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The Importance of Real-World Situation in Enhancing Students' Thinking Skills.

Dissertation Submitted to the Department of English in Partial Fulfilment of the Requirements for the Degree of Master in English *Didactics.*

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Declaration of Authenticity

We declare that this research study entitled “The Importance of Real-World Situations in Enhancing Students' Thinking Skills”, supervised by Ms. Samira Boussaha in the academic year (2024- 2025), and submitted to the department of English at Chadli Bendjedid University, El-Tarf, Candidates for the Master's degree, has not been published before. Except for the quotations and definitions from various sources that are clearly stated, this dissertation was written entirely in our own style and words. We know that plagiarism is unethical and forbidden. We accept complete responsibility for our work.

Signatures :

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Dedication

"By Nadjette Draidi"

This earnest endeavor is proudly dedicated to the loving memory of my mother "Houria" whose unwavering love and wisdom taught me that even the darkest nights hold stars, and that no mountain is too high to climb. I believed her and hold every word very tightly; she also taught me that anything could be accomplished through hard work**.** Mom was a hard worker herself, instilling in me the importance of a strong work ethic and perseverance. She has been a great role model and example for me.

Forever in my heart.

Acknowledgement

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Abstract

This dissertation examined the role of real-world situations in enhancing thinking skills among middle school students through project-based learning (PBL). Using a mixed-methods approach, the study included student activities, questionnaires, survey and classroom observations over a five-week period. Results indicated that PBL significantly enhanced critical thinking, problem-solving, and creativity among students, aligning with theories of learning by Lewey, Dewey, Piaget Kolb, and Vygotsky. However, challenges such as time constraints and student engagement were identified. To address these them, it is recommended to offer workshops to enhance teachers' PBL skills, including assessing thinking skills and using reflective journals; to develop strategies for better time management, such as streamlined planning and engagement techniques; to improve access to resources and materials for PBL activities and to incorporate structured reflection phases to foster metacognitive skills and ensure all students have access to real-world learning experiences, regardless of their school's resources or location. By prioritizing scaffolding, reflection, and equity, educators can cultivate the thinkers and problem-solvers needed for the 21st century. Future research should explore the application of PBL in diverse cultural contexts and address the emotional and motivational factors that influence learning in real-world situations.

Keywords: Project-Based Learning (PBL), Critical Thinking, Metacognitive Skills, Equity in Education and Reflective Journals

List of Abbreviations

- AC: Abstract Conceptualization
- AE: Active Experimentation
- Bloom’s Taxonomy: Revised Bloom's Taxonomy of Educational Objectives
- CE: Concrete Experience
- DK: David Kolb
- HOTS: Higher-Order Thinking Skills
- JD: John Dewey
- JP: Jean Piaget
- LV: Lev Vygotsky
- LW: Kurt Lewin
- MS: Middle School
- PBL: Project-Based Learning
- Q: Questionnaire
- RO: Reflective Observation
- SG: Sub-group
- SG1, SG2, SG3: Sub-groups 1, 2, and 3
- ZPD: Zone of Proximal Development

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General Introduction

1. Background and Context

In the rapidly changing landscape of the 21st century, the Algerian education systems are facing increasing pressure to prepare students for complex, real-world challenges. In both academic and professional settings, the ability to think critically, solve problems creatively, and adapt to new situations has become essential for success (Trilling & Fadel, 2009).

Despite this growing demand, many traditional educational systems continue to be based on abstract theory and rote memorization, which frequently fails to bridge the gap between classroom learning and practical application. Teachers still keep to these methods of teaching and do not encourage their students to achieve their full potential (Misra, 2018). They are simply expected to memorize and recite facts, theories, and concepts as accurately as possible.

Consequently, this leads educators to consider carefully how to equip students with the ability to break free from rigid patterns of thinking and embrace this innovative mindset. Research suggests that fostering such skills is not merely advantageous but essential for preparing students to navigate an ever-evolving global landscape (Trilling & Fadel, 2009).

Real-world situations are authentic, contextually relevant scenarios that mirror challenges encountered outside the classroom. They have emerged as a promising avenue for fostering higher-order thinking skills (HOTS) such as analysis, evaluation, and synthesis (Kolb, 2015).

Research suggests that when students engage in tasks grounded in real-world contexts, they demonstrate improved cognitive engagement, motivation, and the ability to transfer knowledge across domains (Hmelo-Silver, 2004). For example, project-based learning (PBL)

initiatives have been shown to enhance students' problem-solving abilities by requiring them to apply theoretical concepts to tangible, real-life issues (Thomas, 2000). This approach not only makes learning more relevant and meaningful but also prepares students to thrive in a dynamic and interconnected world.

2. Problem Statement

Despite the recognized importance of thinking skills, the Algerian education system still relies on traditional teacher -centred approaches that emphasize memorization rather than application. This disconnects between classroom learning and real-world application limits students' ability to develop critical and creative thinking skills. As a result, students often struggle to transfer their knowledge to new situations or address complex real-life problems. There is a growing need to explore how to effectively integrate realistic scenarios into education to bridge this gap.

3. Purpose of the Study

The main objectives of this study are:

1. To examine the role of realistic scenarios in enhancing students' critical and creative thinking skills.

2. To identify effective strategies for integrating realistic scenarios into the curriculum.

3. To explore the challenges teachers face in implementing realistic scenario-based learning experiences.

4. Research Questions

This dissertation seeks to address these concerns by examining the role of real-world situations in fostering students' thinking skills. Specifically, it aims to answer the following research questions:

1. How do authentic learning tasks influence students' critical thinking abilities?

2.What are the benefits and challenges associated with integrating realistic scenarios into classroom instruction?

3. What strategies can teachers use to effectively integrate realistic scenarios into their teaching practices?

5. Hypothesis

This study hypothesizes that:

1."Implementing project-based learning (PBL) activities that incorporate real-world scenarios will lead to a significant improvement in students' problem-solving skills compared to traditional lecture-based instruction."

This hypothesis is based on the findings that PBL enhances problem-solving abilities (Thomas, 2000) and the theoretical framework of experiential learning (Kolb, 2015), which suggests that engaging in real-world tasks fosters deeper cognitive engagement and practical skill development.

2."Teachers who receive professional development focused on integrating realistic scenarios into their teaching practices will experience fewer challenges in implementing those scenarios and report higher levels of student engagement and learning outcomes."

This hypothesis is derived from the recommendation for professional development workshops and the identification of time constraints and student engagement as main challenges (as discussed in the dissertation). It predicts that targeted training will improve teachers' ability to implement PBL effectively.

3."Incorporating structured reflection phases into project-based learning activities will lead to increased metacognitive skills and self-assessment among students, as compared to PBL activities without reflection."

This hypothesis is based on the recommendation to integrate structured reflection phases and the theoretical underpinnings of metacognition in Kolb's experiential learning theory (Kolb, 2015). It predicts that reflection will enhance students' ability to think about their own learning processes and improve their self-assessment skills.

6. Significance

By addressing these questions, this study contributes to the growing body of literature on experiential and competency-based education.

The dissertation highlights the importance of real-world situations in enhancing students' thinking by bridging theory and practice, fostering critical thinking, promoting lifelong learning, boosting motivation, preparing students for careers, cultivating empathy, supporting diverse learning styles, encouraging interdisciplinary learning, aligning with global trends, and contributing to educational research and policy.

This study adds to the expanding field of research on experiential and competency-based education. The findings can inform curriculum design that better prepares students for the demands of the 21st century. Additionally, the study contributes to the broader debate on education reform by providing evidence-based insights into the benefits and challenges of authentic situation-based learning.

It serves as a call to action for educators and policymakers to prioritize real-world learning as a cornerstone of modern education.

7-Limitations

Despite the efforts to design a robust study, several limitations should be acknowledged. First, the relatively small sample size and the specific geographical and

cultural context of the study may limit the generalizability of the findings. The results may not accurately reflect the experiences of students and teachers in other educational settings or cultures. Researchers and educators should exercise caution when applying these findings to diverse populations or contexts. Second, the study is conducted in a specific geographical and cultural setting, which may introduce contextual biases that affect the transferability of the results to other regions. Third, the reliance on self-reported data introduces the possibility of response biases, such as social desirability bias. Participants may have provided answers they believe are socially acceptable rather than their true opinions or experiences. This could lead to an overestimation or underestimation of the impact of realistic scenarios on thinking skills. Finally, the study employs a cross-sectional design, The cross-sectional design of the study precludes the establishment of causal relationships. While the study can identify associations between the implementation of realistic scenarios and thinking skills, it cannot definitively conclude that the scenarios cause the observed improvements. Longitudinal studies with experimental or quasi-experimental designs would be necessary to more confidently establish causality which precludes the establishment of causal relationships between the implementation of realistic scenarios and the enhancement of thinking skills.

8-Structure of the Study

The study is structured into three main sections which ensures a comprehensive exploration of the research topic, beginning with a thorough theoretical foundation, followed by a rigorous empirical investigation, and concluding with a thoughtful discussion of the implications and future directions for research and practice.

Descriptive Theoretical Portion:

The descriptive theoretical portion of this study is divided into two chapters that provide a comprehensive review of relevant literature and establish a solid theoretical foundation. Chapter 1, the Literature Review, delves into the background and context of 21st-century

skills and the challenges faced by the Algerian education system. It examines theoretical frameworks such as Kolb's Experiential Learning Theory (2015) and reviews existing research on project-based learning (PBL) and its impact on critical and creative thinking skills. The chapter also discusses the challenges and strategies associated with integrating realistic scenarios into classroom instruction. Chapter 2, the Conceptual Framework and Research Questions, articulates the detailed conceptual framework guiding the study, presents the research questions and hypotheses, and operationalizes the key concepts and variables. This chapter justifies the chosen methodology and demonstrates its alignment with the research objectives, setting the stage for the subsequent empirical analysis.

Empirical Section:

The empirical section of this study consists of one chapter focused on analysing both quantitative and qualitative responses, along with discussions of findings from the data collected. Chapter 3, Methodology, describes the mixed-methods research design, participant selection, and sample characteristics. It outlines the data collection methods, including surveys, interviews, and observational studies, and details the data analysis techniques, such as quantitative statistical analysis and thematic analysis of qualitative data. Chapter 4, Results and Findings, presents and analyses the quantitative data, including descriptive statistics and inferential tests that address the research questions. It also provides a thematic analysis of the qualitative data, highlighting key themes and patterns emerging from participant responses. The integration of quantitative and qualitative findings offers a comprehensive understanding of the impact of realistic scenarios on thinking skills, providing robust evidence to support the study's conclusions.

Discussion and Conclusion:

The final section of this study, the Discussion and Conclusion, comprises two chapters that synthesize the findings and provide a thoughtful analysis of their implications. Chapter 5,

Discussion, interprets the findings in the context of the existing literature and theoretical frameworks, addressing the research questions and hypotheses. It discusses the implications of the findings for educational practice and policy, while also acknowledging the limitations of the study and suggesting areas for future research. Chapter 6, Conclusion, summarizes the main findings and their significance, reflecting on the contributions of the study to the field of education. It offers practical recommendations for educators and policymakers based on the study's outcomes, providing a clear and actionable path forward for improving educational practices through the integration of realistic scenarios.

Chapter one:
Literature Review

Introduction:

This chapter critically examines the learning theories (experiential learning, constructivism) and empirical evidence underpinning the role of real-world contexts in enhancing critical thinking, problem-solving, creativity, and decision-making. It synthesizes key contributions from Dewey, Kolb, Piaget, Vygotsky, and contemporary research on pedagogies like project-based learning and simulations. The analysis establishes how authentic experiences drive deeper cognitive engagement and skill development, while acknowledging inherent limitations and gaps in the current literature.

1.1. Theories of learning

1.1.1. Experiential learning

George is a 9-year-old child. He spots a lighter on a table and attempts to play with it. A hint of fire comes out and touches his finger. He feels the pain and learns that fire is dangerous, and that lighters are not meant to be played with. This incident or experience teaches him something.

It makes him know more about fire safety than any lecture or warning could have (Structural learning, n.d.).

George's experience with the lighter is an example of experiential learning, a process through which knowledge is created through direct action upon experiences, and not passive learning (Structural learning, n.d.).

Experiential learning is learning from experience. We know because we have experienced an event, situation, feeling or incident. It is based on the idea that the best way to know something is to go through the experience. These events or situations assist us in creating the concept and recalling it for extended periods. Whatever, whether a child learning to stay away from fires or a student learning physics through experiments, this method claims that lived

experiences such as feelings, accidents, or incidents plant concepts in the mind much more powerfully than abstractions. By putting students in actual situations, experiential learning puts abstract ideas into concrete teaching, allowing for better retention and practical knowledge.

Experiential learning shows that people learn more effectively when they engage, reflect, and apply knowledge in real-world situations. Benjamin Franklin's saying, "Tell me and I forget, teach me and I may remember, involve me and I learn," conforms to David Kolb's Experiential Learning Theory (1984) which states that learning happens from a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984).

Experiential learning is an educational philosophy that accounts for "learning from experience or learning by doing. Experiential education initially immerses the learner in an experience and then encourages reflection on the experience in an attempt to build new skills, new attitudes, or new ways of thinking. (Lewis & Williams, 1994). It places the students in the midst of the experience, their direct exposure to the world around them promotes the acquisition of knowledge, skills, and values. This 'learning by doing approach invites them to participate in an experience, then reflect about it in an attempt to acquire new knowledge or skills It allows them to link theory and practice in a rich and dynamic way. Experiential learning 'Activity' can range from one person describing a principle or performing a very simple task to very sophisticated group interactions involving a broad array of mental qualities and behaviours.

Exercises such as field trips, simulation, role play and community service exercises do not simply offer experiential, hands-on education but also challenge the imagination, develop decision-making abilities, and establish critical thinking skills. A 2025 report from Lindsey Seril (Article from a blogger) shows that Students in active learning environments score 6% higher on average on examinations, reflecting higher understanding and critical thinking. It

shows that grade on a course is improved by half of one letter grade on average using active learning strategies (Seril, 2025).

Research indicates that active learning activities (e.g., rehearsal, teaching others, simulations) results in greater retention and learning gain than passive activities (e.g., lectures, reading), but the specific percentages depend on the person and context. Below is a more honest model of learning retention based on educational psychology which distinguish between active and passive approaches of learning.

Learning Method	**Retention Effectiveness**	**Key Sources**
Passive Methods		
- Reading textbooks	Low	Hattie (2008)
- Listening to lectures	Low	Freeman et al. (2014)
- Watching videos/demos	Moderate	Mayer (2009)
Active Methods		
- Participating in discussions	Moderate-High	Prince (2004)
- Practice by doing (e.g., simulations, labs)	High	Kolb (1984)
- Teaching others/real-world application	Very High	Fink (2003), Nestojko et al. (2014)

Table1: Evidence-Based Learning Retention Framework

*(Inspired by Edgar Dale's " Kolb's Experiential Learning Theory and Cone of Experience") (*1946, Chapter 4**,** pp. 37-52).

Dale's Cone of experience dictates learning techniques from abstract (reading) to concrete (first-hand experience) shows that concrete experience in active participatory

techniques like doing and simulation triggers more retention than through passive modes. (Dale, 1946).He regards retention of learning as heightened in cyclical phases of concrete experience, reflection, abstract conceptualization, and active experimentation. Kolb, D. A. (1984). Experiential Learning: Experience as the Source of Learning and Development.

