how PBL has improved students' capacity for both critical and creative thought. The impact cluster draws attention to PBL's wider impact on learning objectives. The curriculum integration cluster looks at the difficulties and strategies involved in using PBL in interior design education, while the Skill Development cluster investigates how PBL has prepared students for the field.

4. DISCUSSION

4.1. Effectiveness

In the realm of interior design education, PBL has emerged as a highly effective pedagogical approach, consistently demonstrating its ability to enhance students' creative and critical thinking skills.

Indrapangastuti *et al.* [23] highlight how PBL encourages students to deeply engage with design problems, fostering higher-order thinking by challenging them to explore creative solutions and critically analyze design challenges from multiple perspectives. This is echoed by Galford *et al.* [9], whose research shows that integrating PBL into studio-based learning environments allows students to engage with realistic design problems, which not only sharpens their creativity but also develops essential skills like teamwork and collaboration as key components of critical thinking.

The practical application of PBL in real-world settings further underscores its effectiveness. Asojo and Vo [4] provide compelling evidence from a project at a Midwest university where students, through a seven-week PBL studio project, were tasked with redesigning the education wing of Minnesota's official natural history museum. This immersive experience enabled students to critically evaluate their design solutions while honing their creative thinking, an outcome similarly observed by Qureshi *et al.* [31], who found that engaging with complex, ill-defined design challenges in a PBL setting significantly enhances students' ability to generate innovative solutions and refine their ideas through critical analysis. Moreover, the integration of theoretical knowledge with practical application, as discussed by Chance *et al.* [32], highlights PBL's role in bridging the gap between theory and practice. By allowing students to apply theoretical concepts in a studio environment, PBL fosters a deeper engagement with the design process, which not only enhances creativity but also develops critical thinking. This is further reinforced by Salama and Crosbie [33], whose study at Kyambogo University found that combining PBL with a skills lab significantly improved students' professional competencies, building their confidence and equipping them with the practical skills necessary for success in the interior design field.

PBL's emphasis on collaboration is another recurring theme across these studies. Research by [4], [9] both emphasize how the collaborative nature of PBL enhances students' ability to work in teams, communicate effectively, and reach compromises, all essential for developing creative and critical thinking skills. The importance of teamwork in PBL is further validated by Ashour *et al.* [46], who report that a significant majority of students acknowledged the positive impact of PBL on their creative thinking and overall learning outcomes. Finally, PBL's impact extends beyond the classroom, as Wardani *et al.* [3] illustrate through the integration of service learning within PBL. By engaging in real-world tasks and interacting with the community, students not only master their specialized knowledge but also develop a deeper understanding of their role as designers and their impact on society. This approach not only reinforces their creative and critical thinking abilities but also prepares them for the complexities of professional practice, as noted by Raycheva *et al.* [42], who emphasize the importance of hands-on experience and iterative problem-solving in PBL. In conclusion, the findings from these studies collectively affirm that PBL is a highly effective strategy for enhancing creative and critical thinking skills in interior design education. By engaging students with real-world problems, fostering collaboration, and bridging theory with practice, PBL equips future designers with the cognitive and professional skills essential for success in the field.

4.2. Pedagogical impact

PBL has a profound impact on the overall learning experience and engagement of interior design students, as evidenced by various studies. Islamiati *et al.* [36] found that PBL significantly enhances student engagement, particularly in large class settings, by fostering active participation, teamwork, and self-confidence. The interactive and real-life activities characteristic of PBL create a dynamic learning environment where students are not only more engaged but also more invested in their learning process. Despite some challenges, such as task complexity and increased workload, the real-world relevance and flexibility of PBL enrich the overall learning experience, making it a valuable tool in interior design education.

The hands-on, immersive nature of PBL is further highlighted by Asojo and Vo [4], whose study demonstrates that PBL significantly enhances the learning experience by placing students in real-world design environments. Through a seven-week studio project, students collaborated with professionals and stakeholders, developing critical skills such as communication, collaboration, and problem-solving. The reflections from students indicate that this approach not only deepens their understanding of the design process but also makes learning more relevant, interactive, and engaging. These findings suggest that PBL effectively transforms the learning environment into a more dynamic and involved space, fostering greater student engagement.

