ADOPTING PROBLEM-BASED LEARNING FOR BUILDING TECHNOLOGY PROGRAMS IN HIGHER EDUCATIONAL INSTITUTIONS OF DEVELOPING COUNTRIES

Ahmed Jibril Wushishi[1*] and Alhassan Ndagi Usman[2]
[12]Department of Technical Drawing, School of Technical Education, Niger State College of Education, Minna, Nigeria.
[2]Department of Building Technology, School of Technical Education Niger State College of Education, Minna, Nigeria.
E-mail: [1]jibrilushishi@gmail.com & [2]algogogius@gmail.com

Abstract
Problem-based learning has been effectively adopted in many developed countries. In developing countries, however, there are still restraints and challenges to adopting this student-centered instructional approach for Building Technology (BT) programs in many Higher Educational Institutions (HEIs) despite the skill gap. PBL is a student-centered approach that inspires students to study independently and apply their skills in solving real-world problems in an appropriate and realistic context. Few literatures have explored the adoption of PBL in HEIs in developing countries. Therefore, this paper provides an overview of PBL currently in HEIs of developing countries and convincing evidence for its effectiveness in instruction. The paper offers the basis for adopting PBL in BT instruction in HEIs of developing countries. The paper also describes a potential model of implementation, identifies some challenges facilitators may encounter during the application, and provides strategies for effective adoption, including the integration of real-world problems, collaborative group work, and the training of facilitators to guide students appropriately. Additionally, it provides specific recommendations for enhancing the adoption of PBL in HEIs of developing countries. As educational paradigms shift to embrace modern, student-driven methodologies, this analysis highlights the urgent need for HEIs in developing countries to adopt PBL strategies, which can significantly enhance both teaching and learning outcomes, prepare students for complex problem-solving, and ultimately, better equip them to meet societal and labor market demands.
Keywords: Adoption, Problem-Based Learning, Building Technology and Higher Educational Institutions

Introduction

Higher educational institutions (HEIs) in developing countries are immeasurable intellectual organizations. They impart in-depth knowledge and understanding to develop the students' opportunities for lifelong learning, new frontiers of knowledge, and upgrading their knowledge and skills from time to time but based on societal needs (Ogunode et al., 2025). HEIs comprise universities and colleges and various professional institutions that provide teaching and learning, human resource management, financial management, research, and innovation (Adedoyin et al., 2024).

The 4th industrial revolution (4IR) is driving the global economy and associated development including HEIs, which have evolved into technological centers through the delivery of lifelong skills for the future. HEIs invariably affect the understanding, capability, and potential of the educated person (Ogunode et al., 2025). Therefore, the system of delivery at HEIs ought to be modified to deliver services that are 4IR savvy, more importantly; the processes must be 4IR compliance to deliver lifelong skills to building technology undergraduates. The presence of student-centered learning in teaching and learning results in robust collaborative self-directed learning, and learner involvement in learning and content creation results from the influence of student-centered learning in education (Ogunode et al., 2025).

The transformation in teaching and learning now entails teachers leaving traditional approaches and embracing principles of skills-based, guided inquiry learning, and this involves teaching useful and employable skills using their professionalism for the students to implement the skills upon their graduation (Solissa et al., 2024).
PBL has been widely adopted due to its ability to impact students, ' solving, decision-making, and group collaboration skills (Baniyah et al., 2024). PBL stimulates students' interest due to independent learning adopted by the students in deciding and finding solutions to the problem at hand (Pratami et al., 2024).