In addition, to reinforce active learning 's value, Freeman et al. (2014) performed a meta-analysis of 225 experiments and discovered that active learning strategies boost exam scores by 6% and cut failure rates by 55% in comparison with passive lectures. Freeman, S. et al. (2014). Active learning increases student performance in science, engineering, and mathematics. PNAS.

Nestojko et al. (2014) further states that instructing others or planning to instruct increases retention as well as comprehension. Nestojko, J. F. et al. (2014). Expecting to teach enhances learning and organization of knowledge in free recall of text passages." Memory & Cognition.".

Mayer's Multimedia Learning theory (2009) names that the integration of the visual and narration like videos, boosts retention compared to using just text, but active processing is superior in the learning process. Mayer, R. E. (2009). Multimedia Learning.

We have all learned to walk or talk, not by being shown or told, but by practising and refining our technique. Consequently, trainers and facilitators can implement this method in all sorts of situations with people from all walks of life (“Experiential Learning”, n.d.). Experiential learning suggests that ideas are not fixed; rather, they form and re-form through experience

developing skills and behaviours to handle various situations and the ability to apply this knowledge.

Thus, the main principle of experiential learning is the focus on the learning process rather than outcomes. Learning is therefore an evolving process with the learner at the centre

of this process. Learning is based on where the participant is, their relationship with what has happened previously, and where they want to be in the future. The process of learning is grounded in experience. As a result, education involves refining and modifying old ideas as well as implanting new ones, and experience is the vehicle through which this process can take place. Implementing, testing, evaluating and refining ideas exclusively with reference to familiar experiences does not present an opportunity for learning, because experience must violate expectation to hold value.

Learning is a transactional process which occurs when there is an interaction between the learners and their environment and thus the learners gain a large applicable knowledge when they refine and test theories rather than just memorize them. This knowledge acts as a foundation for further growth and problem-solving., When the learners face new but familiar situations.

1.1.1.1. Kurt Lewin (1890-1947):

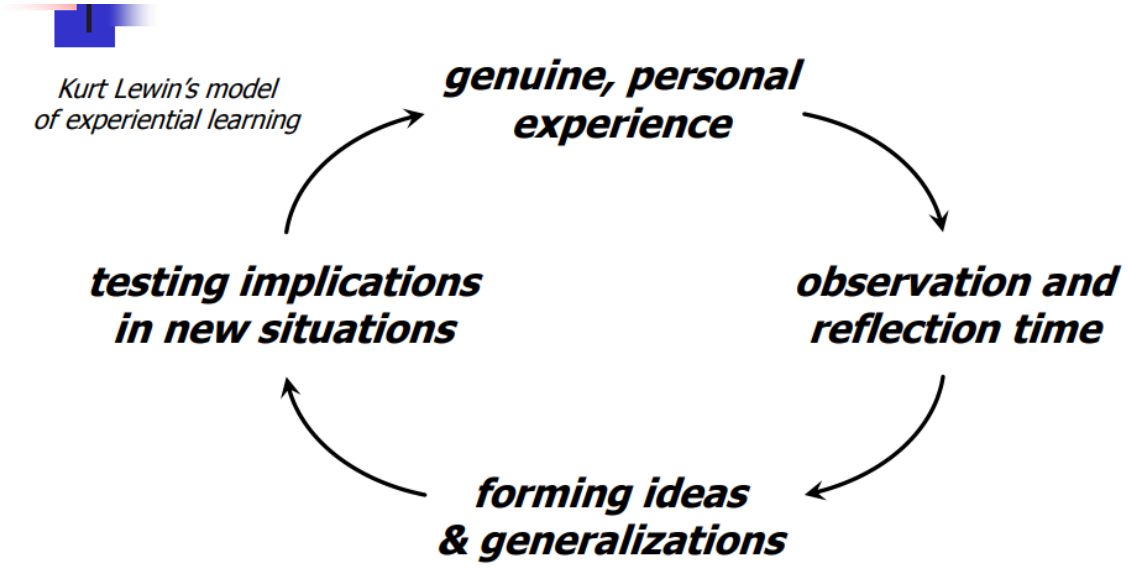


Figure 2: The Learning Circle of Experience.

For Lewin, experiences are vivid and tangible and serve as public references that encourage collective engagement. This facilitates social learning, problem-solving, and continuous feedback where consequences are evaluated (Structural Learning, n.d.). Lack of feedback from educators and peers can interrupt the learning cycle and leads to its ineffectiveness and thus causing the cycle to stop from repeating properly. This Inefficacy may be the result of focusing on action and decision at the expense of information gathering, or being focused in data collection and analysis. Social learning and problem-solving enabled through this structure result in ongoing goal-oriented feedback where consequences are taken into account.

1.1.1.2. John Dewey (1859-1952):

John Dewey, a renowned American philosopher, psychologist, educational reformer and one of the leading proponents of the school of thought known as pragmatism , is the pioneer of experiential education. He emphasised the importance of learning through experience and reflection.

Dewey view of learning is similar to that of Lewin but with a little bit difference. It emphasizes the importance of feedback while passing through the cycle.

For Dewey Learning moves from spontaneous to intentional and not in cycles.

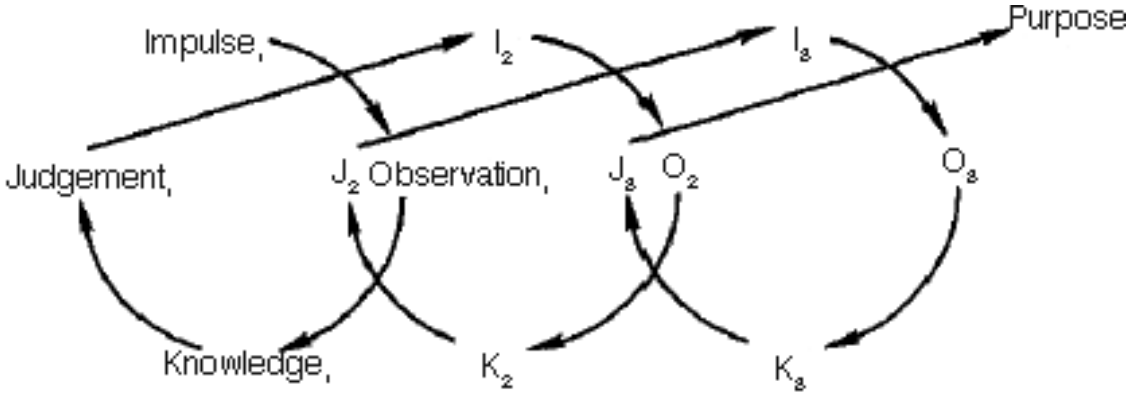


Figure 3: Dewey ‘s Model of Experiential Learning
(adapted from Dewey, 1938, pp. 25–26).

According to him, learning is a journey where each stage of the journey still consists of four steps: impulse, observation, knowledge, and judgement. Each step progresses as the judgement and knowledge is contextualised and used to refine future impulses. The actions arising from these impulses then become more sophisticated at each step, until they become purposeful (Experiential Learning.org, n.d.).

Dewey argues that meaningful learning happens when students engage actively with their environment and use their knowledge in real-world contexts. Dewey's stresses the importance of experiential learning and the role of real-world situations in enhancing critical thinking, problem-solving, creativity, and decision-making (Dewey, 1938). He explains that in order to be meaningful and effective, learning must be linked to real-life experiences which means that we can learn best by actively engaging with the material rather than passively listening to lectures or memorizing facts.

He also critiques traditional education as being too abstract and disconnected from students' lives (Sawyer, 2018, pp. *26*(2), 26–53). For him, educational experiences are important in shaping future learning and decision-making abilities. He argues that "Education is not preparation for life; education is life itself" (Dewey, 1916, p. 89) .It is not only restricted to gain theoretical knowledge but also get practical experience Education is all about integrating knowledge with life and teaching practical thinking skills.

This view of education ensures that students have meaningful experiences which contribute to their growth as learners.

Dewey insisted on the fact of engaging students in active problem-solving instead of passively absorbing information: "There is no such thing as genuine knowledge and fruitful understanding except as the offspring of doing... To 'learn from experience' is to make a backward and forward connection between what we do to things and what we enjoy or suffer

from things in consequence" (Dewey, 1938, p. 42). He remarked how critical thinking and problem-solving arise naturally when learners actively engage with real-world challenges and reflect on the consequences of their actions.

Dewey also discusses the need for education to foster creativity and adaptability, which are essential for decision-making. According to him, when students face real-world difficulties, this will urge them to use their intelligence and creativity to find solutions, and thus enhancing decision-making abilities. He points "Growth depends upon the presence of difficulty to be overcome by the exercise of intelligence" (Dewey, 1938, p. 42).

For Dewey, learning should happen inside meaningful contexts to be engaging and transferable; by putting learning in authentic, real-world contexts, educators can help students see the relevance of their studies and apply their knowledge flexibly across situations. He points: "The business of education might be defined as an emancipation and enlargement of experience" (Dewey, 1938, p. 30). His emphasis on active engagement, reflection, and real-world application provides a strong theoretical foundation for these skills.

1.1.1.3. David A. Kolb (1939)

Influenced by Jean Piaget, Kurt Lewin, and John Dewey, David Kolb came up with his Experiential learning theory in 1984. His theory is based on learning through experience. For him, "Learning is the process whereby knowledge is created through the transformation of experience. "He argued that effective learning leads to the acquisition of abstract concepts that can then be used in different situations.

Kolb's theory is composed of two parts. One details with the four-stages cycle that the learning experience follows. And going through these stages, learners can transform their experiences into knowledge. The other , deals with the learning styles and the cognitive processes which are essential for the acquisition of knowledge. According to Kolb, learners can show their understanding when they can apply the abstract concepts the have acquired to

new situations and this indicate that the learning has gone beyond the simple memorization or comprehension to the practical, flexible use. Kolb created the Experiential Learning Cycle in 1974. This four-stage model views learning as an integrated process. All four stages are mutually supportive because Kolb believes that effective learning is a cyclic process that involves experiencing, reflecting, thinking and acting (Kolb, 1984).

Kolb's (1984) model of experiential learning is one of the most widely used theoretical frameworks in education. It consists of four stages: Concrete Experience where Students actively engage in an experience, Reflective Observation during which Students reflect on the experience, identifying any connections, inconsistencies, or alignment between the experience and their prior knowledge, Conceptual Thinking and Through reflection, students generate new understandings/ideas or modifies their existing conceptualization of an idea/concept in order to draw conclusions and make hypotheses and finally and finally, Active Experimentation where Students plan and test their conclusions/hypotheses by applying their knowledge to new experiences.

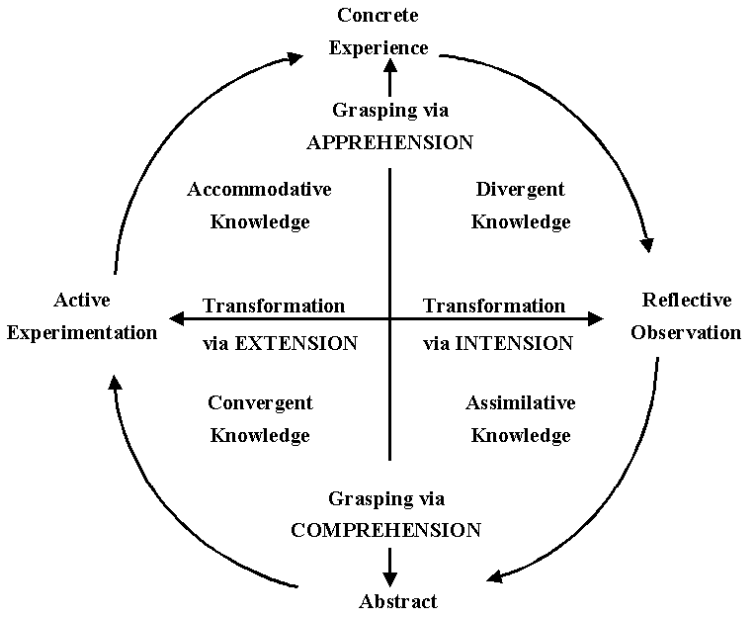


Figure 4: Kolb's Experiential Learning Cycle (Kolb, 1984, p. 21).

Despite the fact that experience has an important role in learning, it still be the only one phase in Kolb's experiential learning cycle. All stages in the cycle must be addressed to ensure the occurrence of meaningful learning.

According to the cycle, learning occurs when an individual comes across an experience and reflects upon it. This leads to an analysis and formulation of abstract concepts. Learners can then experiment with their hypotheses in various situations (Structural Learning, n.d.).

According to Kolb, real-world situations is very important to foster critical thinking, problem-solving, creativity, and decision-making abilities and this when the learners are engaged in a four-stage learning cycle that includes concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984, p. 38). For him, learning is more effective if it occurs in real-world contexts where learners can actively engage with problems and challenges. He noted "Learning is the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p. 38).

Kolb considered real-world experiences as the raw material for learning which enable the learners to develop practical skills such as critical thinking and problem-solving.

Kolb describes how experiential learning fosters critical thinking and problem-solving when the learners reflect on their experiences and apply abstract concepts to new situations. He indicates, "The experiential learning model portrays two dialectically related modes of grasping experience: Concrete Experience (CE) and Abstract Conceptualization (AC)... These modes represent different ways of understanding the world, through direct experience or through symbolic representation" (Kolb, 1984, p. 68). Switching between concrete experiences and abstract thinking makes the learners develop the ability to analyse problems critically and devise creative solutions.

Creativity, also plays a great role of in the learning process according to Kolb, particularly where learners generate new insights during the reflective observation: "In

Reflective Observation (RO), the learner views the experience from many perspectives, looking for meanings and connections... This stage encourages divergent thinking and creative exploration" (Kolb, 1984, p. 70). Kolb suggests that real-world experiences provide fertile ground for generating novel ideas and approaches when linking creativity to the reflective process,

In the final stage of Kolb learning cycle, he discusses how active experimentation helps learners refine their decision-making abilities by applying what they have learned in real-world scenarios: "Active Experimentation (AE) involves trying out new ideas and skills in practice, testing implications in new situations... It is the stage where decisions are made and actions are taken" (Kolb, 1984, p. 72). Here, Kolb emphasizes how real-world application permits learners to test hypotheses, make informed decisions, and adapt their strategies based on outcomes.

Kolb's entire framework revolves around the idea that real-world situations are essential for meaningful learning. He summarizes this as follows: "The experiential learning cycle begins with concrete experience, moves through reflective observation and abstract conceptualization, and culminates in active experimentation... Each stage builds upon the previous one, creating a continuous process of growth and development" (Kolb, 1984, p. 68).

This cyclical process ensures that learners integrate theoretical knowledge with practical experience, fostering skills like critical thinking, problem-solving, creativity, and decision-making.

Implication of Kolb Experiential learning Model for education:

Instructors, trainers and teachers should design a variety of experiential activities. Furthermore, these activities should be delivered in a way that promotes engagement for all learners, regardless of their preferred approach. Experiential activities inside the classroom include: Field trips, Art projects, Science experiments, Role-playing exercises, Reflection and

journaling, Opportunities for internship and Interactive classroom games (Journal of Learning Design and Leadership, n.d.).