According to Tsang *et al.* [37], PBL's influence on student engagement and learning experience is particularly notable because it presents students with real-world challenges that mirror those encountered in professional practice. This approach immerses students in practical, task-oriented scenarios, effectively bridging the gap between academic learning and professional application. Similarly, Qureshi *et al.* [31] emphasize that by involving students in solving real-world design problems, PBL helps them develop a deeper understanding of design principles, increases their motivation to learn, and enhances their ability to

apply theoretical knowledge in practical settings. This real-world engagement is crucial in making the education process more meaningful and aligned with the demands of the interior design profession.

Furthermore, the study by Rahayu and Hermansyah [39] underscores the positive influence of PBL on students' overall satisfaction and achievement. Students reported higher levels of satisfaction and a greater sense of accomplishment when PBL methods were applied compared to traditional teaching approaches. The active involvement in real-world problems, small group collaboration, and self-directed learning activities characteristic of PBL made the education process more interactive and collaborative. This alignment with real-world challenges not only enhances engagement but also ensures that the learning experience is directly applicable to the professional practices students will encounter in their careers.

The collective findings affirm that PBL significantly enhances the overall learning experience and engagement of interior design students. By immersing students in real-world challenges, fostering active participation, and promoting collaboration, PBL transforms the learning environment into a more dynamic and meaningful space. This approach not only deepens students' understanding and motivation but also prepares them for the complexities of professional practice, making PBL an invaluable tool in interior design education.

4.3. Skill development

PBL is an effective approach for preparing interior design students to meet industry challenges and expectations by equipping them with essential skills and experiences directly applicable to professional practice. According to Park [40], PBL enhances students' innovation abilities, a critical skill in the creative industries. By engaging in problem-solving tasks that mirror real-world scenarios, students are encouraged to think creatively and develop innovative solutions. These abilities are crucial in the interior design industry, where professionals must often devise creative solutions to complex design problems. PBL's emphasis on student-centered learning and innovation not only enhances students' technical skills but also prepares them to meet the dynamic and evolving demands of the industry, making them more capable and adaptive professionals.

The practical application of PBL in studio environments further prepares students for the realities of the interior design profession. Galford *et al.* [9] emphasize that integrating PBL into interior design studios effectively simulates real-world design problems, allowing students to engage in teamwork, collaboration, and problem-solving. These exercises mirror the dynamics of professional practice, where navigating client needs, working as part of a team, and managing the complexities of design projects are essential skills. Through these realistic design challenges, PBL equips students with the practical knowledge and confidence needed to succeed in their future careers.

Additionally, Zhang and Li [41] highlight that PBL prepares students for industry challenges by immersing them in real-world scenarios through collaboration with successful professionals and companies. This hands-on experience provides students with insights into industry standards and expectations, fostering creativity and teamwork—skills crucial in the design field. By navigating the complexities of professional environments through PBL, students gain industry-relevant skills and a deeper understanding of the demands and dynamics of the interior design profession.

The findings of Asojo and Vo [4] further illustrate how PBL prepares students for industry challenges by engaging them in a practical, seven-week project to design an education wing for a museum. This project provided students with real-world experience by collaborating with a global architecture firm, developing essential collaborative skills through team-based work, and applying problem-solving strategies to complex design problems. Interacting with stakeholders and receiving feedback also helped students understand and meet industry standards and expectations. This comprehensive approach equips students with the practical skills and experiences necessary to thrive in the professional design environment.

With these findings it's crystal clear that PBL prepares interior design students for industry challenges and expectations by fostering innovation, enhancing practical skills, and providing real-world experience through collaboration and problem-solving. By simulating the complexities of professional practice, PBL ensures that students are not only technically proficient but also capable of adapting to the dynamic demands of the interior design industry, making them well-prepared to excel in their careers.