Furthermore, the independent nature of PBL made it relevant to the different abilities of Building Technology (BT) undergraduates to come up with their thoughts and individual approaches in providing solutions to the given problem through engaging in real-life activities (Baniyah et al., 2024). PBL emphasizes solving real-world problems (Pratami et al., 2024), which is crucial in BT. This approach enables students to apply theoretical knowledge to practical scenarios, making learning more meaningful and relevant to their future careers. PBL develops critical skills (Siswanto et al., 2025), and BT often requires critical thinking, problem-solving, and decision-making skills. PBL fosters these skills by challenging students to analyze complex situations, collaborate with peers, and develop innovative solutions (Solissa et al., 2024). The construction industry relies heavily on teamwork and collaboration among various professionals (Habeeb & Eyupoglu, 2024). PBL encourages group work, allowing students to learn how to communicate effectively and work together to address challenges, skills that are vital in the workplace. Moreover, the PBL helps learners solve complex problems independently within the classes with the help of a lecturer who serves as a facilitator.

Therefore, PBL is anticipated to offer clarifications that will change teaching and learning in HEIs of developing countries.
In developing countries, PBL may be relatively a new actor in the teaching and learning process for HEIs but it plays an important function in developing improved learning and understanding between facilitators and learners via group collaboration within the HEI environment (Habeeb & Eyupoglu, 2024). The focus now is more on a student-centered approach to bringing improvement to learners in a class.

PBL in the Changing Terrain of HEIs
The concept of learning through problem management is not new but the emergence of PBL as an approach started from the works of Barrows, who found out in his research in medical instruction that medical students did not seem to think at all for the most part (Oktaviani & Abdjul, 2024). There has been growing anxiety about HEIs to re-assess and make clear their aims (Habeeb & Eyupoglu, 2024). The move towards a model of HEIs which is receptive to industry demand in the world of work, has increased for greater vocational relevance and this move has brought a closer bond between HEIs and industry (Nwosu et al., 2023). This has fostered changes in curricula generally, in precise the growth of personal skills and potentials for life and work through the development of key skills in HEIs (Lozano et al., 2022). A more distinct student population compared to former years necessitates a broader range of approaches, that will take into cognizance the diversity of student learning requirements and study patterns (Rodriguez-Sanchez et al., 2024). Such demands have made HEIs in developing countries like Nigeria consider PBL to take care of students' requirements (Ogunode et al., 2025).

The adoption of PBL arises from its innovative means of managing curricula problems or initiating improvement to teaching and learning in HEIs for building technology undergraduates (Tan, 2021) on the other hand, it may have been adopted because it offers prospects for life skill development and the call for the end of teacher-student boundaries in terms of knowledge development (Tan, 2021). There seem to be several reasons for the increasing popularity of PBL

while at the same time, there is obvious disdain for it as a stimulus for prompt transition in people's lives. From the foregoing, the adoption of PBL is yet to be realized from the viewpoint of HEIs in developing countries.

PBL is a significant approach to learning, which must be fundamentally placed in HEI curricula compared to what it is presently. Nevertheless, PBL has been misjudged in different ways, which signifies that it has not been accepted as a fundamental approach within the HEIs because, it is an approach that is often misconstrued and this tends to result in wrong views about the prospects for its adoption (Siswanto et al., 2025), and this misunderstanding has resulted in the sarcasm of its significant in terms of preparing students for an intricate and changing skillful life that can be acquired from it to develop student learning pattern (Solano et al., 2023). Learning should be seen as a recurring procedure in which students make modifications from which they acquire an understanding of themselves, and the methods and settings in which they can learn effectively.

Adopting PBL in BT Programs

PBL is in support of every development in the HEIs environment; of most prominent is the teaching and learning. In developing countries like Nigeria, the National Policy on Education necessitates the education sector to develop and standardize quality and obtainable education, training, and research (Nigeria, 2014). However, research has shown that PBL adoption in HEIs in BT programs is still in the early stages in developing countries with literature showing a gap in the adoption of PBL (Solissa et al., 2024). Therefore, there is a need, as a necessity for Nigerian HEIs to adopt PBL to develop desired life-long skills in building technology undergraduates. The educational system in most developing countries has been transformed but innovative requirements are necessary to create a more robust instructional approach for success within their structures and the boundaries that may be required (Ibrahim, 2023).