1.1.1.3.1. Drawbacks of Kolb's Experiential Learning:

Despite the fact that Kolb's Experiential Learning Model shapes modern teaching methods stressing that meaningful education arises from experience, reflection, and real-world application, there still be some drawbacks such as: Insufficient Attention to Reflection – Kolb's model helps plan learning activities but fails to deeply analyse the reflective process itself (Boud et al., 1983).Overstated Learning Styles – The four learning styles are presented as universal, but alternatives (e.g., memorization, information assimilation) may suit different contexts better (Jarvis, 1987; Tennant, 1997).Limited Cultural Consideration .The model is based on Western assumptions and lacks adaptation to diverse cognitive and communication styles across cultures (Anderson, 1988).And least but not last ,Overly Linear Stages , Learning doesn't always follow neat, sequential stages; thinking can be non-linear (Journal of Learning Design and Leadership ,n.d.).

1.1. 2.Constructivism:

Constructivism is a theory of both knowing and learning. Certain fields such as philosophy and sociology focus on "knowing. For them "knowledge is constructed by people" (Academia, edu, n.d.). According to Krahenbuhl (2016), constructivism "is an epistemological view of knowledge, arguing that knowledge is derived in a meaning-making process through which learners construct individual interpretations of their experiences and thus, construct meaning in their minds" (Structural Learning. n.d, p. 4), whereas psychology and education focus on "learning"

For this theory of learning, two perspectives became dominant: individual constructivism and social constructivism. The first perspective focuses on the construction of meaning inside a person and the other focuses on the construction of meaning among people,

others have argued that all learners construct meaning socially as well as individually (Piaget, 1950, pp. 7, 13).

Individual or cognitive constructivism sees learning as the result of constructing meaning based on an individual's experience and prior knowledge. It evolved from Piaget's work as a reaction to behaviourist and information-processing theories of learning.

Social constructivism evolved from the work of individual constructivists, Vygotsky and others who consider knowledge creation as the result of social and cultural perspective. This theory believe that learning occurs when meaning is constructed during social interaction within culture and through language.

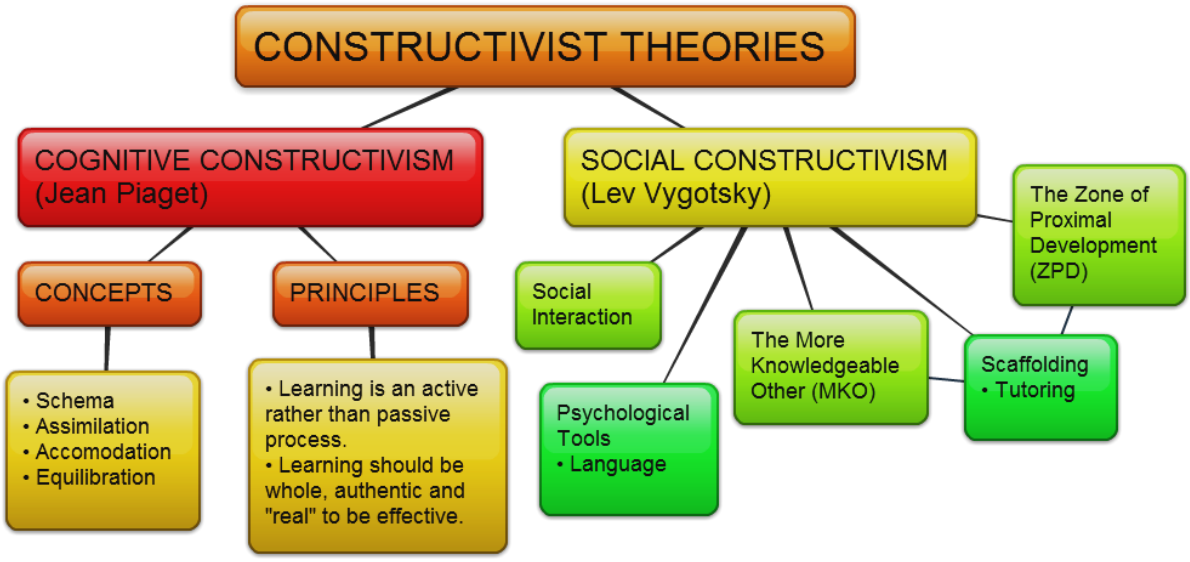


Figure 5: Constructivist Learning Theory

As earlier indicated, Jean Piaget and Lev Semionovich Vygotsky are widely recognized as the most influential developmental psychologists in the 20th Century. Their study of cognitive development has provided the foundation for constructivist learning theory. Constructivists‟ theory believes that people develop their knowledge through active participation during learning. However, Piaget (1970, 1977) tells us that cognitive development is a product of the mind achieved through observation and experimentation, whereas Vygotsky

(1978) views cognitive development as a social process, achieved through interactions with other knowledgeable members of the culture. Piaget refers to his work as “cognitive“ constructivism.

1.1.2.1. Jean Piaget (1896-1980):

Piaget’s ideas followed on from Lewin and Dewey’s, in that he conceived experience, conceptualisation, reflection, and action as the basis for adult thought. He believed that as we grow, we view the world in an abstract way and can construct our own meaning and knowledge as a result. This differs from children who have a concrete phenomenological interpretation. Thus, learning requires interaction between an individual and their environment. Concepts and schemas are assimilated from and accommodate to experiences, and if either of these things becomes dominant, learning is interrupted:

- Too much accommodation and we imitate things and sculpt ourselves to our environment rather than learning from it.
- Too much assimilation and we end up imposing ourselves with no regard for environmental realities.

As adults we are able to manipulate the balance of these two factors to make efficient learning more possible. In experiential learning this is achieved by tailoring the nature of the activity and providing suitable facilitation (Piaget, 1950, pp. 7, 13).

Piaget’s theory comprises two major elements: „ages“ and „stages“. According to him, these elements help predict what learners can and cannot understand at different ages and stages. Piaget’s theory of cognitive development suggests that human beings are unable to automatically understand and utilize information that they have been given, because they need to “construct“ (Piaget, 1951, p. 166) their own knowledge through prior personal experiences so as to enable them create mental images. The primary role of the teacher in a constructivist environment, therefore, should be to provide the setting, pose the challenges, and offer the

support that will motivate or encourage learners to create their own knowledge through their personal experiences (Lunenburg & Ornsteing,2008) .

Piaget states that children learn by interacting with their world, building knowledge through active engagement, testing ideas, and solving problems.

"The child is someone who constructs his own moral worldview, who forms ideas that are not only a product of adult teaching but also of active experimentation and interaction with reality**"** (Vygotsky, 1978, p. 86). For Piaget, real-world experiences are very importance in shaping cognitive abilities, including problem-solving and decision-making (Piaget, 1950).

He adds that children develop critical thinking and problem-solving skills through assimilation and accommodation processes. For him, "Intelligence is what you use when you don't know what to do: it involves the ability to think critically, solve problems, and adapt to novel situations (Vygotsky, 1978, p. 86). Here, he points that intelligence develops through encounters with unfamiliar or challenging real-world problems.

Creativity also plays a role in in cognitive development, particularly during the stages of play and exploration. He v considers play a way of experimentation that permits children to test ideas and generate creative solutions: He claimed "Play is the answer to how anything new comes about... It is through play that children develop flexible thinking and the ability to innovate" (Vygotsky,1930/2004, p. 7–97). (Original work published 1930) For him, real-world exploration fosters creativity and innovation. Piaget argued that decision-making abilities arise as children progress through the stages of cognitive development, particularly during the formal operational stage (ages 11+), when they begin to think abstractly and reason hypothetically: "During the formal operational stage, individuals become capable of systematic planning, logical reasoning, and considering multiple possibilities before making decisions (Vygotsky, 1930/2004, pp. 7-97).For him, real-world experiences provide opportunities for children to practice decision-making and refine their reasoning abilities.

Piaget ‘theories shed light on how critical thinking, problem-solving, creativity, and decision provide skills develop. By emphasizing active engagement with the environment, experimentation, and reflection, Piaget's work aligns closely with contemporary educational practices that prioritize experiential and contextualized learning. His work highlights the importance of real-world situations in fostering intellectual growth, creativity, and decision-making abilities despite all this, Piaget’s work has been criticized for its failure to take account of environmental and cultural circumstances (Cole, 1971).

1.1.2.2. Vygotsky

Vygotsky refers to his work as „social“ constructivism. Vygotsky’s theory is very similar to Piaget’s assumptions about how knowledge is created as well as how people learn, but Vygotsky places more importance on the social context of learning. In Piaget’s theory, the teacher plays a limited role, whereas in Vygotsky’s theory, the teacher plays an important role in learning. Learning activities in constructivist settings are characterized by active engagement, experiential learning, inquiry-based, problem–based learning, and collaboration with others. As a dispenser of knowledge, the teacher’s role is to guide, facilitate, coach, provoke, and co-explore in ways that allow the learner to engage in critical and creative thinking, analysis and synthesis of ideas during the learning process as the teacher assumes the role of co-learner who encourage learners to question, challenge, and formulate their own ideas, opinions, and conclusions.

Figure 6: Zone of Proximal Development

(adapted from Vygotsky, 1978, p. 86).

Vygotsky's sociocultural theory of learning gives a great importance to the social interaction and contextualized learning**.** His concept of the "Zone of Proximal Development (ZPD)", one of his most influential contributions to educational psychology, refers to the gap between what a learner can do independently and what they can achieve with the guidance of a more knowledgeable other (e.g., a teacher, peer, or expert). His work emphasizes how real-world, socially mediated learning fosters higher-order cognitive skills.

Vygotsky emphasized that learning occurs through social interaction and collaboration in culturally meaningful contexts. For him, real-world situations provide the scaffolding necessary for learners to develop advanced cognitive skills: "Learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in their environment and in cooperation with peers" (Schunk, 2008, pp219–225).

According to him, real-world, socially embedded activities foster intellectual growth, including critical thinking and problem-solving (Vygotsky, 1978).

Vygotsky explained that problem-solving abilities develop within the ZPD through guided participation in meaningful tasks. He described how learners internalize strategies and approaches modelled by experts: "Through others, we become ourselves... The role of instruction is to provide tools and strategies that help children solve problems independently" (University College Dublin, n.d.). Here, Vygotsky suggests that real-world problem-solving emerges as learners engage in collaborative activities and gradually internalize the skills needed to tackle challenges on their own.

Vygotsky also argued that creative abilities are nurtured through social interactions and cultural practices: "Imagination is a form of creative activity that arises from the recombination of previously acquired elements in new ways... It is developed through participation in cultural activities and interactions with others" (Clemson University, n.d.). He viewed that engagement with real-world, culturally relevant experiences fosters creativity.

Vygotsky said that when the learners do guided activities that require thinking about what they're doing, they get better at making good decisions and this happens in their Zone of Proximal Development (ZPD)."The process of decision-making involves weighing alternatives, predicting outcomes, and evaluating consequences, all of which are facilitated through social interaction and scaffolding" **(**Colorado College, n.d.). To him, decision-making is a socially mediated process that develops over time.

As a Sum up, Vygotsky's theory underscores the importance of real-world, socially mediated learning in fostering critical thinking, problem-solving, creativity, and decision-making. Through activities in the Zone of Proximal Development (ZPD), learners gain the skills and strategies to handle complex issues on their own. His focus on collaboration, scaffolding, and cultural context resonates strongly with modern educational approaches.

The constructivist classroom shifts the focus from teacher-centred instruction to student-centred learning, emphasizing active engagement, collaboration, and the construction of knowledge through personal experiences and interactions. This contrasts with the traditional classroom, which tends to be more passive, with a strong emphasis on rote learning, fixed curricula, and teacher-directed instruction.

1.1.3. Contemporary research

Contemporary research often uses Dewey, Kolb, Piaget, and Vygotsky' s work with modern pedagogical approaches such as project-based learning, inquiry-based learning, and experiential education to emphasise the role of real-world situations in enhancing critical thinking, problem-solving, creativity, and decision-making.

Research demonstrates that real-world contexts provide ways for learners to engage in authentic problem-solving, requiring them to analyse complex scenarios, evaluate evidence, and construct arguments and this enhances critical thinking skills.

Hmelo-Silver, Duncan, and Chinn (2007) argued that **"**Problem-based learning engages students in authentic tasks that require them to think critically, evaluate multiple perspectives, and justify their reasoning" (Hmelo-Silver et al., 2007, p. 375).

Abrami et al. (2015) also stated that real-world applications significantly enhance critical thinking outcomes. Jonassen (2011) Studies claim that real-world situations help learners develop adaptive problem-solving skills by presenting them with ill-structured problems that mirror every day. He explains how real-world problem-solving tasks promote higher-order thinking and adaptability. "Real-world problems are inherently complex and multifaceted, requiring learners to integrate knowledge, skills, and strategies to devise effective solutions" (Jonassen, 2011, p. 218). And Merrill (2002) also focused on the fact that instructional design should focus on real-world tasks to improve problem-solving abilities.

Contemporary research shows that real-world contexts stimulate creativity by encouraging divergent thinking and innovation. Beghetto and Kaufman (2014) demonstrate how real-world projects enhance creativity by making students face novel ideas and solutions. "When students are given opportunities to apply their knowledge to real-world challenges, they are more likely to engage in creative thinking and produce innovative outcomes." Csikszentmihalyi (1996) emphasizes that creativity flourishes when individuals are immersed in meaningful, real-world activities.

Research demonstrates that real-world scenarios improve decision-making skills by requiring learners to weigh options, predict outcomes, and reflect on consequences.

Klein (1998 discusses how real-world experiences shape decision-making abilities, particularly through the use of mental simulations and pattern recognition. “Effective decision-making arises from experience with real-world situations, where individuals learn to recognize patterns and anticipate outcomes" (Klein, 1998, p. 45). Halpern (2014 argues that decision-making skills are best developed through exposure to authentic, complex problems.

Contemporary research consistently supports the idea that real-world situations play a crucial role in fostering critical thinking, problem-solving, creativity, and decision-making.

1.1.4. Bloom’s Taxonomy

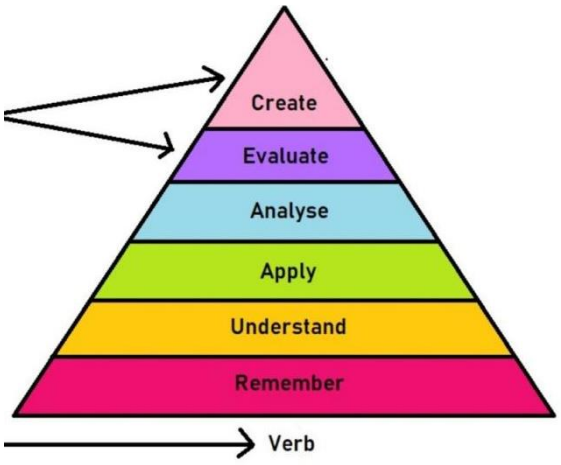


Figure 6: Bloom’s Revised Taxonomy (Anderson & Krathwohl, 2001, p. 28).

Many Learning Taxonomies or classifications are designed to help students to develop different kinds of learning behaviour and characteristics and to describe this process. they are used to identify different stages of learning development and thus provide a useful tool in distinguishing the appropriateness of particular learning outcomes for particular module level within the learning program.

The most common Learning frameworks is Bloom's Taxonomy which was created in 1956 by the educational psychologist Dr Benjamin Bloom. It classifies learning objectives from basic to advanced levels. This framework was created to promote higher forms of thinking in education, such as analysing and evaluating concepts, processes, procedures, and principles, rather than just remembering facts (rote learning). It is most often used when designing educational, training, and learning processes *(*Conte, 1997).