4.4. Curriculum integration

4.4.1. Challenges in implementing PBL in interior design education

Implementing PBL in interior design education presents several challenges that need to be addressed for effective integration into the curriculum. One significant challenge identified by Galford *et al.* [9] is the evaluation process. In PBL settings, students often struggle with assessing their own and their peers' performance, as traditional assessment methods may not fully capture the complexities of problem-solving tasks and collaboration. This highlights the need for clear and effective evaluation criteria that can accurately measure student performance and learning outcomes in PBL environments.

Further challenges are noted by Chan and Blikstein [43], who point out that a lack of mentoring, insufficient planning time, and limited experience with PBL implementation can hinder its effectiveness. These factors can lead to difficulties in integrating PBL into the curriculum, potentially affecting the overall success of the learning approach. Similarly, Wang [44] highlight several issues encountered during the implementation of PBL in the context of teacher education. The study reports that instructors may face challenges when adapting to the facilitator role required in PBL, particularly in guiding student inquiry, managing classroom discussions, and providing constructive feedback. In addition, balancing teaching time with course content and designing meaningful problem scenarios that stimulate in-depth discussion can be difficult during the early stages of implementation. Nevertheless, the findings suggest that with appropriate instructional planning and facilitation, PBL can enhance pre-service teachers' professional knowledge, learning engagement, reflective abilities, and teamwork. These findings underscore the importance of pedagogical preparation and instructional support for educators seeking to implement PBL effectively in higher education settings.

Kumar *et al.* [45] add to this by identifying gaps in the curriculum, particularly in sustainability modules and designers' technical understanding. Without a solid foundation in these areas, students may find it challenging to engage with complex, real-world problems, which are central to PBL. Moreover, external challenges such as the lack of specific legal frameworks and client interest in sustainability can further hinder the practical application of PBL projects in interior design. Asojo and Vo [4] also emphasize the difficulty students face in mastering effective communication, collaboration, and compromise, which are essential skills in PBL but can be challenging to develop.

4.4.2. Best practices in implementing PBL in interior design education

Despite these challenges, several best practices have been identified to enhance the implementation of PBL in interior design education. Galford *et al.* [9] suggest that PBL can be effectively integrated into studio-based learning environments by adapting the model to meet the specific needs of interior design students. This includes the successful planning and execution of PBL sessions, with a focus on developing realistic design problems that align with client needs. The study also emphasizes the importance of fostering teamwork and collaboration among students, which are critical skills for professional practice. By adopting these practices, educators can bridge the gap between academic learning and real-world application, thereby enhancing students' preparedness for their future careers.

Wang [44] further highlight several positive outcomes associated with the implementation of PBL in teacher education. The study notes positive outcomes from the use of critique sessions, which facilitate students' learning progress by providing constructive feedback and opportunities for reflection. These sessions are essential elements in PBL, helping students refine their design skills and problem-solving abilities. Additionally, the study underscores the importance of fostering teamwork and improving communication skills, both of which are crucial for the successful implementation of PBL. By addressing these areas and incorporating structured critique sessions, educators can enhance the effectiveness of PBL in interior design education.

While there are significant challenges in implementing PBL in interior design education, adopting best practices such as clear evaluation criteria, adequate planning, fostering teamwork, and incorporating critique sessions can significantly improve its effectiveness. These practices help bridge the gap between theoretical knowledge and practical application, preparing students to meet the demands of the interior design industry.

4.5. Study implication

The implications of this research on the integration of PBL in interior design education are multifaceted, influencing both educational practices and industry preparedness.

4.5.1. Implications for educators

The research suggests that educators should consider a more systematic integration of PBL into the interior design curriculum. This approach can foster critical thinking, creativity, and practical problem-solving skills among students. To achieve this, courses may need to be redesigned to include more collaborative, project-based assignments that closely mirror the complexities of real-world professional practice. Additionally, traditional assessment methods may fall short in capturing the depth of learning that PBL facilitates. Therefore, educators are encouraged to develop more holistic assessment strategies that evaluate both individual and group contributions, as well as the overall learning process, rather than focusing solely on the final outcome. The study also underscores the importance of involving industry professionals in the educational process. By incorporating real client projects and collaborations with design firms, educators can provide students with valuable insights into industry standards and expectations, effectively bridging the gap between academic theory and professional practice.