The current mode of teaching and learning in HEIs in Nigeria often does not facilitate collaborative learning, and students may find it challenging to translate academic knowledge or the theory aspect learned into practical skills required in the workforce (Siswanto et al., 2025). There is a pressing need to adopt Problem-Based Learning (PBL) in these programs, as it shifts the focus to a student-centered approach that encourages independent research, collaboration, and practical problem-solving (Anggraeni et al., 2023). PBL can enhance students' engagement and readiness for the complexities of the construction industry, ultimately bridging the skills gap and aligning education outcomes with labor market demands (Owolabi et al., 2023). Integrating PBL not only promotes deeper understanding but also fosters adaptability and innovation among students.

PBL is essential in allowing transformation from a traditional teaching and learning approach to a more problem-solving learning approach. Learners can study effectively in PBL, and facilitators can also do their job easily. They will have access to all relevant materials that will aid in solving the problem at hand and most essentially, PBL can deliver acceptable instruction for future generations. Building Technology (BT) provides individuals with the necessary skills needed for successful employment or for graduates to become self-employed (Owolabi et al., 2023). However, most BT graduates are found with abstract knowledge, which contributes very little in preparing them for realistic abilities they will meet in their employment industry.

However, the employment requirement of workers has changed drastically because of the changes being witnessed in this 21st century of technology and Artificial Intelligence. To meet these needs, a substitute to the traditional instruction approach should be introduced to BT graduates in developing countries, where teaching and learning delivery is aligned with the workplace and practices in the employment industries (Kissi et al., 2023). Moreover, teacher-centered approaches deprive students of learning because, the features of the 21st-century youths

necessitate action learning, interactivity, and teamwork and are not in line with the traditional base approach (Muhammad, 2021). The need for a shift from the traditional approach to more activity-based approaches is paramount. Consequently, the desire for Nigeria to become among the best-developed nations in the globe and the vision of eliminating poverty and hunger cannot be achieved without a critical development in manpower. Furthermore, one of the challenges in the education sector, most especially in building technology programs, is the desire to go along with the changing needs of the economy and employers, in terms of employability competencies and skills (Datta et al., 2023).

Some gains can be harnessed if PBL is to be adopted in various institutions of developing countries are shown in Table 1.

Table 1: Implication for the Adoption of PBL in the BT Program of HEIs

SN	Theme	Inferences
1	Enhanced Problem-Solving Skills	PBL fosters critical thinking and problem-solving abilities among students. They learn to identify, analyze, and solve real-world problems encountered in building technology
2	Integration of Theory and Practice	PBL facilitates the integration of theoretical knowledge with practical applications. Students engage in hands-on activities, simulations, and real-world projects, bridging the gap between classroom learning and professional practice
3	Promotion of Collaborative Learning	Students work in teams to solve complex problems. This promotes communication skills, teamwork, and the ability to exchange ideas, mirroring real-world collaborative environments in the building technology industry.
4	Student-Centered Learning Environment	PBL shifts the focus from the instructor to the students, empowering them to take ownership of their learning process. They become active participants in their education, driving their inquiry and exploration in building technology concepts
5	Preparation for Professional Practice	By engaging in authentic problem-solving scenarios, students develop skills and competencies directly applicable to their future careers in building technology.
6	Cultivation of Lifelong Learning Skills	Through PBL, students develop a mindset of lifelong learning, as they become adept at seeking information, analyzing problems, and adapting to changing circumstances within the dynamic field of building technology

In this	7	Interdisciplinary Learning Opportunities	Building technology encompasses architecture, construction management, and sustainability. PBL encourages interdisciplinary collaboration, allowing students to explore the connection between different fields and gain holistic perspectives

regard, introducing an active teaching and learning approach like PBL, which is student-centered, becomes vital because of the role PBL plays in aiding student study behavior and effective skills acquisition. A transitional adjustment for many PBL students has been documented in terms of feeling overwhelmed with the outcome of the PBL instructional approach (Jiang et al., 2022). Though a little difficult for an undergraduate who is already used to traditional instruction the students drastically not only improve their study habits by being taught what to do but to actively take charge of determining what needs to be studied (Miliou et al., 2022).