Benjamin Bloom (1956) and his collaborators identified three domains of educational activities: Cognitive: mental skills (Knowledge) Affective: growth in feelings or emotional areas (Attitude) Psychomotor: manual or physical skills (Skills) However, the Cognitive Domain is the most widely known and used. Later, it was revised by Anderson and Krathwohl. Their main interest was what learners do to learn, how they remember, understand, then apply, analyse, evaluate and create. The taxonomy is provided along with lists of suggested verbs useful for writing learning objectives (what students will do) and outcomes (what students, hopefully, will have done by the end of the curriculum) (Dalgarno & Lee, 2010)

In Bloom's revised Taxonomy, there are six levels of cognitive learning according. Each level is conceptually different. The six levels are remembering (retrieve, recall, or recognize relevant knowledge from long-term memory) , understanding(demonstrate comprehension through one or more forms of explanation), applying (use information or a skill in a new situation), analysing(break material into its constituent parts and determine how the parts relate

to one another and/or to an overall structure or purpose), evaluating(make judgments based on criteria and standards), and creating(put elements together to form a new coherent or functional whole; reorganize elements into a new pattern or structure).43

The revised version uses verbs (e.g., "remembering") instead of nouns (e.g., "knowledge") and “creating" is placed at the top of the hierarchy in the revised version, emphasizing its importance as the highest level of cognitive skill. The revised taxonomy emphasizes active learning and measurable outcomes.

Bloom’s Taxonomy is a hierarchical framework that categorizes educational goals into six levels of cognitive complexity, ranging from remembering and understanding to evaluating and creating. It helps educators design learning objectives, assessments, and instructional strategies to promote higher-order thinking skills.

Bloom’s Taxonomy is a powerful tool for educators, curriculum designers, and learners alike. By systematically addressing each level of cognition, it ensures that learning moves beyond rote memorization to deeper understanding, critical thinking, and creativity. Whether we are designing a lesson plan, writing exam questions, or reflecting on our own learning, Bloom’s Taxonomy provides a clear roadmap for achieving meaningful educational outcomes.

1.1.5. Empirical Pedagogies

Many researches show that Real-world pedagogical approaches, such as case studies, simulations, and project-based learning (PBL), foster critical thinking, problem-solving, and metacognitive skills. They immerse the learners in an authentic, complex scenarios and bridge the gap between the theoretical knowledge and the practical application (Kolb, 1984; Lave & Wenger, 1991). Syntheses of active learning research (Prince, 2004) further underscore their role in developing higher-order cognitive skills through iterative, context-driven engagement."

1.1.5.1. Case Studies:

Case study is the collection and presentation of detailed information about a particular participant or small group, including the accounts of subjects themselves. It is a form of qualitative descriptive research which looks carefully at an individual or small group of participants and make conclusions only about that participant in that specific context. It explores and describes participants.

A case study is to gather information about an individual or group so that this information can be generalized to many others. But it is sometimes difficult to generalize the results to a larger population and thus, it tends to be highly subjective. According to Flyvbjerg (2006), case studies help develop "practical wisdom" by challenging learners to deal with uncertainty, conflicting information, and ethical issues. For instance, medical students who used case studies to diagnose patients showed better diagnostic skills than those who just memorized information (Breslow et al., 2019).

In education, case study method is used “to transfer much of the responsibility for learning from the teacher on to the student, whose role, as a result, shifts away from passive absorption toward active construction" (Boehrer 1990).

1.1.5.2. Simulation:

Simulation is to re-enact a real-world scenario for entertainment, education, preparing for an anticipated event, or troubleshooting a problem. These scenarios are conducted in a controlled environment where variables can be modified or adjusted as needed. However, simulations cannot take into account every variable due to its complex process.

A classic example of a simulation is a fire drill which prepares people for a potential fire emergency the fire alarm is activated without a real fire, participants practice evacuation procedures safely as if the scenarios were true. The purpose of this simulation is to teach people the correct responses in case of a real fire without their lives actually being in danger. Other

examples of simulations consist in simulating cardiopulmonary resuscitation (CPR), science laboratory experiments, simulations used in movies, sports, and video games.

Simulations work by making models or systems to recreate real-world scenarios. These models can be any physical setups, device, or representation designed to describe or mimic a process when it cannot be experienced directly.

The use of simulations in various educational and training contexts provide realistic, hands-on experiences in a controlled environment and empirical evidence show how these simulations enhance learning outcomes in fields such as medicine, aviation, and engineering.

According to Parisi (1997), the main feature of a simulation is the reproduction of a particular aspect of an observed or possible reality. It is not, however, a static reproduction, but an active, or rather, an ‘‘interactive’’ one.

Salas et al. (2008), provides empirical evidence from aviation training where they demonstrate that pilots trained using flight simulators make 40% fewer errors in emergency scenarios than those trained in the traditional way.

And this is a real proof of how simulated training enhance performance under high-stress conditions.

Another empirical evidence, reported by Zigmont et al. (2011) on page 1282 show that virtual surgeries enhance surgical accuracy and stress management skills for the residents.

And in in engineering education, Dalgarno and Lee (2010) demonstrated that students who use virtual laboratories obtain better results in conceptual understanding and problem-solving tasks than those using traditional laboratory methods.

From the above evidences, we can deduce that empirical evidences encourage the use of simulation in education and training in many fields. Simulations improve performance, acquisition, decision making and ensure a safe learning environment. Theses simulations are most effective in domains where real -world mistakes can have serious consequences.

1.1.5.3. Project-based learning (PBL):

Project-based learning (PBL) is defined as “a teaching method in which students actively explore real world problems and challenges and gain a deeper knowledge and skills by working for an extended period of time to investigate and respond to an authentic, engaging, and complex question, problem, or challenge” (Buck Institute for Education, 2021). Taking its principle from constructivist principles, PBL emphasizes the creation of tangible products and aligns with 21st-century skill development (Bell, 2010). PBL engages learners in designing solutions to real-world problems emphasizing collaboration, creativity, and applied research**.** "Students taught with a more progressive, open, project-based model developed more flexible and useful forms of knowledge and were able to use this knowledge in a range of settings." (Boaler, 1998).

It is also noted that students at the project-based school show a high level of performance than those at the traditional school, and this not only in term of conceptual questions but also on applied problems that required the application of conceptual knowledge. From this, it becomes apparent that project-based learning approach really enhance deeper understanding and practical skill application compared to traditional educational methods.

A recent meta-analysis of PBL research, looking at journal articles published over a 20-year period, found project-based learning had a medium to large positive effect on students’ academic achievement compared with traditional instruction (Chen & Yang, 2019). And in a study in four countries in South and Central America, researchers reported that inquiry and problem-based learning improved students’ math and science scores on standardized tests (Bando et al., 2018).

It has also been noticed that empirical evidence also favours the use of Project-Based Learning (PBL) and this through many dimensions of educational outcomes.

According to (Thomas, 2000; Blumenfeld et al., 1991). PBL Enhances Academic Achievement and helps students to get higher-order thinking skills and content retention it is also demonstrated that Students engaged in PBL obtain better results compared to their peers on standardized tests, they also show deeper understanding of the material.

Darling-Hammond et al., (2017) stated that PBL develops critical thinking, problem-solving, collaboration, and communication skills which are important competencies for the modern workforce. Hmelo-Silver et al., (2007) as well argued that PBL promotes metacognitive skills and enables students to reflect on their learning processes and strategies.

Buck Institute for Education, (2018) claimed that Students in PBL environments demonstrate higher levels of engagement, interest, and motivation compared to traditional classroom settings. And according to Kolb & Kolb, (2005), The experiential nature of PBL aligns with how learners naturally process information and this leads to an increased intrinsic motivation.

Bell and Cowie (2001) explained that PBL encourages students to construct meaning and apply concepts in real-world contexts and this results to a long-term retention of knowledge as students are more engaged and able to connect what they learn to practical situations outside the classroom.

The National Research Council, (2012) also clarifies that PBL prepares students for the complex, problem-based real-world work and citizenship and this by simulating authentic tasks and scenarios. Case studies demonstrate how successful relations with the community partners and the industry professionals can provide valuable real-world experiences.

And least but not last and according to (Schraw & Dennison, 1994), PBL enhances specific thinking skills such as metacognition which improves self-regulated learning, systems thinking concepts which are developed through simulation and modelling, and innovation and this through various educational and training approaches.

3. Limitations/gaps:

This study is constrained by several key limitations. First, the theoretical frameworks used in this study such as experiential learning and constructivism, are simply based on Western education and this might not work in other cultures or places. These later, with different economic levels, may hold, different cultural values, limited resources, and different teaching methods and This will limit its application to non-western countries.

Additionally, the empirical approaches praised the use of project-based learning but neglected the unequal opportunities students may face to access real world experiences. Urban and rural schools, for instance, may have different chances and poor schools as well, can't implement simulations or field trips activities.

Furthermore, the study doesn't pay enough attention to emotions and motivations sides which affect learning in real-world situations. And neglects as well the role of the learners' curiosity and anxiety and their impact on thinking, and the intrinsic motivation and its importance in keeping students' persistence in complex scenarios. The study neither give a clear definition of the term "real-world "nor state whether fake simulations or classroom projects represent real challenges, and this gives us the impression that they're more effective than they actually are.

These limitations demonstrate that we are in need of other researches that look enough at culture, fairness, and psychology in order to understand how real-world contexts can help improve thinking skills for different groups of people in various settings.

Conclusion:

This chapter synthesizes theoretical and empirical evidence supporting the use of real-world learning contexts to enhance critical thinking, problem-solving, creativity, and decision-making. Drawing on experiential and constructivist learning theories, it shows that authentic, meaningful tasks foster deep understanding and practical skills by engaging learners in

complex, realistic challenges. Empirical studies confirm these benefits, including improved critical thinking, creativity, decision-making, and knowledge retention. However, the chapter also notes limitations, such as cultural applicability concerns, access challenges, and the underexplored role of affective factors. Despite these gaps, the evidence strongly advocates for real-world learning experiences as crucial for developing 21st-century skills, setting the stage for practical implementation discussions in subsequent chapters.

CHAPTER TWO:
Research Methodology

Research Methodology

Introduction:

This chapter details the mixed-methods approach investigating how a real-world, project-based learning (PBL) activity on school littering enhanced middle school students' critical thinking and problem-solving skills. The study involved 67 Algerian students and 32 teachers, utilizing surveys, structured observations of group work, artifact analysis (e.g., recycled prototypes, data charts), and teacher questionnaires. Data collection occurred across a five-week PBL intervention focused on analysing causes, proposing solutions, and creating recycled products. This design enabled triangulation to comprehensively address how authentic problem-solving influenced students' cognitive processes and collaborative strategies

2.1. Aim:

This study aims to explore and quantify how a project-based learning activity focused on school littering improves middle school students' critical thinking and problem-solving skills, as measured through a mixed-methods approach involving surveys, observations, artifact analysis, and teacher feedback**.**

2. 2. Research Design

This study employed a mixed-methods design to investigate how project-based learning (PBL) with real-world scenarios enhances thinking skills. It focused on a group of middle school students who were engaged in a project-based learning (PBL) activity centred on reducing littering at their school. This approach allows for an in-depth examination of how students apply critical thinking, problem-solving, and collaboration .

In the initial stage of the study, the researcher conducted a comprehensive survey among the students to gauge their existing understanding of the causes and potential solutions to the littering issue. This survey aimed to collect baseline data on students' knowledge and perceptions regarding littering, providing valuable insights into their current awareness and

attitudes. By understanding their initial perspectives, the researcher could tailor the subsequent project-based learning activities to address any misconceptions and enhance their understanding of the problem.

The implementation stage involved a series of project-based learning (PBL) activities designed to engage students in addressing the littering problem within their school environment. These activities were structured across four key components: reflection, research, discovery, and application. During reflection, students analysed the survey results to identify key areas of concern; in research, they delved deeper into the causes and effects of littering and explored potential solutions; in discovery, they brainstormed and designed practical strategies to reduce littering; and finally, in application, they put their ideas into practice by creating recycled products and organizing awareness campaigns. This stage aimed to foster critical thinking, problem-solving, and collaboration skills as students applied theoretical knowledge to real-world situations.

The final stage of the study focused on evaluating the impact of the PBL activities on students' understanding and behaviour regarding littering. The researcher conducted a series of assessments, including student and teacher questionnaires, structured observations of group work, and artifact analysis of student-produced materials such as recycled products and investigative reports. The student questionnaires aimed to measure changes in their understanding of littering causes and solutions, while the teacher questionnaires sought feedback on the effectiveness of the PBL activities and observations of students' learning outcomes. Through these assessments, the researcher sought to determine the overall effectiveness of the intervention and gain a deeper understanding of students' learning progress and behavioural changes resulting from their participation in the PBL activities.

2.3. Participants:

The study which involved 67 middle school students grade 3 consisted of 26 males and 41 females, aged between 13 and 17. They are from Bouzered Houcine middle school in Annaba, Algeria. The students took part in a project-based learning (PBL) activity which focused on addressing littering in their school environment. They were organized into small groups to find about the causes of littering, suggest some solutions, or create recycled products from waste objects, and this depends on the task assigned to them. The student sample was selected through convenience sampling.

Additionally, 32 teachers were surveyed about the project and its role in enhancing thinking skills. The teachers had enough experiences and knowledge about using PBL with their students. They were selected by using purposive sampling to be certain that their insights were based on direct experience with PBL methodologies.

One school administrator was interviewed to provide supplementary information about the littering problem in the school. The researcher also surveyed the learners about littering in their school.

2.4. Data Collection

Data were collected from four interconnected sources:

2.4.1. Student Activities

Data was also collected through many students' activities in order to investigate how project-based learning (PBL) enhances thinking skills. Students counted and categorized littered items such as plastic wrappers, papers), daily over one week.

Area	Type of waste
Class rooms (3 classrooms simply)	**Papers**
	Pencil Shavings
	Plastic bottles
	Seeds

	Chocolate wrappers
	Broken pens
	Empty Jus boxes
Playground	**Empty Jus boxes**
	Packaging material
	Chocolate& sweets wrappers
	Donuts wrappers
Green area	**Empty Jus boxes**
	Satchels
	Plastic bottles
	Glass bottles

Table2: School Area and Type of waste generated

Sl. No	Type of waste	Sun	Mon	Tues	Wedn	Thurs
	Broken pens	**8**	**5**	**7**	**7**	7
1	Papers	**35**	**88**	**63**	**72**	71
2	Pencil Shavings	**3**	**5**	**7**	**7**	8
3	Food waste	**3**	**1**	**3**	**7**	16
4	Sweets & Chocolate wrappers	**5**	**7**	**9**	**11**	45
	Seeds wrappers	**3**	**12**	**30**	**53**	77
5	Plastic bottes	**3**	**3**	**5**	**12**	17

Table3: Type and Quantity of waste generated
(in 3MS1, 3MS2 and 3MS3 classrooms in the school at the end of the school day)

The litter was collected in a limited scope focusing on three classrooms used by Grade 3 students to systematically quantify litter patterns.

Students also collaborated with each other to identify and document hotspot within their school such as the playground and classrooms. They used their observational skills to

hypothesize the causes behind littering such as busy areas like the playground or insufficient waste bins.

Finally, students were divided into two groups: the Investigation Group who conducted interviews to explore root causes of littering and suggested solutions such as awareness campaigns, while the Recycling Group designed functional items like school building from, copy books covers, and pencil holders from juice boxes and this demonstrates creativity and practical problem-solving. These activities generated quantitative data (daily litter counts, hotspot trends) and qualitative artifacts (investigative reports, recycled prototypes), providing observable evidence of students' critical analysis, collaboration, and innovation through hands-on engagement with authentic challenges.