4.5.2. Implications for students

For students, engaging in PBL offers a more dynamic and engaging learning experience. The implications are significant, as students who participate in PBL are likely to be better prepared for the challenges of the professional world. They develop critical thinking skills, learn to work collaboratively, and gain the ability to apply theoretical knowledge to real-world situations. Moreover, PBL equips students with essential skills such as teamwork, communication, and problem-solving—qualities that are highly sought after in the interior design industry. This pedagogical approach also enhances their capacity for innovation and adaptability, making them more competitive in the job market and better equipped to navigate the evolving demands of the design industry.

4.5.3. Implications for the interior design industry

The interior design industry stands to benefit significantly from graduates who have been trained through PBL. These students are likely to be more innovative, adaptable, and proficient in team-based work, all of which contribute to the advancement of the field. As they enter the workforce, these graduates bring with them a readiness to tackle the industry's dynamic challenges with creativity and confidence. Furthermore, the research highlights the potential for deeper collaboration between educational institutions and the industry. Such partnerships could yield mutually beneficial outcomes, including the development of new teaching methodologies, the refinement of industry standards, and the continuous enhancement of interior design practices. These collaborations ultimately contribute to the growth and evolution of both educational programs and professional practice in interior design.

4.6. Study limitation

One of the primary limitations of this study is the scarcity of available research on the specific intersection of PBL and interior design education. The limited number of studies on this topic meant that the systematic review was based on just 21 articles. This relatively small sample size may not fully capture the diversity of experiences and outcomes associated with PBL in the context of interior design. Additionally, the narrow scope of available literature may have restricted the study's ability to generalize findings across different educational settings or cultural contexts. Consequently, the conclusions drawn from this review should be interpreted with caution, as they reflect the findings from a limited pool of research. Further studies are needed to explore this area more comprehensively and to validate the findings in a broader range of contexts.

5. CONCLUSION

In interior design education, innovative pedagogy plays a crucial role in shaping how students learn and apply their skills in real-world scenarios. PBL, as an innovative pedagogical approach, has emerged as a transformative method in this field. Through a systematic review, this research highlights the significant impact PBL has on various aspects of interior design education. The findings of 21 articles thoroughly reviewed in this study show that PBL enhances creative and critical thinking skills among interior design students. By engaging students in real-world problem-solving tasks, PBL fosters creativity and higher-order thinking, allowing students to develop innovative solutions that are vital in the design industry. This active learning approach encourages students to think critically, analyze complex problems, and apply their theoretical knowledge in practical settings, making them more adept at tackling industry challenges. PBL has been shown to significantly improve the overall learning experience and engagement of interior design students. The interactive nature of PBL, combined with real-life relevance, creates a dynamic and involved learning environment. Students report higher levels of satisfaction and achievement, as PBL encourages collaboration, teamwork, and active participation, which are essential components of professional practice in interior design.

Moreover, PBL prepares students for the demands and expectations of the interior design industry by providing them with practical, hands-on experience. Through collaboration with professionals, engagement with real-world projects, and exposure to industry standards, PBL equips students with the skills and confidence needed to navigate the complexities of the design profession. This preparation is crucial for students to transition smoothly from academic settings to professional environments.

However, the implementation of PBL in interior design education is not without challenges. Issues such as the complexity of evaluation, lack of mentorship, and inadequate teaching facilities can hinder the effectiveness of PBL. Despite these challenges, best practices, such as adapting PBL to the specific needs of interior design students, fostering teamwork, and incorporating structured critique sessions, have been identified as strategies to overcome these obstacles and enhance the effectiveness of PBL. In conclusion, PBL, as an innovative pedagogical approach, offers significant benefits in interior design education by

bridging the gap between academic learning and professional practice. While it presents certain challenges, its ability to cultivate essential industry skills and enhance student engagement and learning outcomes underscores its value in preparing students for successful careers in the dynamic field of interior design. As educators continue to refine and implement PBL, it will likely play an increasingly vital role in shaping the future of interior design education.

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C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

Fu : Funding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

DATA AVAILABILITY

Data availability is not applicable to this paper as no new data were created or analyzed in this study.

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