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## **Effectiveness of Teaching Methods (Project-Based Learning (PBL) and Inquiry-Based Learning (IBL)) on Student Learning Outcomes among Grade 6 Students**

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### **ABSTRACT**

This study aimed to compare the effectiveness of three teaching methods—Project-Based Learning (PBL) and Inquiry-Based Learning (IBL) on student learning outcomes among Grade 6 students. A comparative research design was employed to assess which method yields better academic performance and engagement. The sample consisted of 30 students from a City District Government School, selected through purposive sampling. Pre-tests and post-tests were administered to evaluate improvements in learning outcomes. The results indicated variations in effectiveness among the methods, with Project-Based Learning showing the highest gains in student understanding and application of knowledge, followed by Inquiry-Based Learning. The findings highlight the potential of active, student-centered approaches to enhance learning, especially when tailored to the needs and contexts of the learners. This study contributes to the growing body of research on innovative pedagogical strategies in public sector schools and provides practical implications for curriculum designers and educators.

### **INTRODUCTION**

The way students learn has undergone significant transformations in recent years. With the advent of new technologies, teaching methodologies, and educational philosophies, educators are now faced with a multitude of choices when it comes to designing instructional strategies. Two prominent learning methods that have gained widespread attention are inquiry-based learning (IBL) and project-based learning (PBL). Each of these methods has its unique strengths and weaknesses, and educators often wonder which approach is most effective in promoting student learning.

Inquiry-based learning has been shown to foster critical thinking, creativity, and problem-solving skills (Huang et al., 2020). Similarly, project-based learning has been found to promote deeper learning, engagement, and collaboration (Wiggins & McTighe, 2020).

Recent studies have also highlighted the importance of considering student-centered approaches, such as IBL and PBL, in promoting student motivation and engagement (Kuh et al., 2020).

Despite the growing body of research on these learning methods, there is a need for further investigation into their relative effectiveness. Which method is most effective in



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promoting student learning? Are there certain contexts or student populations for which one method is more suitable than others? This study aims to address these questions by comparing the effectiveness of IBL and PBL among students. By exploring the strengths and limitations of each approach, this research seeks to provide educators with a more comprehensive understanding of how to design instructional strategies that promote optimal learning outcomes.

### Statement of the Problem

The study is designed to compare the effectiveness of various teaching methods — project-based learning and inquiry-based learning — on student learning outcomes.

### Research Objectives

The primary objective of this research is to compare the effectiveness of Project-Based Learning and Inquiry-Based Learning in enhancing student learning outcomes. The study aims to:

Assess the impact of PBL and IBL on students' academic performance, engagement, and retention.

Identify the strengths and limitations of each teaching method in different learning environments (e.g., elementary, secondary, and higher education).

- Provide evidence-based recommendations on the most effective approach for improving student learning outcomes.

### Research Questions

To achieve the research objectives, the study seeks to answer the following questions:

How do Project-Based Learning (PBL) and Inquiry-Based Learning (IBL) compare in terms of student learning outcomes (academic performance, engagement, and retention)?

Which teaching method demonstrates the highest effectiveness in fostering critical thinking, problem-solving, and knowledge retention?

What are the key challenges and benefits of implementing PBL and IBL in various educational settings?

## LITERATURE REVIEW

Comparing different learning methods among students is essential for understanding how to promote academic achievement, social skills, and emotional intelligence. Research has consistently shown that inquiry-based learning (IBL) and project-based learning (PBL) are effective in improving student learning outcomes (Huang et al., 2020; Wiggins & McTighe, 2020). IBL, for instance, encourages students to explore and investigate real-world problems, promoting critical thinking, creativity, and problem-solving skills. PBL, on the other hand, involves students working on extended projects that require critical thinking, problem-solving, and collaboration.

Moreover, these approaches foster a positive classroom environment, promote social inclusion, and enhance student motivation and engagement (Gillies, 2020; Li, 2022). For example, studies found that IBL and PBL promote deeper learning and engagement among students (Hall et al., 2022). Recent research has also explored the effectiveness of IBL and PBL in promoting critical thinking, problem-solving, and collaboration among students (Chen, 2023; Wang, 2022). This literature review aims to synthesize existing research comparing different learning methods among students, exploring effective strategies, approaches, and interventions implemented between 2020 and 2025.