These activities produced both quantitative data (like daily litter counts and hotspot trends) and qualitative materials (such as investigative reports and recycled prototypes). This mix of data showed how students used critical analysis, worked together, and came up with innovative solutions by actively tackling real-world problems.

2.4.2. Students Survey

A Survey was supplied to the students in order to assess changes in their understanding to the causes and solutions of littering. The tool included eleven questions among which there are closed-ended questions which are followed by options such as asking about the primary cause of littering in our school, with options like lack of bins, peer influence, or careless behaviour, The aim of this type of questions is to measure common perceptions and identify initial patterns. And open-ended prompts like "Describe one way to reduce littering". These questions require students to answer in their own word, come up with creative and practical solutions and show their abilities in problem-solving. This two-part method enabled the study to see the changes in student viewpoints and how well they could

solve problems, which supported the research goal to examine how real-world project-based learning (PBL) improves critical thinking and innovation

This survey measures skill development, explains how combining different types of questions helps achieve the study's goals, and also describes how analysing the data (by categorizing themes) assesses critical thinking skills.

2.4.3. Teachers Questionnaire

A 14-item survey was distributed to 32 teachers (29 papers were received back) to gather information about their perspectives on the of PBL to fosters the thinking skills. The questionnaire comprised a combination of: open-ended questions and Likert-scale items and this to get precise point of views about the importance of PBP in enhancing thinking skills.

By linking teachers' perceptions with student outcomes (such as the litter reduction trends as well as the creative solutions, and the observational data, the questionnaire served to emphasise the impact of PBL on real-world thinking skills while identifying strategies used by the teachers for optimizing such initiatives. This approach reinforced the study's validity and provided actionable recommendations to implement PBL in middle school curricula.

2.4.4. Students' observation:

The researcher observed the students during the group work sessions over the course of 3 weeks for 12 hours using a structured checklist to document their collaboration, critical analysis and problem-solving.

The frequency of peer discussions, assigning roles, and resolving conflict between them were the main aspects to focus upon during the collaboration phase. The researcher also payed attention to the students' critical analysis during which the frequency of peer discussions, designating roles, and resolving conflict between then were focused upon. Additionally, the way students solved problems, were also give a certain attention and this by looking at their creativity in designs or interventions. Field notes also provided qualitative details such as group dynamics, leadership behaviours, and non-verbal interactions like enthusiasm during prototype testing or frustration during revisions.

These methods documented the student engagement with the real-world tasks and thus creating a detailed dataset for later analysis.

2. 4.4.1. Student Artifact:

Students' project materials, including brainstorming notes, posters, presentations, written reflections and recycled objects, were collected and analysed. These artifacts provided insight into their thought processes, creativity, and ability to synthesize information.

CHAPTER THREE:
Results

Introduction:

This chapter presents the triangulated findings from the five-week PBL intervention on school littering. It revealed how real-world problem-solving developed middle school students' cognitive and collaborative skills. The Quantitative results demonstrate waste pattern identification and behavioural trends, while qualitative analysis uncovers students' critical thinking processes and cognitive dissonance regarding littering. Structured observations document collaborative dynamics across student groups, and teacher questionnaires validate skill development outcomes. Together, these data streams illuminate both the competencies cultivated (critical analysis, creativity, collaboration) and persistent gaps in translating awareness to action. The evidence establishes how authentic project engagement reshapes thinking patterns and problem-solving approaches.

3.1. Analysis of Student Activities:

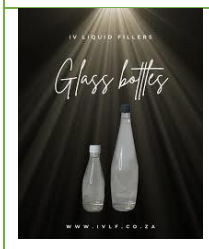
Area	Waste Types		Patterns
CLASSROOMS		Papers (High)	High academic/stationery waste + snack packaging
		Pencil Shavings (Med	
		Juice Boxes (High)	
PLAYGROUND		Juice Boxes (High)	Dominated by commercial snack packaging
		Wrappers (High)	
		Packaging (Med)	
GREEN AREA		Juice Boxes (High)	Beverage-focused waste; glass bottles unique to this zone
		Plastic Bottles (High)	
		Glass Bottles (Low)	

Table4: School area and types of waste generated.

The three main areas observed during this study were the playground, the 3 classrooms devised for grade 3 students and the green area. It is noticed that:

The classrooms contained a combination of academic and snack waste, mostly papers, with some pencil shavings and juice boxes. A lot of paper wastes suggest a lot of writing and note-taking and the Juice boxes indicate snacking during class or breaks.

The playground is mainly littered with juice boxes and wrappers, with some packaging and this was due to the high human traffic. The waste here, mostly from snacks and drinks, suggests that students are consuming these items during their breaks. This is a common behaviour in school settings where students have short periods of free time to eat and socialize. This is a common behaviour in the school settings where students have short periods of free time to eat and socialize.

In the green area, the beverage wastes such as juice boxes and plastic bottles, with a few glass bottles were the most predominant, this area sees a lot of beverage waste, with a mix of plastic and glass bottles. The presence of glass bottles is unique to this zone, possibly indicating different types of drinks or activities here.

From this, we can notice that the Juice Boxes are a common waste item across all areas, and this gives the impression that they are a popular beverage choice among the students.

Additionally, Paper waste is significant in the classrooms which reflect academic activities.

The snack packaging such as wrappers and packaging is prevalent in areas where students take breaks or play which indicates eating habits during these times.

The Glass bottles stand out in the green area, possibly due to the school proximity to the market.

3.1.1. The qualitative insights:

The waste patterns reflect the different activities and daily routines of the students in various parts of the school. Therefore, each place in the school needs its own waste management plan based on what kind of waste is produced there. Moreover, to encourage people to use

reusable bottles and containers can greatly reduce the amount of single-use waste, especially in the playground and the green area places.

This qualitative analysis helps us to understand the waste generation in relation to the student activities and the school environment. It also guides us towards a more effective waste management and sustainability initiatives.

Sl. No	Type of waste	Sun	Mon	Tues	Wedn	Thurs	Total
	Broken pens	8	5	7	7	7	34
1	Papers	35	88	63	72	71	339
2	Pencil Shavings	3	5	7	7	8	30
3	Food waste	3	1	3	7	16	30
4	Sweets & Chocolate wrappers	5	7	9	11	45	77
	Seeds wrappers	3	12	30	53	17	167
5	Plastic bottes	3	3	5	12	17	40

Table 5: Type and Quantity of Waste Generated in the three MS3 Classrooms

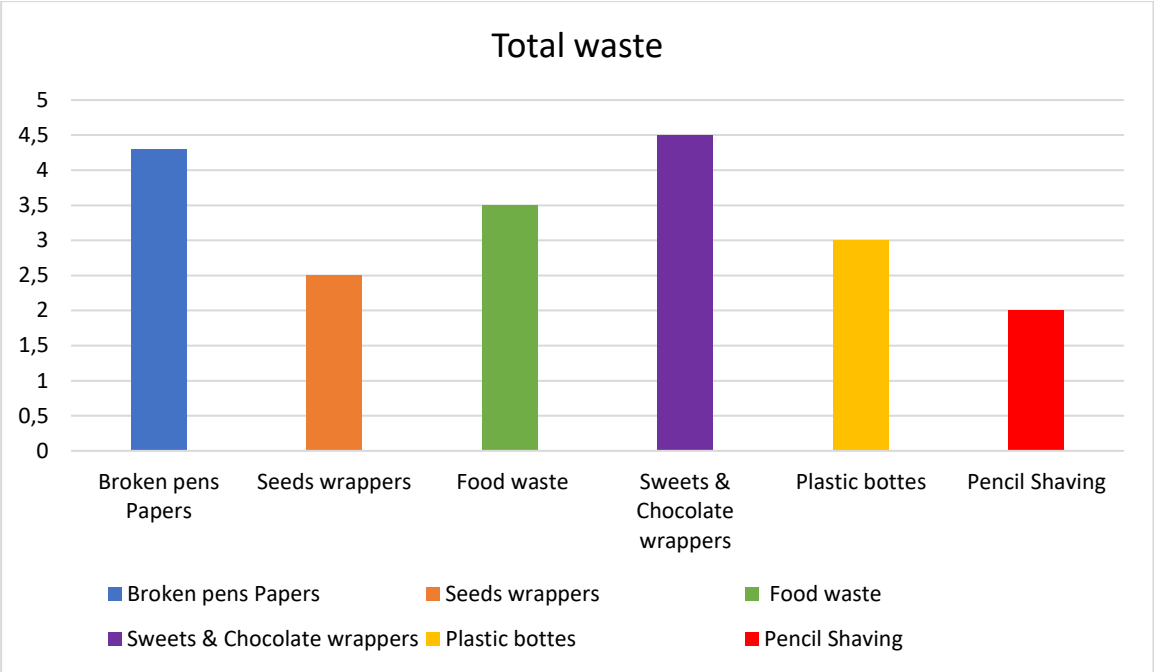


Chart 1: Type of waste.

Plastic bottles After being engaged with a litter count for five days in a limited area (grade 3 three classrooms), data now is analysed using the qualitative approach. and it was noticed that many notable trends and anomalies were detected:

For example, the paper Waste showed a peak on Monday with 88 units, and it gradually decreased to 71 units by Thursday. This pattern suggests a correlation with the beginning of the week and potential assignment submissions after the weekend. Papers have the highest total waste and this indicates that it is the most commonly generated waste item across all days.

Snack packaging like sweets and chocolate wrappers increased fivefold from Sunday (5 units) to Thursday (45 units) whereas, Seeds Wrappers Saw a dramatic 25-fold spike from Sunday (3 units) to Thursday (77 units) which indicated a significant consumption pattern on Thursdays. Seeds wrappers take the second place, with a significant amount of waste, after papers, suggesting a possible correlation with activities or meals involving seeds. The consistent waste like broken pens kept a stable rate of about 7 units per day, which indicated a daily wear and tear. The amount of pencil shavings as well, didn't change too much from day to day, it stayed

consistent which simply reflected routine classroom activities. And anomalies such as the food waste showed an unexpected rise on Thursday with 16 units higher than the other days. Food waste and Pencil Shavings have relatively lower totals compared to the other categories, but still represent areas where waste reduction strategies could be beneficial.

The plastic bottles also showed rise on Thursday with 17 units, and thus deviating from the average daily range of 3 to 7 units. This increase may be related to a specific event or day-related factor. 3. Sweets and Chocolate wrappers and Plastic bottles also show considerable waste, highlighting the need for monitoring and possibly reducing consumption of these items.

These observations revealed varying waste generation patterns across different types of waste and identified specific days with unusual waste outputs, warranting further investigation into potential causes.

3. 2. School Litter Survey Analysis

1. I am in school and need to dispose trash, I... (tick all that you think are appropriate)

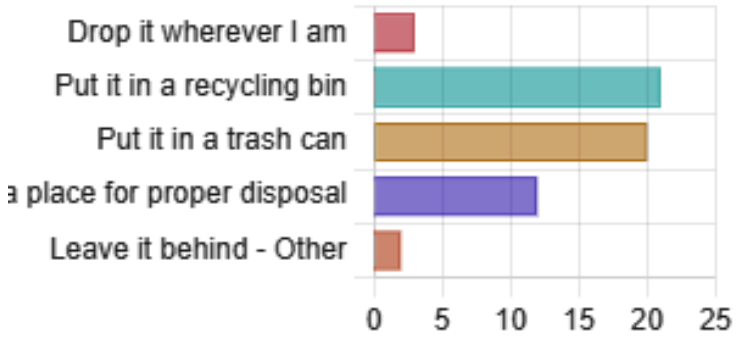


Chart 2: How Students Dispose of Trash in School: Preferred Methods.

The survey responses reveal several attitudes towards waste disposal among the students. Only three students admitted to dropping their trash wherever they are, which indicates a lack of awareness about proper waste disposal and a disregard for cleanliness. On the positive side, 21 students chose to put their waste in a recycling bin, demonstrating a good understanding of recycling and a willingness to participate in environmentally friendly practices. Additionally, 20 students opted to put their trash in a traditional trash can, suggesting

that they are aware of standard waste disposal methods. Twelve students indicated that they put their waste in their pocket until they find a place for proper disposal, which shows some level of responsibility and an effort to dispose of waste correctly. Finally, the small number of two responses for leaving waste behind under the "Other" category suggests that this behaviour is not common among the students.

2. Is litter a concern to you?

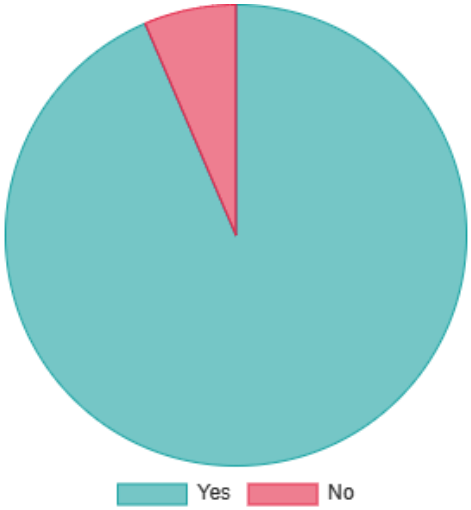


Chart 3: Public Concern About Litter

The survey results show that a high percentage of students, with 58 responses, are aware of the issue of litter, indicating that the majority are concerned about it. Conversely, the low percentage of 4 responses indicating that students are not concerned suggests that most students do, in fact, take littering seriously.

3. If yes, why is litter of concern to you? (tick all that you think are appropriate)

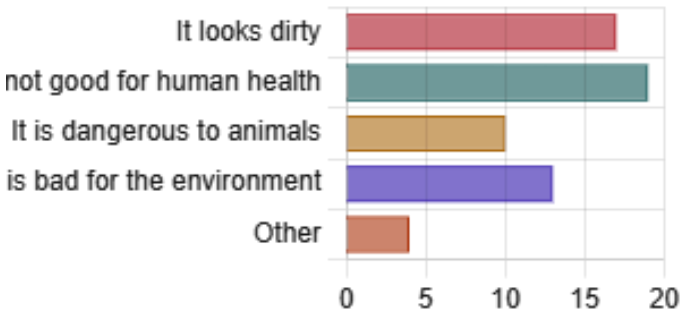


Chart 4: Reasons Why Litter is a Concern: Public Opinions

These results highlight various reasons why students are concerned about litter. Seventeen students mentioned that litter makes the area look dirty, indicating that aesthetic concerns are a significant factor for them. Nineteen students expressed that litter is not good for human health, suggesting a high level of health awareness. Ten students pointed out that litter is dangerous to animals, revealing empathy for wildlife. Thirteen students stated that litter is bad for the environment, demonstrating an evident level of environmental consciousness. Finally, the four responses under "Other" indicate that some students have unique concerns not covered by the other options, showing a range of diverse perspectives on the issue of litter.

4. Why do you think littering occurs? (tick all that you think are appropriate)

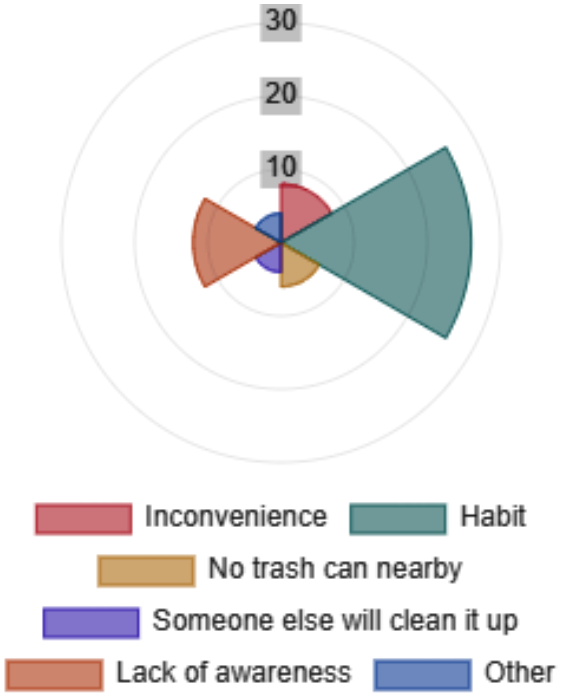


Chart 5: Reasons Behind Littering: Public Perceptions

. The survey responses provide insights into the reasons behind littering behaviour among students. Eight students mentioned that littering might occur due to inconvenience, suggesting

.