From the foregoing, there is a need for a complete instructional approach of BT undergraduates to a more robust and active student self-directed learning approach like the PBL, which allows students to explore their talents. Moreover, PBL aids in developing students' problem-solving skills, collaborative skills, communication skills, creativity, and critical thinking skills.

Challenges

Collaboration is significant in the PBL curriculum, BT undergraduates will learn best when they interact with their peers compared to working alone but forming a collaborative classroom of PBL is tasking (Hidayati et al., 2023). This must be done to provide a conducive environment for BT undergraduates to interact and express their views.

There is also the problem of adjusting roles, in a collaborative PBL, the lecturer acts as a facilitator and he is responsible for changing or introducing the real-world problem to the groups for a proper solution (Anggraeni et al., 2023). Successful implementation of PBL hangs on the ability of the facilitator to change the way they introduce the real-world problem and manage the class.

Another major challenge is identifying the real-world problem, knowing fully well that PBL classes revolve around authentic problems. To implement PBL class effectively, both the facilitator and students must identify good driving problems that are relevant to students' careers thereby allowing them to develop their investigations.

The last and final challenge is the development of assessment methods and instruments. It is essential to design suitable learning assessment techniques that will tackle both individual and group accountability (Herrera-Pavo, 2021). Herrera-Pavo (2021) asserts that skillful PBL facilitators often develop guidelines in partnership with their students so that students can foster an understanding of their group work and establish standards for quality outcomes.

Strategies for Effective Adoption of PBL in BT

The effective adoption of PBL in BT programs requires thoughtful strategies tailored to the unique challenges faced by HEIs in Nigeria. However, emphasis on training and development for educators can give room for effective implementation (Olugbade, 2025). In this regard, academic staff should be adequately trained in PBL methodologies, and this can be through professional development workshops on how to devise real-world problems relevant to the building technology field. This can enhance the understanding of PBL principles and equip academic staff with the skills necessary to create and facilitate PBL environments. There is also the issue of curriculum integration (Fred).

The existing curriculum should be reviewed and redesigned to incorporate PBL effectively. This can involve identifying key areas where PBL can reinforce theoretical knowledge through practical application. Collaborative efforts in the academic environment can lead to a more cohesive curriculum that emphasizes problem-solving skills.

Another strategy is more resource allocation, this means that adequate resources, including materials and tools, must be provided to support PBL activities. HEIs should ensure access to construction sites, laboratories, and simulation software, which can help in simulating realistic problems that students might face in the building industry. Educators should create an atmosphere where experimentation and innovation are rewarded. This mindset will help students feel more comfortable tackling complex problems and taking ownership of their learning thereby, promoting a growth mindset in the students.

Creating a collaborative learning environment can establish a culture of collaboration among BT students (Owolabi et al., 2023), which is essential for PBL's success. Group projects and peer-led discussions can foster teamwork and enhance collective problem-solving abilities (Fajimi et al., 2024). Encouraging diverse groups facilitates the sharing of varied perspectives, which surely enriches the learning experience. A good implementation of ongoing assessment will ensure that both students and facilitators track progress and address difficulties promptly. Constructive feedback on projects can guide students in refining their approaches and enhance critical thinking skills.

Conclusion

This paper attempts to introduce the adoption of PBL in Building technology programs for more advanced skill acquisition and employable skills. In Building Technology, PBL can offer many advantages over the traditional teaching and learning methods used in HEIs of developing countries. In PBL, students use real-world problems, which serve as motivation during the learning process, identify the basis of the problem, and decisively proffer proper solutions to the problem.