The review examines the theoretical frameworks and empirical studies that underpin the



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effectiveness of IBL and PBL. It also analyzes recent findings, highlighting the strengths and limitations of each approach. By synthesizing existing research, this review provides insights into the most effective learning methods for promoting academic achievement, social skills, and emotional intelligence among students.

### **Define Inquiry-Based Learning**

Inquiry-based learning (IBL) is a student-centered approach that encourages learners to explore and investigate real-world problems and questions (Huang et al., 2020). IBL fosters critical thinking, creativity, and problem-solving skills by encouraging curiosity-driven learning (Wiggins & McTighe, 2020). This approach provides opportunities for students to ask questions, gather information, and draw conclusions, emphasizing the process of inquiry over the end product (Hall et al., 2022). IBL promotes deeper learning and engagement among students by encouraging them to take ownership of their learning (Chen, 2023). Moreover, IBL helps students develop essential skills such as communication, collaboration, and time management (Li, 2022). Overall, IBL is an effective approach that prepares students for success in the 21st century.

### **Define Project-Based Learning**

Project-Based Learning (PBL) is a dynamic teaching method where students actively engage in real-world, meaningful projects to gain knowledge and skills. This approach focuses on solving complex problems or answering thought-provoking questions, encouraging critical thinking, creativity, and collaboration (Wiggins & McTighe, 2020). By working on a project over an extended period, students develop a deeper understanding of the subject matter and build essential skills like problem-solving, communication, and time management (Hall et al., 2022).

In PBL, students take ownership of their learning, working autonomously or in teams to create a public product or presentation for a real audience. This approach enhances academic achievement while fostering personal growth, creativity, and civic engagement (Chen, 2023). Teachers play a facilitative role, providing guidance, support, and feedback as students navigate the project's challenges and successes (Li, 2022).

Key characteristics of PBL include open-ended issues, connection to classroom knowledge, student-centered learning, and authentic assessment criteria (Wiggins & McTighe, 2020). By incorporating these elements, educators create transformative learning experiences that prepare students for success in the 21st century.

### **Importance**

The importance of learning methods such as Inquiry-Based Learning (IBL) and Project-Based Learning (PBL) among students cannot be overstated. IBL and PBL encourage critical thinking, creativity, and problem-solving skills, essential for success in the 21st century (Huang et al., 2020; Wiggins & McTighe, 2020).

Moreover, PBL promotes collaboration and communication among students. Research found that both IBL and PBL foster student autonomy and motivation (Gillies, 2020). IBL and PBL encourage a love of learning and motivate students to achieve their full potential (Chen, 2023).

The implementation of IBL and PBL also promotes teacher professional development. Teachers develop new skills and knowledge when implementing these methods, ensuring they are equipped to provide high-quality instruction (Wang, 2022).

Research has shown that IBL and PBL can improve academic achievement and reduce the achievement gap, motivating students to learn and reach their full potential (Hall et



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al., 2022).

## Uses of Manipulatives and Visuals

The use of manipulatives and visuals enhances student learning in Inquiry-Based Learning (IBL) and Project-Based Learning (PBL). In IBL, manipulatives and visuals facilitate exploration and discovery, promoting critical thinking and problem-solving skills (Archer-Kuhn et al., 2020). For example, physical models or digital simulations help students investigate complex phenomena and deepen understanding.

In PBL, manipulatives and visuals represent real-world problems and scenarios, making learning authentic and engaging (Tomlinson & Moon, 2020). Diagrams or flowcharts help students visualize and analyze complex systems or processes.

By incorporating manipulatives and visuals, educators create interactive, immersive learning environments that promote engagement, motivation, and understanding.

## Conclusion

In conclusion, the exploration of learning methods such as Inquiry-Based Learning (IBL) and Project-Based Learning (PBL) reveals their potential to enhance student learning outcomes. IBL encourages critical thinking and problem-solving through exploration and discovery (Archer-Kuhn et al., 2020). PBL promotes real-world application and collaboration, developing critical thinking and problem-solving skills (Tomlinson & Moon, 2020). The use of manipulatives, visuals, and diverse representations, along with effective assessment, are essential components of these approaches.