That they may choose to litter if it is more convenient for them. The most significant cause identified was habitual behaviour, with 26 students indicating that they litter out of habit. Six students pointed out the lack of trash cans nearby as a contributing factor, highlighting the importance of infrastructure. Four students noted that they believe someone else will clean up the litter, indicating a tendency to shift responsibility. Twelve students identified a lack of awareness as a reason for littering, suggesting that there is room for educational improvement. Finally, four students mentioned time constraints, stating that they don't have time to look for bins, which also plays a role in their littering behaviour.

5. Where does litter end up? (tick all that you think are appropriate)

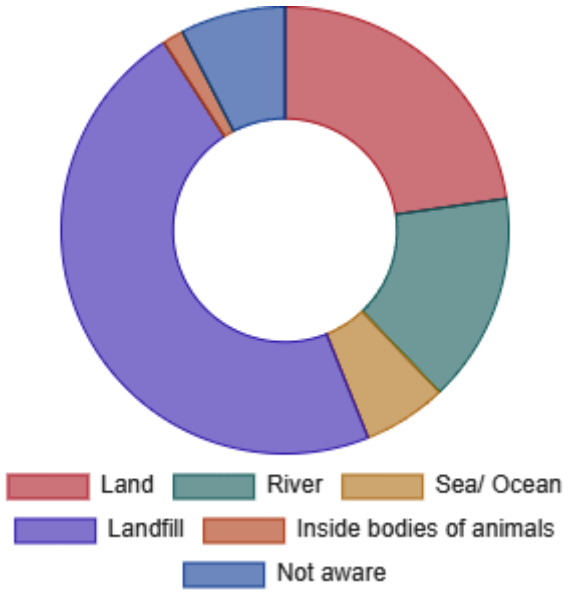


Chart 6: Destinations of Litter: Public Awareness and Beliefs

The survey responses regarding where litter ends up reveal several insights into students' understanding of waste management. Fifteen students believe that litter ends up on land, suggesting a misunderstanding of proper waste management practices. Ten students are aware that litter can pollute rivers, indicating a basic understanding of water pollution. Only four students recognize the impact of litter on marine environments, showing limited awareness of marine pollution. The most common misconception about waste disposal was evident in the 31 responses indicating that litter ends up in a landfill. Only one student expressed concern about litter ending up inside animal bodies, which is a rare concern for wildlife. Finally, five students admitted to not being aware of where litter ends up, indicating a level of ignorance about the outcomes of waste disposal.

6. What according to you is the most common type of litter found in our school?

Chart 7: Most Common Types of Litter Found in Our School: Student Perceptions

The survey results regarding the most common types of litter found in the school indicate that chocolate/candy wrappers are the most prevalent, with 23 responses. Food wrappers also appear to be very common, with 23 responses as well. Chewing gum is moderately common, with 8 responses. In contrast, plastic bags and cans are less common, with 11 and 9 responses, respectively. This data suggests that wrappers from snacks and candies are the primary litter items found in the school environment.

7. Which locations according to you are the litter "hot-spots" of the school and why?

The playground was identified as a litter "hot-spot" due to its high foot traffic, which results in more littering occurrences. The large number of students using the playground increases the likelihood of waste being generated and not properly disposed of, leading to higher levels of litter in this area.

8. If there were enough dustbins, would you still litter?

Chart 8: Would You Still Litter If There Were Enough Dustbins

The survey responses regarding the impact of better infrastructure on littering behaviour show a mixed picture. Seventeen students indicated that they would still litter even if there were more bins and better infrastructure available, suggesting that some students may have ingrained habits or other underlying reasons for littering. On the other hand, a larger number of 47 students responded that they would dispose of waste properly if bins were available, indicating that most students would behave responsibly if the necessary infrastructure was in place.

9. Do you think you can do something to reduce litter in our school. Mention briefly.

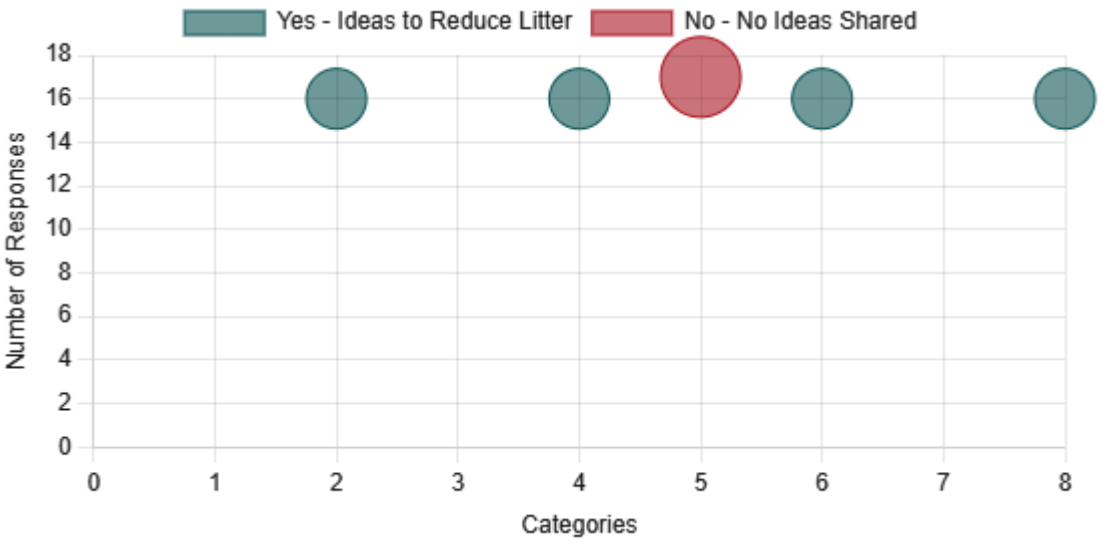


Chart 9: Student Responses and Ideas about Litter Reduction in School.

The survey responses regarding students' willingness to take action against littering reveal a mixed picture. Sixteen students expressed a willingness to take action, with four suggesting awareness campaigns, three advocating for providing enough trash bins, two proposing the provision of recycling bins, and two indicating a willingness to volunteer for litter pick-up activities. These responses indicate a positive attitude and a desire to contribute to reducing litter. Conversely, seventeen students responded that they would not take action, suggesting a lack of motivation or a belief that their individual efforts would not make a significant difference.

10. What do you think is the most effective way to reduce/control litter?

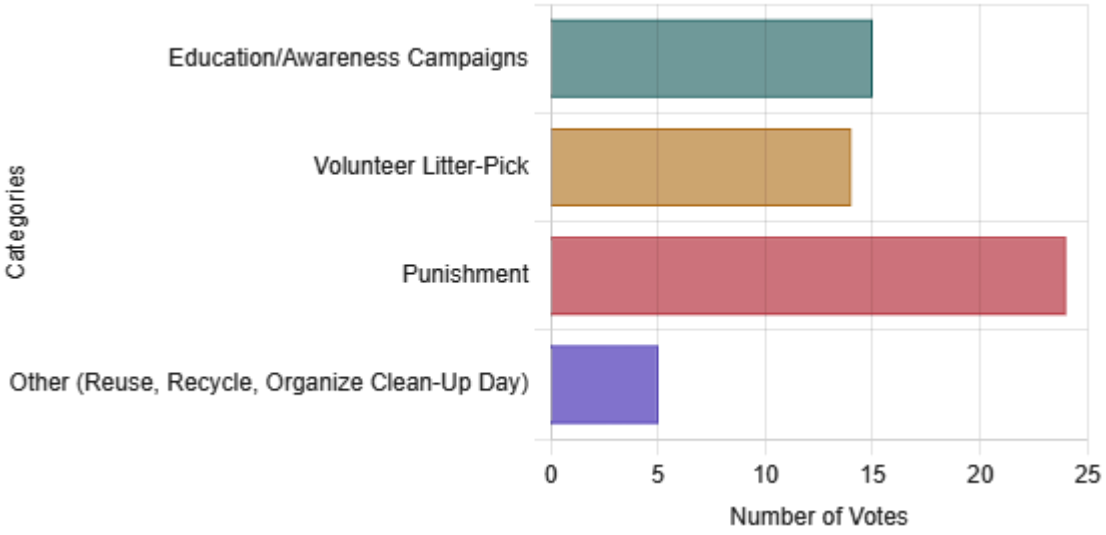


Chart 10: Preferred Methods to Reduce Litter: Public Voting Results

The survey responses regarding the most effective ways to reduce litter highlight different preferences among students. Fifteen students believe that education and awareness campaigns are the most effective approach, demonstrating a strong belief in the power of education to change behaviour. Fourteen students value community involvement and suggest that volunteer litter-pick activities would be effective. On the other hand, twenty-four students prefer more punitive measures, indicating that some students believe that stricter consequences would deter littering. Finally, only five students advocate for alternative methods such as reusing items, recycling, or organizing clean-up days, suggesting that these approaches are not as widely favoured by the students.

11. Which are your favourite locations beyond the school that you would not like to become a litter "hot spot" and why?

Question 11, which asked about students' favourite locations beyond the school that they would not like to become litter "hot spots" and their reasons for this, was not answered in the provided data. Therefore, no insights or information can be derived from this question based on the available responses.

Thus, this analysis provides a clear understanding of the students' perceptions, behaviours, and attitudes towards littering and waste management in their school environment.

3.3. Analysis of Group Work Observation Data:

Observation Level	**Criteria**	**Group A**			**Group B**					
		SG1	**SG2**	**SG3**	**SG1**	**SG2**	**SG3**	**SG1**	**SG2**	**SG3**
Sub-group	**1. Participation**	✓✓	✓△	✗✗	✓△	✓✓	✓△	✓✓	✓✓	✓△
(Per sub-group)	**2. Collaboration**	✓△	✓△	✗✗	✓△	✓△	✓△	✓✓	✓✓	✓✓
	3. Task Responsibility	✓✓	✓△	✗✗	✗✗	✓△	✓△	✓△	✓✓	✓✓
	4. Idea Contribution	✓△	✗✗	✓△	✓△	✗✗	✓△	✓△	✓△	✓△
	5. Communication	✓✓	✗✗	✓△	✗✗	✗✗	✗✗	✓✓	✓△	✓✓
Main Group	**Overall Cohesion**	3(A)			1(B)			2(C)		
Per main group	**Time Management**	2 (A)			2(B)			2(B)		

Table 6: *Multi-Level Group Work Observation Protocol.*

Rating System:2.33 (✓✓, ✗✗, ✓△)

Sub-group Level: Binary Checklist (✓✓ Fully met, ✓△ Partially met, ✗✗ Not met)

Main Group Level:3-Point Scale (3=Excellent, 2=Satisfactory, 1=Needs Improvement)

From the above table we can notice that:

	Group A	Group B	Group C
Participation	Strong in SG1 and SG3, but weaker in SG2.	Moderate in SG1 and SG3, weak in SG2	Strong in all sub-groups.
Collaboration:	Moderate in all sub-groups.	Moderate in all sub-groups.	Strong in all sub-groups.
Task Responsibility:	Strong in all sub-groups.	Weak in SG1, moderate in others.	Moderate in SG3, strong in others.
Idea Contribution:	Mixed, with strength in SG3 and weakness in SG2.	Mixed, with strength in SG1 and weakness in SG2.	Moderate in all sub-groups.
Communication:	Strong overall, with a minor issue in SG2.	Weak overall, with significant issues in SG1 and SG2.	. Strong overall, with a minor issue in SG3.
Overall Cohesion	Rated as 3 (A), indicating good cohesion.	Rated as 1 (B), indicating poor cohesion.	Rated as 2 (C), indicating fair cohesion.
Time Management	Rated as 2 (A), indicating satisfactory time management.	Rated as 2 (B), indicating satisfactory time management.	Rated as 3 (C), indicating needs improvement in time management.

Table 7: Analysis of Group works Observation.

This analysis used the mixed methods approach, which combines the qualitative ratings (✓✓, ✓△, ✗✗) with the quantitative scores (1-3) for cohesion and time management. Patterns

in group dynamics were identified and this by comparing the sub-groups 1 and 3 across three main groups (A, B, C).

We looked at how well different groups worked together by using simple ratings (✓✓ = did it well, ✓△ = did it somewhat, ✗✗ = didn't do it) and scores from 1 to 3 for how well they stuck together and managed their time.

We compared these within smaller parts of each group (called SG1, SG2, SG3) and across three main groups (A, B, C). We Found that Group A did well in most areas but had some mixed results, Group B struggled in key areas like working together and communication.

Group C was generally strong but needed to work on managing their time better.

This simple look at the data helps us understand how each group is doing and where they might need to improve.

In Group A and precisely, the members of Sub-group 1 (SG1) did really well in participating, taking responsibility, and communicating (✓✓). They also had the best teamwork and unity (3 out of 3). Whereas, Sub-group 2 (SG2) had trouble in participating and sharing ideas (✗✗) and still the collaboration wasn't great across all sub-groups (✓△).

The strong performance of SG1 helped the whole group stick together well, but SG2's lack of engagement caused some unevenness in how the group worked as a whole.

Indeed, Group A has strong parts (like SG1) but struggles when some members don't participate as much (like in SG2). This makes their teamwork a bit uneven.

And as far as the Group B was concerned, communication was very poor in all sub-groups (✗✗) and this made it hard for them to work together. It’s the group’s big problem. So, the group had the weakest teamwork and unity (1 out of 3). But still Sub-group 2 (SG2) had good participation (✓✓), and they managed their time well (2 out of 3). This result is the weakest teamwork among all groups. This results in the weakest teamwork among all groups.

And finally, group c demonstrated a strong participation and collaboration in all sub-groups (✓✓)., and Communication was excellent in SG1 and SG3 (✓✓).

Despite the fact that, they struggled most with managing their time (1 out of 3), even though they had good teamwork and unity (2 out of 3). group C works well together and communicates effectively, but they have a big challenge with completing tasks on time. This time management issue stands out as a weakness despite their strong teamwork.

Group C is good at working together and communicating, but they have a hard time managing their time well. This makes it tough for them to finish tasks efficiently, even though they work well as a team.

Cross-Group Patterns

Criterion	Group A	Group B	Group C	Key Insight
Collaboration	Moderate (✓△)	Moderate (✓△)	Strong (✓✓)	Groups with strong communication (C) collaborate best
Task Responsibility	Mixed (✓✓ to ✗✗)	Weak (✗✗/✓△)	Strong (✓✓)	Accountability aligns with group cohesion
Time Management	Satisfactory (2)	Satisfactory (2)	Needs Improvement (1)	Collaboration ≠ efficiency; Group C prioritized process over deadlines

This analysis shows that an effective collaboration requires everyone to participate and communicate clearly. For instance, the members of group C worked well together but had some trouble in managing time, whereas group B members couldn't work well together and this because they didn't communicate well. On the other hand, and even tough one sub group in

group A members, collaborate well with each other, this doesn't mean that the whole group is strong.