With PBL, students can improve their intellectual ability to think and see the relevant factors related to the problem at hand and discuss and offer meaningful solutions. Students also learn the ability to decide and learn independently, the materials they need, and how to convey their solutions. Finally, employing PBL in the classroom is still tasking for facilitators; it is also essential to empirically assess the efficacy of PBL in Building Technology Programs in HEIs of developing countries.

Recommendations

HEIs should incorporate real-world challenges specific to the building technology field into the curriculum. This will help students understand the practical applications of their knowledge and develop the ability to propose viable solutions to industry-relevant issues.

Encourage collaborative learning by forming diverse student groups for projects. This approach will enhance teamwork skills, expose students to different perspectives, and promote collective problem-solving, which is essential in the construction industry.

Provision of comprehensive training programs for instructors and facilitators on the principles and practices of PBL. This training should equip them with the necessary skills to guide and support students throughout the learning process effectively. A robust system for continuous assessment that incorporates feedback mechanisms should be established. This will help in evaluating students' understanding and progress while also allowing for adjustments in teaching and learning strategies to meet learning objectives better.

References

Adedoyin, O. B., Altinay, F., Gemikonakli, E., Altinay, Z., & Dagli, G. (2024). National Policy on Open Educational Resources for Higher Education in Nigeria: Evaluation of Institutional Compliance Rate to Infrastructure and the Connectivity Goal. *Higher Education Policy*, 1-30.

Anggraeni, D. M., Prahani, B. K., Suprapto, N., Shofiyah, N., & Jatmiko, B. (2023). A systematic review of problem-based learning research in fostering critical thinking skills. *Thinking Skills and Creativity*, *49*, 101334.

Baniyah, B., Subandi, S., & Jaenullah, J. (2024). Application of Problem Base Learning Model Based on Critical Thinking Concepts in Improving Students' Learning Outcomes at SMP Negeri 3 Menggala. *Attractive: Innovative Education Journal*, *6*(1), 399-413.

Datta, S. D., Tayeh, B. A., Hakeem, I. Y., & Abu Aisheh, Y. I. (2023). Benefits and Barriers of Implementing Building Information Modeling Techniques for Sustainable Practices in the Construction Industry—A Comprehensive Review. *Sustainability*, *15*(16), 12466.

Fajimi, B. A., Kester, K. O., & Ukpabi, D. (2024). Issues and Prospects in Continuing Education for Skills Development of Automobile Technicians in Nigeria. *Àgídìgbo: ABUAD Journal of the Humanities*, *12*(2), 645-660.

Fred, R. K. Enhancing Practical Technical Skills in Africa through Bottom-Up Model for TVET-Industrial Revolution Blended with China Technical Progressive Model.

Habeeb, Y. O., & Eyupoglu, S. Z. (2024). Strategic Planning, Transformational Leadership, and Organization Performance: Driving Forces for Sustainability in Higher Education in Nigeria. *Sustainability*, *16*(11), 4348.

Herrera-Pavo, M. Á. (2021). Collaborative learning for virtual higher education. *Learning, culture and social interaction*, *28*, 100437.

Hidayati, N., Zubaidah, S., & Amnah, S. (2023). Effective learning model bases problem-based learning and digital mind maps to improve student's collaboration skills. *International Journal of Evaluation and Research in Education (IJERE)*, *12*(3), 1307-1314.

Ibrahim, M. S. N. (2023). Gender and Diversity in a Problem and Project Based Learning Environment: A Book Review. *Asian Journal of Engineering Education*, *7*(2), 33-36.

Jiang, D., Dahl, B., & Du, X. (2022). A narrative inquiry into developing learner agency of engineering students in an intercultural PBL environment. *European Journal of Engineering Education*, *47*(6), 1103-1121.

Kissi, E., Aigbavboa, C., & Thwala, D. W. (2023). *Emerging Debates in the Construction Industry: The Developing Nations' Perspective*. Taylor & Francis.