While challenges exist, the benefits of IBL and PBL make them valuable tools for educators seeking to create engaging and inclusive learning environments. Incorporating these methods can promote student engagement, motivation, and understanding, ultimately leading to improved learning outcomes.

## RESEARCH METHOD

The current study aimed to compare the impact of two teaching methods—project-based learning and inquiry-based learning—on the learning outcomes of Grade 6 students. A total of 30 female students from the City District Government Girls School were selected using purposive sampling. The research focused on analyzing how effective each teaching method was in improving student learning, based on their use in real classroom settings where these methods were already being practiced by teachers.

### Research Design:

The study used a comparative research design, which means it evaluated and compared the effectiveness of two different teaching approaches in actual classroom environments. Instead of controlling everything or randomly assigning students, the researcher selected classes where project-based learning (PBL) or inquiry-based learning (IBL) was already being used during a specific period.

### Population of the Study

All Grade 6 students at the City District Government School, Shadman, Lahore, were considered the population for this study.

### Sample of the Study

Data was collected from 30 Grade 6 students at the City District Government School, Shadman, Lahore. These students were chosen using purposive sampling.



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### **Research Procedure**

The study had two phases. First, observations were made before applying each teaching method to note student behavior, engagement, and teamwork. After the teaching methods were used, a post-test was given to measure learning improvements, and students provided feedback about how effective they found each method.

Using the first phase's results, the teaching plans were improved. In the second phase, students were taught again with the refined methods. More observations, post-tests, and reflections were done to check for further improvements. This cycle helped continuously improve the teaching methods and their effectiveness.

The independent variables in this study were the two teaching methods: project-based learning and inquiry-based learning. The dependent variable was student learning outcomes, measured through observations, tests, quizzes, and projects to get a complete view of student achievement.

### **Setting of the Study**

The research was conducted in a government school that serves about 2,000 students from nursery to Grade 10. The student body is diverse, representing various cultures, backgrounds, and socio-economic groups from across the city.

### **Research Instruments**

To compare the two teaching methods (PBL and IBL), pre- and post-observations and a checklist were used as research tools.

### **Technique of Data Collection**

Data was collected using pre-test and post-test checklists along with the teaching interventions

### **Technique of Data Analysis**

Data was analyzed using descriptive statistics (mean, standard deviation) and inferential statistics (Paired Sample t-test).

### **Validity**

To ensure the study's validity, the research was designed to reflect real classroom settings where PBL and IBL were already in use. This made the comparisons realistic and authentic. The research tools, such as observation checklists and assessments, were carefully aligned with the study's goals of measuring student learning outcomes. Experts, including experienced teachers and colleagues, reviewed the tools and procedures to make sure they were accurate and reliable. Their feedback helped refine the instruments to ensure the data truly reflected the impact of the teaching methods on student learning.

### **DATA ANALYSIS**

The data analysis comparing project-based learning and inquiry-based learning shows important findings about how these methods affect student learning. Both teaching methods positively impact academic achievement, engagement, and skill development. Project-based learning leads to higher academic achievement and increased motivation. Inquiry-based learning helps improve critical thinking and problem-solving skills. Overall, these methods offer unique benefits that can improve student learning and engagement. The study used a mixed-methods approach to evaluate the effectiveness of each method.



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### **Pretest Evaluation**

The researcher gave a standard test to measure students' progress, but the results were disappointing. A checklist was created to assess students' skills in two teaching methods: Project-Based Learning and Inquiry-Based Learning.

Even though engaging methods like project-based learning and inquiry-based learning were used, the test scores showed many students struggled to show what they understood. The teacher realized that the test might not have matched the teaching methods well and did not fully reflect students' knowledge and skills. This made the teacher rethink the way they assessed students and consider better ways to measure progress.

Because the pretest results were disappointing, the teacher used different teaching methods to help struggling students. These included project-based learning activities where students worked on real-life projects to learn new skills. For example, students were asked to design and build a model themselves to better understand the topic. The teacher also used inquiry-based learning strategies, encouraging students to explore questions and solve problems on their own. Classroom activities included peer-to-peer learning, the Jigsaw method, and open-ended questions to engage students in active learning.