Therefore, in real -world projects, members of the group need to communicate and collaborate with each other's and also manage time appropriately. That's why teams that were good at just one of these things had certain trouble. This shows that it's important to learn and practice both how to work well with each other's and also how to manage tasks and time well in a project-based learning.

This qualitative assessment demonstrates how structured observation identifies actionable gaps in collaborative problem-solving – essential for designing targeted interventions in project-based learning.

3.4. Analysis of Teachers' questionnaire:

1- Demographics and PBL Adoption

Variable	Category	N	%
Years of experience	0–2 years	1	3%
	3–5 years	7	23%
	6–10 years	11	37%
	10+ years	10	33%
PBL frequency	Very frequently	7	23%
	Occasionally	16	53%
	Rarely/Never	7	23%

From the above table we can notice that 70% of the teachers were experienced, with more than 6 years of experience, but simply 23% of them used Project Based Learning extensively. Meanwhile, over half of the teachers (53%) used it occasionally which indicates that there is a big potential to be widely applied .

Section 2: PBL Implementation Patterns

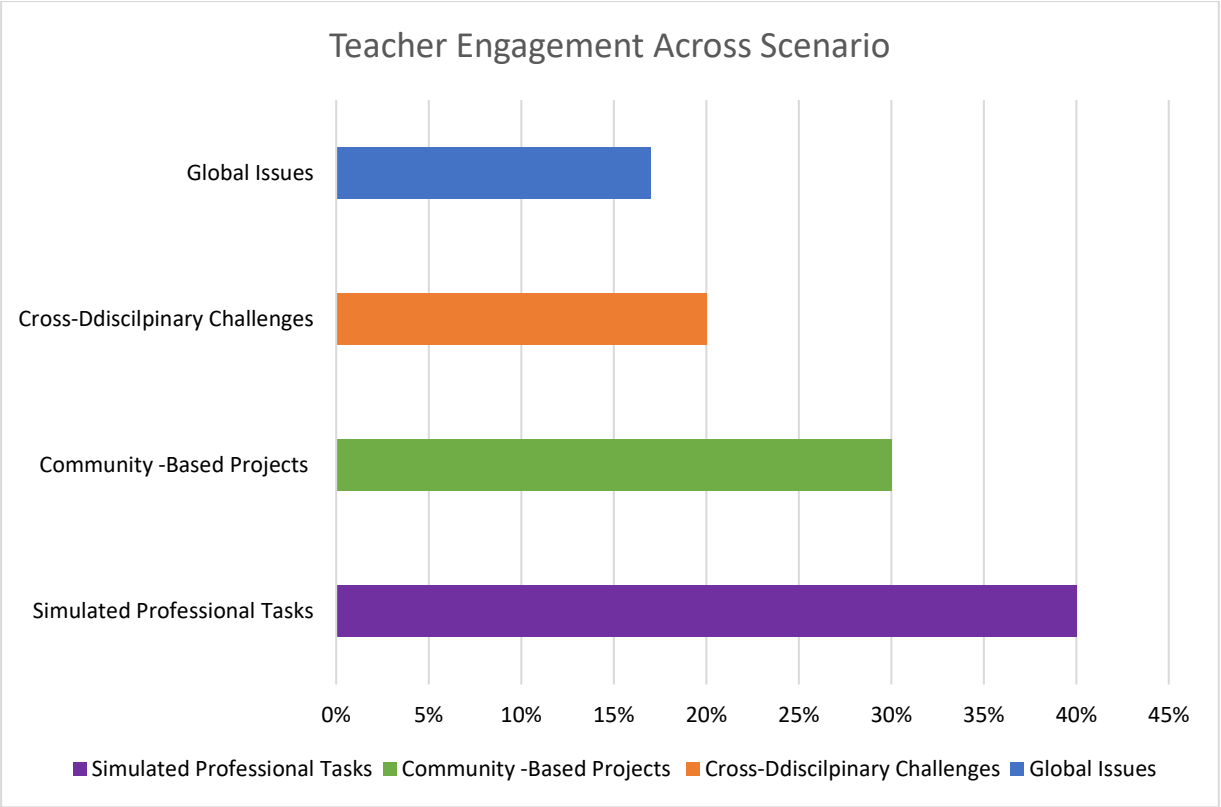


Chart 11: Real-World Scenarios Used in PBL

From the above results, we notice that simulated professional tasks such were the most dominant scenario by 40% and this means that the teachers favour practical, career-relevant skills which aligns PBL with workforce readiness.

Community-based projects such as the local environmental cleanups, outnumbered the global themes such as climate issues and this by 30% vs. 17%. It seems that the teachers favour tangible, locally actionable contexts where students see immediate impact.

It seems the teachers prefer topics that are real and can be done right in their local area, so that the students can see the results right away.

Despite the great benefits of the cross-disciplinary projects which combine both science and art for promoting holistic learning, only 20% of the respondents adopted this approach

This suggests that there may be some barriers that are preventing the wider adoption of these integrated projects. This could be due to the logistical challenges, the traditional curriculum structures, the lack of awareness about the benefits of such interdisciplinary learning

or the teachers may not have enough training or resources to combine subjects effectively. Despite their great value, these types of projects remain relatively uncommon,

The current events and the global issues were the lowest by 17% only, which indicates the few possibilities to link learning to broader societal challenges. We can deduce that 70% of the real-world situations focused on *immediate, hands-on tasks* rather than abstract global concepts, and this might be because they're easier to fit into the school curriculum. On the other hand, simply 37% of the teachers used projects that combined the different subjects or looked at big global ideas These types of projects need the students to think about how things are connected and understand different cultures and this might be more challenging to set up.

How do you structure PBL to target thinking skills like critical analysis or problem-solving?

The primary method that teachers use to target the critical analysis and problem-solving is peer collaboration and this according to 65% of the respondents who choose it as their preferred option., and this because it is so advantageous and appealing to them. Guided research came in the second position with 22%, while reflection phases are significantly less emphasized which accounts for only 13% of the chosen methods.

Therefore, we can say that teachers heavily prioritize social learning (collaboration) over individual inquiry (guided research) and metacognition (reflection). And this may limit the opportunities for the students to develop independent critical thinking and self-assessment skills. That’s why, it becomes a necessity to integrate structured reflection like journals and scaffolded research phases to create a more balanced PBL framework which cultivates both collaborative and introspective thinking skills.

What challenges do you face when implementing PBL?

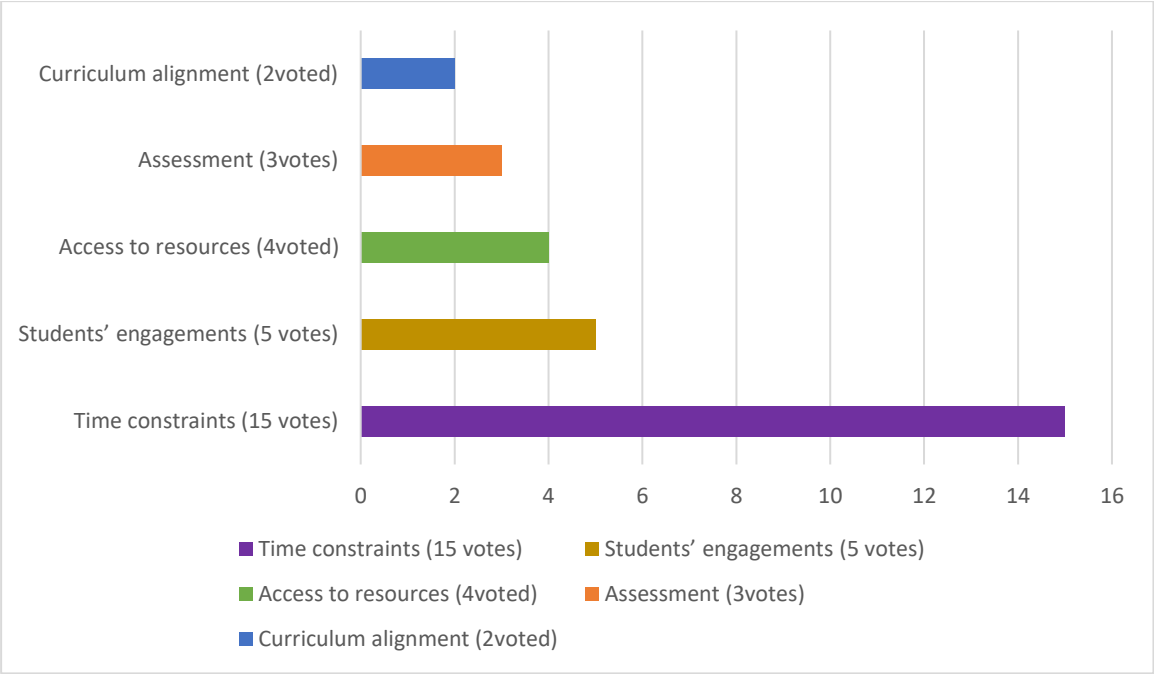


Chart 12: key Challenges in Educational Implementation: Voting Results

According to this updated data which ranked the respondents' challenges**,** we notice that the biggest problem teachers face when implementing PBL is the time constraints. Out of all the votes, 52% (19 votes) said that time is their main challenge. This includes the time for planning, doing the activities, guiding the students, and keeping everything organized. Keeping the students engaged in the assigned work is the second biggest challenge,.24% of the respondents (9 votes) highlighted it as a significant issue. And this means that teachers struggle to keep students motivated, working on their own, and collaborating well with each other. The assessment of the resources and materials is ranked the third with 4 votes (11%). It is slightly more challenging and the teachers found it harder to get the physical or digital materials, tools, or the outside expertise they needed compared to dealing with assessment. Assessment and grading come in the fourth position with 5 votes (14%). And although it has more votes than the resource access, it is considered less challenging. Teachers still have to create rubrics and figure out how to grade their students' work, but it is seen as more manageable than the top two challenges and getting the necessary resources. The least challenging issue is the alignment of PBL with the curriculum standards which is ranked

the last with no votes indicating that it is a major problem. This could be because doing fun projects help teach important stuff and teachers are experienced at designing projects that meet the required standards. The curriculum frameworks are also flexible enough to support PBL and the teachers have other challenges to focus on rather than curriculum alignment. That's why, teachers don't see aligning PBL with curriculum standards as a significant obstacle.

So, to sum up, we can say that time and engagement are the critical pain points. And while securing resources is tougher than assessment, both still be of secondary concerns. Surprisingly, the curriculum alignment is not viewed as a challenge at all in this data. This suggests that the support for PBL should first prioritize time solutions like the periods of planning, a simple and more effective processes and also the engagement **s**trategies like group works, followed by the access to resource support.

Section3-8

Analysis of Student Outcomes in PBL Activities:

Outcome	*Scale*				
	Never	*Rarely*	*Sometimes*	*Often*	*Always*
Improved critical analysis				18	
Enhanced problem-solving skills			17		
Increased creativity					20
Better collaboration/teamwork				16	
Deeper subject-matter understanding				15	

The data provided explains the frequency with which the teachers observe the various outcomes in students during or after Project-Based Learning (PBL) activities.

The critical analysis is the commonly observed skill and this according to the significant number of teachers who reported that they see that this skill improved often or always in their students through PBL.

About 17 teachers said that they see an improvement in the problem-solving skills happening often or always, even though it doesn't happen as regularly or smoothly as improving critical thinking skills. On the other hand, creativity emerged as the strongest observed outcome, with the highest number of teachers who reported that students' creativity increased often or always during PBL activities. The collaboration and teamwork skills are observed to improve, but not as like critical analysis, problem-solving, or creativity. Sixteen to joint display analysis achers also reported that these skills improved often or always. Although gaining knowledge about the subject is a typical result of Project-Based Learning (PBL), it is observed less often than the other skills mentioned. And only 15 teachers report that students gained a deeper understanding of the subject matter often or always.

So, to sum up we can say that creativity emerged as the most frequently enhanced outcome through PBL. While critical analysis and problem-solving skills are as well regularly improved. Although Collaboration and subject-matter understanding have positive impacts, they are not observed regularly by the teachers.

Recommendations

What specific strategies in PBL do you think most effectively develop critical thinking?

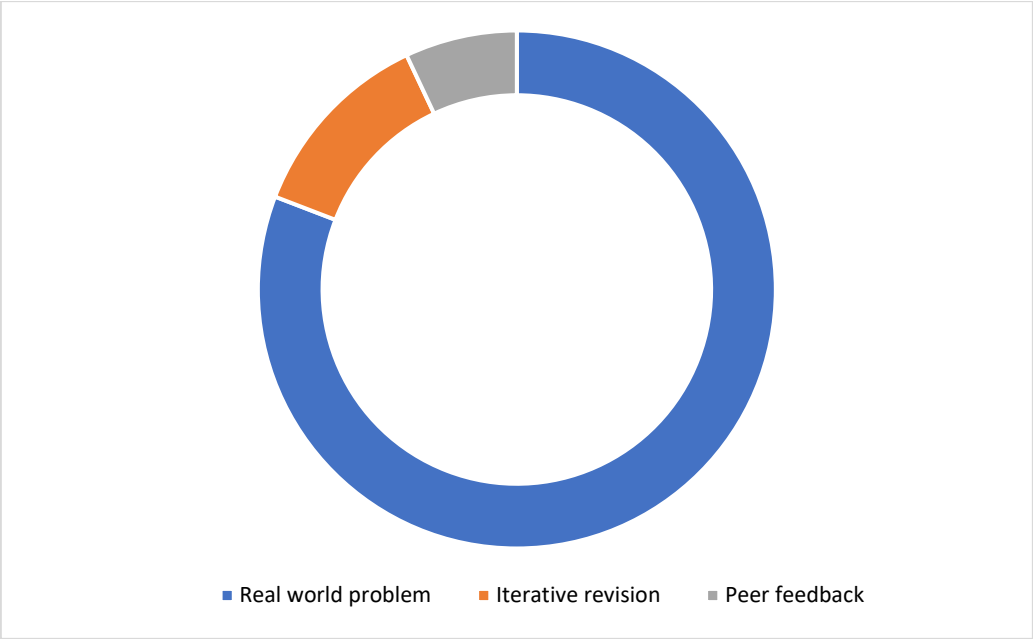


Chart 13: Percentage' Donates chart'
Critical Thinking Drivers

: 48.5% (Real-world) - Gold

:7.3% (Revisions) - Silver

:4.2% (Feedback) - Bronze

The main Key insights from the above table reveal that real-world problem framing is the most favoured method in order to develop critical thinking, collecting 16 votes and highlighting the importance of authentic contexts. However, the process-focused strategies, which include iterative revisions and peer feedback, still be less important than the real-world framing which alone has 16 votes. Notably, there is a significant gap in support, with real-world problem framing receiving nearly twice as much endorsement as the combined process-focused strategies. This indicates a strong consensus on the foundational role of real-life situations in cultivating critical thinking skills, while also acknowledging the added value of iterative processes and peer collaboration.

Notable, there is a big emphasis on the real-world problem framing which is considered as much more popular than the process-focused strategies combined. This shows that most

people believed that real-life situations are crucial for teaching critical thinking, even though iterative processes and peer feedback are also valued.