Lozano, R., Barreiro-Gen, M., Pietikäinen, J., Gago-Cortes, C., Favi, C., Jimenez Munguia, M. T., Monus, F., Simao, J., Benayas, J., & Desha, C. (2022). Adopting sustainability competency-based education in academic disciplines: Insights from 13 higher education institutions. *Sustainable Development*, *30*(4), 620-635.

Miliou, O., Ioannou, A., Georgiou, Y., Vyrides, I., Xekoukoulotakis, N., WILLERT, S., Andreou, A., ANDREOU, P., Komnitsas, K., & Zaphiris, P. (2022). The Design of a Postgraduate Vocational Training Programme to Enhance Engineering Graduates' Problem-Solving Skills Through PBL. *training*, *11*, 4.

Muhammad, U. I. (2021). *Conceptual framework of project-based learning for woodwork technology education at colleges of education in Nigeria* [Thesis, Universiti Teknologi Malaysia].

National Policy on Education, (2014).

Nwosu, L. I., Bereng, M. C., Segotso, T., & Enebe, N. B. (2023). Fourth Industrial Revolution Tools to Enhance the Growth and Development of Teaching and Learning in Higher Education Institutions: A Systematic Literature Review in South Africa. *Research in Social Sciences and Technology*, *8*(1), 51-62.

Ogunode, N. J., Olabisi, O. S., & Adetayo, O. O. (2025). Energy Crisis in Nigerian Universities: Implication for Effective Planning and Administration for Decision Making to Ensure Sustainable Development of University Education System in Nigeria. *Miasto Przyszłości*, *56*, 85-94.

Oktaviani, I., & Abdjul, T. (2024). The Influence of Problem-Based Learning (PBL) Model on Student Learning Outcomes on the Concept of Measurement. *Jurnal Penelitian Pendidikan IPA*, *10*(8), 4498-4503.

Olugbade, D. (2025). Strategies for Small Business Resilience and Technological Adaptation Towards Embracing Industry 5.0 in Nigeria. In *The Future of Small Business in Industry 5.0* (pp. 247-264). IGI Global Scientific Publishing.

Owolabi, J. D., Ogundipe, K. E., Ogunbayo, B. F., & Aigbavboa, C. O. (2023). Barriers to Attracting and Retaining Female Construction Graduates into Academic Careers in Higher Education Institutions. *Buildings*, *13*(10), 2673.

Pratami, N. H., Putra, A. P., & Arifin, Y. F. (2024). Improving learning outcomes through problem-based learning: A literature review. *Practice of The Science of Teaching Journal: Jurnal Praktisi Pendidikan*, *3*(2), 65-76.

Rodriguez-Sanchez, C., Orellana, R., Fernandez Barbosa, P. R., Borromeo, S., & Vaquero, J. (2024). Insights 4.0: Transformative learning in industrial engineering through problem-based learning and project-based learning. *Computer Applications in Engineering Education*, e22736.

Siswanto, D. H., Kuswantara, H., & Wahyuni, N. (2025). Implementation of problem-based learning approach culturally responsive teaching to enhance engagement and learning outcomes in algebraic function limit material. *EDUCATUM Journal of Science, Mathematics and Technology*, *12*(1), 80-88.

Solano, J., Gutierrez, M. Z., Pinel-Guzmán, E., Henriquez, G., & Henriquez, G. S. (2023). Barriers and solutions to successful problem-based learning delivery in developing countries–a literature review. *Cureus*, *15*(8).

Solissa, J., Blegur, J., & Tlonaen, Z. A. (2024). Problem-based learning and problem-solving model: which is more effective in improving student learning achievement? *Retos: nuevas tendencias en educación física, deporte y recreación*(60), 816-822.

Tan, O.-S. (2021). *Problem-based learning innovation: Using problems to power learning in the 21st century*. Gale Cengage Learning.