### **Reflections**

The collection of lesson plans demonstrates a consistent and highly effective use of inquiry-based learning (IBL) and project-based learning (PBL) to teach complex scientific concepts to 6th-grade students. The primary goals across all lessons are to foster active engagement, critical thinking, curiosity, and collaboration.

### **Breakdown by Instructional Focus**

**Inquiry-Based Lessons** (e.g., Cells, States of Matter, Solutions): These lessons excel at sparking curiosity and critical thinking. Students are encouraged to observe, question, hypothesize, and draw conclusions from evidence, effectively building their scientific inquiry skills.

**Project-Based Lessons** (e.g., Solar System, Human Heart, Plant Reproduction): These lessons emphasize collaboration, creativity, and communication. Through group projects that result in a tangible product (model, poster, presentation), students develop problem-solving skills and deepen their understanding through creation and explanation.

### **Consistent Areas for Enhancement**

While the lessons are highly effective, the reflections suggest a few recurring opportunities for enrichment:

#### **Increase Hands-On Experimentation:**

Several reflections suggest moving from observation to active experimentation. Examples include:

Allowing students to plant cuttings themselves (Artificial Propagation)

Incorporating simple diffusion experiments (Particles in Matter)

Using thermometers to measure temperature changes (States of Matter)

Testing variables like temperature on dissolving rates (Solutions)



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### Deepen Real-World Context:

A few suggestions include:

Using case studies or role-playing for digestive disorders.

Inviting health professionals for Q&A sessions

Incorporate Quantitative Skills: Adding simple data collection and measurement (e.g., timing dissolving rates, measuring temperature) could further develop students' scientific skills.

### Conclusion

In summary, this set of lesson plans represents a robust, student-centered science curriculum for 6th graders. The strategic use of IBL and PBL successfully promotes a deep understanding of biological, physical, and astronomical concepts by engaging students as active participants in their learning. The lessons are consistently praised for fostering critical thinking, curiosity, and collaboration, with minor suggestions for adding more hands-on experimentation and real-world connections to make an already strong program even more impactful.

### Posttest

The researcher created a checklist to assess students' skills in two teaching methods: Project-Based Learning and Inquiry-Based Learning. The checklist included indicators such as students' ability to work independently and think critically in project-based learning, and their ability to ask questions and gather evidence in inquiry-based learning. To check students' understanding and creativity, the teacher gave tests that measured their knowledge and creative thinking. The teacher also observed students during different activities and noticed improvements in their problem-solving skills, teamwork, and confidence. This approach helped students learn better and become more enthusiastic about their studies. The teacher could clearly see how well students understood the material and how creatively they applied their learning, showing clear progress.

### Descriptive Analysis

Descriptive analysis is the process of summarizing and explaining the main features of data without making conclusions beyond what the data shows. It helps understand basic characteristics and patterns in the data by presenting it in a simple form (Agresti & Franklin, 2018).

Table 4.1 Descriptive Analysis of Pretest Descriptive Statistics

		Paired Differences				t	df	Sig.	
		Mea	Std.	Std.	95%			(2-	
		n	Deviation	Error	Confidence			tailed	
			n	Mean	Interval of the			)	
				n	Difference				
					Lower	Upper			
					r	r			
Pai	PBL pre	-	.503	.112	-.835	-.365	-	1	.000
r 1	assessment	.600					5.33	9	
	checklist						9		
	- PBL								
	post								
	assessment								



	nt checklist									
Pair 2	IBL pre-assessment nt checklist - IBL post assessment nt checklist	-	.605	.135	-.733	-.167	-	1 3.32 7	9	.004

The paired samples t-test results showed significant improvements in student scores from before to after the teaching methods: Project-Based Learning (PBL) and Inquiry-Based Learning (IBL). The mean differences were negative, indicating improvements. PBL showed a mean difference of -0.600, and IBL showed -0.450. These results were statistically significant, with p-values less than 0.05 (PBL: 0.000, IBL: 0.004). The 95% confidence intervals also supported these improvements. Overall, the findings suggest that both PBL and IBL effectively enhanced student learning outcomes, with significant gains in student skills and knowledge.

**Pretest and Posttest**

**Table 4.2 Demographic Information**

Paired Samples Statistics						
		Mean	N	Std. Deviation	Std. Error Mean	Error
Pair 1	PBL pre-assessment checklist	.25	20	.444	.099	
	PBL post assessment checklist	.85	20	.366	.082	
Pair 2	IBL pre-assessment checklist	.40	20	.503	.112	
	IBL post assessment checklist	.85	20	.366	.082	

The paired samples statistics show significant improvement in student scores for both teaching methods. For PBL, the mean score increased from 0.25 to 0.85, and for IBL, it increased from 0.40 to 0.85. These substantial gains indicate that students benefited greatly from both teaching approaches, proving their effectiveness in improving learning outcomes.

**Summary**

This study compared the effectiveness of two teaching methods — project-based learning (PBL) and inquiry-based learning (IBL) — on Grade 6 students at City District Government Girls School, Shadman, Lahore. Thirty female students were chosen to take



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part.

The study had two main parts. First, pre-tests and classroom observations were done to understand students' starting points in engagement, teamwork, and thinking skills. Then, teachers used either PBL or IBL in their classrooms. Afterward, post-tests, observations, and student feedback measured how much students learned and how well each method worked. Based on these results, teaching plans were improved, and the methods were used again in the second phase, followed by more assessments.

Data was collected through tests, quizzes, projects, and teacher observations. Both simple averages and statistical tests were used to compare student learning outcomes under each teaching method.

### Findings

From the analysis and observations, these important results came out:

**Project-Based Learning (PBL):** Students involved in hands-on projects improved a lot in critical thinking, working together, and solving problems. Working on real-world tasks made them more motivated and helped them understand topics better.

**Inquiry-Based Learning (IBL):** This method encouraged students to be curious and think independently. Students learned to ask questions, explore ideas, and come to conclusions on their own. Classrooms using IBL showed high student interest and deeper understanding.

When comparing the two methods, both helped improve learning but in different ways. PBL was best for teamwork and practical problem-solving, while IBL was better at developing curiosity and inquiry skills.

Teachers noticed positive changes with both methods, such as more student participation, better understanding, and improved cooperation.

### Conclusion

The study concluded that both project-based learning and inquiry-based learning are effective ways to improve learning outcomes for Grade 6 students in a government school setting. Each method helps students develop different skills:

PBL enhances collaboration and practical skills.

IBL promotes curiosity and critical thinking.

The results suggest that teachers should consider using a mix of different teaching approaches rather than relying on just one. This will help meet different student learning needs and support overall success.

### REFERENCES

- Alghamdi, A. K. H. (2021). Inquiry-based learning in science education: A meta-analysis. *International Journal of Instruction*, 14(1), 1–16.
- Anderson, J. R. (2021). *Cognitive psychology and its implications* (9th ed.). Worth Publishers.
- Anderson, R. D. (2020). Reforming science teaching: What research says about inquiry. *Journal of Science Teacher Education*, 31(2), 123–139.
- Anderson, L. W., & Krathwohl, D. R. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.
- Barrows, H. S. (1996). Problem-based learning in medicine and beyond: A brief overview. *New Directions for Teaching and Learning*, 1996(68), 3–12.



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- Barron, B., & Darling-Hammond, L. (2021). Teaching for meaningful learning: A review of research on inquiry-based and project-based learning. *EduTopia*.
- Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. *The Clearing House*, 83(2), 39–43.
- Bell, T., Urhahne, D., Schanze, S., & Ploetzner, R. (2010). Collaborative inquiry learning: Models, tools, and challenges. *International Journal of Science Education*, 32(3), 349–377.
- Belland, B. R., Kim, C., & Hannafin, M. J. (2020). A framework for designing scaffolds that improve motivation and cognition. *Educational Psychologist*, 55(3), 145–161.
- Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist*, 26(3–4), 369–398.
- Boaler, J. (2020). *Mathematical mindsets: Unleashing students' potential through creative math, inspiring messages and innovative teaching*. Jossey-Bass.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school (Expanded ed.)*. National Academy Press.
- Brush, T., & Saye, J. W. (2008). The effects of multimedia-supported problem-based inquiry on student engagement, empathy, and assumptions about history. *The Interdisciplinary Journal of Problem-Based Learning*, 2(1), 21–56.
- Carolan, J., & Guinn, A. (2007). Differentiation: Lessons from master teachers. *Educational Leadership*, 64(5), 44–47.
- Chen, X., & Yang, Y. (2023). The effectiveness of collaborative problem solving in promoting students' critical thinking: A meta-analysis. *Humanities and Social Sciences Communications*, 10, Article 15.
- Chichekian, T., & Shore, B. M. (2016). Cognitive characteristics of inquiry-based teaching: A literature review. *Teaching and Teacher Education*, 61, 368–381.
- Colley, K. M. (2008). Project-based science instruction: A primer. *The Science Teacher*, 75(8), 23–28.
- Darling-Hammond, L., & Cook-Harvey, C. M. (2018). *Educating the whole child: Improving school climate to support student success*. Learning Policy Institute.
- Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, 24(2), 97–140.
- De Jong, T. (2006). Scaffolds for computer simulation-based scientific discovery learning. *Journal of Computer Assisted Learning*, 22(2), 111–119.
- Doppelt, Y. (2003). Implementation and assessment of project-based learning in a flexible environment. *International Journal of Technology and Design Education*, 13(3), 255–272.
- Eick, C. J., & Reed, C. J. (2002). What makes an inquiry-oriented science teacher? *Science Education*, 86(3), 401–416.
- Ertmer, P. A., & Simons, K. D. (2006). Jumping the PBL implementation hurdle: Supporting the efforts of K–12 teachers. *Interdisciplinary Journal of Problem-Based Learning*, 1(1), 40–54.
- Furtak, E. M., Seidel, T., Iverson, H., & Briggs, D. C. (2012). Experimental and quasi-experimental studies of inquiry-based science teaching: A meta-analysis. *Review of Educational Research*, 82(3), 300–329.
- Gallagher, S. A., & Gallagher, J. J. (2013). Using problem-based learning to explore unseen academic potential. *Interdisciplinary Journal of Problem-Based Learning*,



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7(1), 111–131.

- Gillies, R. M. (2020). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education*, 45(3), 39–54.
- Goodnough, K. (2006). Enhancing pedagogical content knowledge through self-study: An exploration of problem-based learning. *Teaching in Higher Education*, 11(3), 301–318.
- Hattie, J., & Yates, G. (2020). *Visible learning and the science of how we learn*. Routledge.
- Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review*, 16(3), 235–266.
- Huang, Y., Shih, Y., & Yang, C. (2020). Effects of inquiry-based learning on students' critical thinking and creativity in science education. *Asian-Pacific Journal of Second and Foreign Language Education*, 5(9).
- Krajcik, J. S., & Blumenfeld, P. C. (2006). Project-based learning. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 317–334). Cambridge University Press.
- Kuh, G. D. (2020). Student engagement: Foundational to student learning and success [Webinar presentation]. Student Opportunity Center.
- Larmer, J., & Mergendoller, J. R. (2015). *Gold standard PBL: Essential project design elements*. Buck Institute for Education.
- Levy, P., & Petruilis, R. (2012). How do first-year university students experience inquiry and research? *Studies in Higher Education*, 37(1), 85–101.
- McTighe, J., & Seif, E. (2021). *Teaching for deeper learning: Tools to engage students in meaning making*. ASCD.
- Pedaste, M., Mäeots, M., Siiman, L. A., de Jong, T., van Riesen, S. A. N., Kamp, E. T., ... & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review*, 14, 47–61.
- Prince, M. J., & Felder, R. M. (2020). Inductive teaching and learning methods: Definitions, comparisons, and research bases. *Journal of Engineering Education*, 95(2), 123–138.
- Strobel, J., & van Barneveld, A. (2009). When is PBL more effective? A meta-synthesis of meta-analyses. *Interdisciplinary Journal of Problem-Based Learning*, 3(1), 44–58.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Wang, Y. (2022). Enhancing student engagement and achievement through inquiry-based and project-based learning in STEM education. *International Journal of STEM Education*, 9(1), 1–15.
- Wiggins, G., & McTighe, J. (2020). *Understanding by design (Expanded 2nd ed.)*. ASCD.
- Willis, J. (2007). The neuroscience of joyful education. *Educational Leadership*, 64(9), 80–85.
- Zohar, A., & Dori, Y. J. (2003). Higher order thinking skills and low-achieving students: Are they mutually exclusive? *The Journal of the Learning Sciences*, 12(2), 145–181.