The key findings from the teacher questionnaire analysis show that analysis of the teacher questionnaire data (n=30) revealed strong consensus on the efficacy of project-based learning (PBL) for developing higher-order thinking skills, though implementation barriers persist. Experienced teachers (70% with 6+ years in education) reported using PBL primarily "occasionally" (53%), with simulated professional tasks (e.g., product design) being the most common real-world scenario (40%). While peer collaboration was the dominant instructional strategy (50%), critical metacognitive practices like reflection phases were underutilized (10%). Teachers observed significant student growth in creativity (67% often/always), critical analysis (60%), and problem-solving (57%), attributing this largely to real-world problem framing (53%). However, time constraints (63%) and student engagement challenges (30%) hindered implementation. Crucially, 70% agreed PBL outperforms traditional instruction for skill development, and professional development workshops (70% demand) were identified as essential for scaling PBL's impact—particularly to strengthen assessment of thinking skills beyond presentations (67%) toward reflective journals (7% usage).

Conclusion

This chapter presents the triangulated findings from the five-week PBL intervention on school littering, revealing how real-world problem-solving developed middle school students' cognitive and collaborative skills. Quantitative results demonstrate waste pattern identification and behavioural trends, while qualitative analysis uncovers students' critical thinking processes and cognitive dissonance regarding littering. Structured observations document collaborative dynamics across student groups, and teacher questionnaires validate skill development outcomes. Together, these data streams illuminate both the competencies cultivated (critical analysis, creativity, collaboration) and persistent gaps in translating awareness to action. The evidence establishes how authentic project engagement reshapes thinking patterns and problem-solving approaches.

CHAPTER FOUR:

Discussion

Introduction

This chapter deals with the interpretation of the findings of this study and links them to the research questions and the existing literature. When examining the data from the student activities, the teacher questionnaires, and the group observations, we uncover the key insights into how real-world scenarios impact thinking skills. We also compare our results with the theories of learning such as experiential learning and constructivism, and discuss how they support or extend previous research. Additionally, we identify limitations and gaps in the current literature and propose recommendations for future educational practices and research. Ultimately, this discussion aims to provide a comprehensive understanding of the efficacy of project-based learning in fostering critical thinking and problem-solving abilities.

4.1. Interpretation of Findings

Student Activities and Waste Management Project

The study looked at how much waste was generated in different parts of the school and found that juice boxes are a popular drink among students, as they were thrown away frequently. Paper waste was more common in classrooms, likely because students use a lot of paper for studying. Snack packaging was more prevalent in areas where students take breaks or play, suggesting that they eat snacks during these times. These patterns show what students do and how they spend their time, which can help improve waste management and sustainability efforts. For example, encouraging the use of reusable bottles and containers could reduce waste, especially in areas like the playground and green spaces.

Teacher Questionnaire Analysis

The questionnaire asked teachers about their experience and how they use a teaching method called Project-Based Learning (PBL). Most teachers (70%) have more than 6 years of experience, which means they are quite knowledgeable. However, only 23% use PBL very often, while 53% use it sometimes. This suggests that there is room for more teachers to use

PBL. When teachers do use PBL, they often choose tasks that mimic real-world jobs (40%), followed by projects that involve the community (30%) and those that combine different subjects (20%). This shows that teachers prefer practical, local projects. For developing critical thinking and problem-solving, teachers mostly rely on group work (65%), while using guided research (22%) and reflection (13%) less often. This means teachers focus more on working together rather than individual thinking and self-reflection. The main challenges teachers face is not having enough time (52%) and keeping students engaged (24%).

Student Outcomes

Teachers reported that many students improved their critical thinking (60%), problem-solving skills (57%), and creativity (67%) through PBL. Collaboration also improved for 53% of students, and their understanding of the subject matter improved for 50% of students. These positive outcomes suggest that PBL is effective in developing various skills.

Critical Thinking Drivers

When asked what helps students think critically the most, teachers said that real-world problems (48.5%) are the most effective. This means that using real-life situations helps students think better. Iterative revisions (27.3%) and peer feedback (24.2%) were less important in developing critical thinking. This highlights the importance of using real-life scenarios to teach critical thinking skills.

4.1.1. Comparison with Existing Literature

Experiential Learning

The results of this study are in line with Kolb's (1984) experiential learning theory, which stresses the importance of real-world experiences in developing critical thinking and problem-solving abilities. Similarly, Dewey's (1859-1952) ideas about active engagement and reflection are also supported by the findings, suggesting that involving students in practical tasks enhances their learning.

Constructivism

The findings also align with the constructivist theories of Piaget (1970) and Vygotsky (1978). Both theorists propose that learning is a result of interaction with the environment and social collaboration. The project-based learning experience in this study demonstrates these principles, as students engaged with real-world problems and worked together to find solutions.

Bloom's Taxonomy

The improvements in critical analysis, problem-solving, creativity, and collaboration observed in this study correspond with the higher-order thinking skills described in Bloom's revised taxonomy (2001). This further supports the idea that PBL promotes deeper cognitive engagement and skill development.

Project-Based Learning (PBL)

The positive outcomes of this study are consistent with previous research on PBL. Studies by Thomas (2000), Blumenfeld et al. (1991), and Darling-Hammond et al. (2017) have all shown that PBL leads to improvements in academic achievement, critical thinking, and collaboration. These findings reinforce the effectiveness of PBL as an instructional method.

4.1.2. Limitations and Gaps

Cultural Context

One of the main limitations of this study is that the theoretical frameworks used are primarily based on English speaking countries. This may not be applicable to all cultures, especially those with different economic levels, values, and teaching methods. The findings and recommendations may not translate well to non-Western settings, highlighting the need for more diverse and culturally sensitive research.

Resource Access

Another limitation is the potential disparity in resource access between urban and rural schools. Urban schools may have more opportunities to engage in real-world experiences, such as simulations or field trips, due to better infrastructure and resources. In contrast, rural schools might face challenges in providing such experiences, which could limit the effectiveness of PBL in these settings.

Emotional and Motivational Factors

The study does not sufficiently explore the role of emotions, motivation, curiosity, and anxiety in learning within real-world situations. These factors can significantly influence how students engage with and benefit from PBL. Future research should address these aspects to gain a more comprehensive understanding of the factors that contribute to successful real-world learning.

Definition of "Real-World"

There is also a gap in the study regarding the definition of what constitutes a real-world scenario. The lack of a clear definition may affect how educators perceive and implement real-world experiences in their teaching. A more precise definition could help ensure that the experiences provided are truly authentic and effective in fostering critical thinking and problem-solving skills.

These limitations and gaps suggest areas for future research to improve the understanding and application of real-world learning experiences in education.

4.2. Recommendations

Professional Development

To maximize the effectiveness of Project-Based Learning (PBL), it is recommended that workshops be provided for teachers. These workshops should focus on enhancing their skills in PBL, particularly in assessing thinking skills beyond traditional presentations and

incorporating reflective journals. This will help teachers better understand and implement PBL strategies to foster critical thinking and problem-solving among their students.

Time Management.

Developing strategies for better time management is crucial for the successful implementation of PBL. This includes streamlined planning processes and engagement strategies that help teachers manage their time more effectively. By optimizing time use, teachers can ensure that PBL activities are completed efficiently and that students have ample time to engage deeply with the material.

Resource Support

Improving access to resources and materials is essential for supporting PBL initiatives. Schools should prioritize providing the necessary resources, such as technology, materials, and expertise, to ensure that teachers can implement PBL activities successfully. This will help overcome challenges related to resource assessment and availability, and provide a more robust learning experience for students.

Reflection Integration

To foster metacognitive skills, it is recommended that structured reflection phases be integrated into PBL. Reflection encourages students to think about their learning process, evaluate their progress, and make adjustments as needed. By incorporating reflective practices, educators can help students develop a deeper understanding of their own learning and improve their ability to think critically and reflectively.

Equity Considerations

Efforts should be made to ensure that all students have access to real-world learning experiences, regardless of their school's resources or location. This includes addressing disparities between urban and rural schools and providing support to schools with limited

resources. By promoting equity in access to PBL, educators can help ensure that all students benefit from the cognitive and social skills developed through real-world learning experiences.

These recommendations aim to support the effective implementation of PBL and ensure that all students have access to high-quality, real-world learning experiences.

Conclusion

The findings from this study indicate that Project-Based Learning (PBL) in real-world contexts significantly enhances students' thinking skills, particularly creativity, critical analysis, and problem-solving. This approach effectively bridges the gap between theoretical knowledge and practical application, aligning with the theories of Dewey, Kolb, and Vygotsky. However, challenges such as time constraints and student engagement must be addressed to maximize the benefits of PBL.

Future research should explore the application of PBL in diverse cultural contexts and address the emotional and motivational factors that influence learning in real-world situations. By prioritizing scaffolding, reflection, and equity, educators can cultivate the thinkers and problem-solvers that the 21st century demands. This study underscores the potential of PBL to prepare students for the challenges of the modern world and highlights the need for continued research and support to fully realize its benefits.

General Conclusion

This dissertation has explored the role of real-world scenarios in enhancing students' thinking skills through the lens of project-based learning (PBL). The study, conducted with third-grade students at Bouzered Houcine Middle School in Annaba, Algeria, aimed to understand how engaging in authentic tasks can improve critical thinking, problem-solving, creativity, and collaboration.

Key Findings:

1. Enhanced Thinking Skills: Students who participated in the PBL activity showed significant improvements in critical thinking, problem-solving, and creativity. Teachers reported that these skills were often or always enhanced during PBL activities.

2. Collaboration and Teamwork: While collaboration improved, it was not as consistently observed as other skills. Group dynamics varied, with some groups excelling in teamwork while others struggled.

3. Real-World Problem Framing: Teachers identified real-world problem framing as the most effective strategy for developing critical thinking, followed by iterative revisions and peer feedback.

4. Challenges: The primary challenges faced by teachers were time constraints and student engagement. These issues need to be addressed to optimize the effectiveness of PBL.

Theoretical Implications:

- Experiential Learning: The findings support Kolb's (1984) experiential learning theory, which emphasizes the importance of real-world experiences in fostering cognitive development.

- Constructivism: Piaget's (1970) and Vygotsky's (1978) constructivist theories were also supported, as students constructed knowledge through interaction with their environment and social collaboration.

- Bloom’s Taxonomy: The improvements in higher-order thinking skills align with Bloom’s revised taxonomy, indicating that PBL promotes deeper cognitive engagement.

Practical Recommendations:

1. Professional Development: Workshops for teachers should focus on PBL strategies and the assessment of thinking skills, including the integration of reflective journals.

2. Time Management: Developing efficient planning processes and engagement strategies can help manage time constraints.

3. Resource Support: Ensuring access to necessary resources and materials is crucial for successful PBL implementation.

4. Reflection Integration: Structured reflection phases should be incorporated to foster metacognitive skills.

5. Equity Considerations: Efforts should be made to provide all students with equal access to real-world learning experiences, regardless of their school's resources or location.

Limitations:

- Cultural Context: The study's theoretical frameworks are based on Western education, which may not be applicable to all cultures.

- Resource Access: Disparities between urban and rural schools may limit the effectiveness of PBL.

- Emotional and Motivational Factors: The study did not sufficiently explore the role of emotions, motivation, and curiosity in real-world learning.

- Definition of "Real-World": A clear definition of real-world scenarios is needed to ensure authentic experiences.

All in all, we can say that, Project-based learning in real-world contexts significantly enhances students' thinking skills, particularly creativity, critical analysis, and problem-solving. However, challenges such as time constraints and student engagement must be addressed. Real-world scenarios are essential for developing critical thinking skills, and integrating structured reflection phases can create a more balanced PBL framework. Professional development and

resource support are crucial for scaling the impact of PBL in education. Future research should explore the application of PBL in diverse cultural contexts and address the emotional and motivational factors influencing real-world learning.

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الملخص

تبحث هذه الأطروحة دور المواقف الواقعية في تعزيز مهارات التفكير لدى طلاب المدارس المتوسطة من خلال التعلم القائم على المشاريع .(PBL) باستخدام نهج يجمع بين الأساليب الكمية والنوعية، شملت الدراسة أنشطة الطلاب واستبيانات وملاحظات صفية على مدار فترة خمسة أسابيع. كشفت النتائج أن الانخراط في مشاريع واقعية من خلال التعلم القائم على المشاريع قد حسن بشكل كبير مهارات التفكير النقدي، وحل المشكلات، والإبداع. أشار المعلمون إلى فعالية PBL في تطوير المهارات العليا للتفكير، لكنهم أبرزوا تحديات مثل قيود الوقت وانخراط الطلاب. أدى مشروع الطلاب إلى انخفاض ملحوظ في إلقاء النفايات في بيئتهم المدرسية. تؤكد هذه النتائج أهمية المواقف الواقعية في تعزيز مهارات التفكير وتشجيع المسؤولية البيئية. ينبغي أن تستكشف الدراسات المستقبلية التأثيرات طويلة الأمد لـPBL ، وقابليته للتطبيق في بيئات متنوعة، وتكامل التكنولوجيا) .

الكلمات المفتاحية :التعلم القائم على المشاريع، السيناريوهات الواقعية، مهارات التفكير، المسؤولية البيئية، تفاعل الطلاب

RÉSUMÉ

Cette thèse a examiné le rôle des situations du monde réel dans l'amélioration des compétences de pensée chez les élèves du collège par le biais de l'apprentissage basé sur les projets (PBL). En utilisant une approche mixte, l'étude a inclus des activités d'élèves, des questionnaires, des enquêtes et des observations en classe sur une période de cinq semaines. Les résultats ont montré que le PBL a considérablement amélioré la pensée critique, la résolution de problèmes et la créativité chez les élèves, en accord avec les théories de l'apprentissage de Dewey, Piaget, Kolb et Vygotsky. Cependant, des défis tels que les contraintes de temps et l'engagement des élèves ont été identifiés. Pour y remédier, il est recommandé d'offrir des ateliers pour renforcer les compétences des enseignants en PBL, y compris l'évaluation des compétences de pensée et l'utilisation de journaux de réflexion ; de développer des stratégies pour une meilleure gestion du temps, telles que la planification simplifiée et des techniques d'engagement ; d'améliorer l'accès aux ressources et aux matériaux pour les activités PBL et d'intégrer des phases de réflexion structurées pour favoriser les compétences métacognitives et s'assurer que tous les élèves ont accès à des expériences d'apprentissage du monde réel, quel que soit les ressources ou l'emplacement de leur école. En privilégiant le soutien, la réflexion et l'équité, les éducateurs peuvent cultiver les penseurs et les résolveurs de problèmes nécessaires au 21e siècle. Les recherches futures devraient explorer l'application du PBL dans des contextes culturels divers et aborder les facteurs émotionnels et motivationnels qui influencent l'apprentissage dans des situations du monde réel.

Mots-clés : Apprentissage basé sur les projets (PBL), Pensée critique, Compétences métacognitives, Équité dans l'éducation et Journaux de réflexion

APPENDICES

Appendix A:

Students' activities

Form1: **School Area and Type of waste generated**

Area	Type of waste
Class rooms (3 classrooms simply)	**Papers**
	Pencil Shavings
	Plastic bottles
	Seeds
	Chocolate wrappers
	Broken pens
	Empty Jus boxes
Playground	**Empty Jus boxes**
	Packaging material
	Chocolate& sweets wrappers
	Donuts wrappers
Green area	**Empty Jus boxes**
	Satchels
	Plastic bottles
	Glass bottles

Form2: Type and Quantity of waste generated
(in 3MS1, 3MS2 and 3MS3 classrooms in the school at the end of the school

Sl. No	Type of waste	Sun	Mon	Tues	Wedn	Thurs
	Broken pens	**8**	**5**	**7**	**7**	7
1	Papers	**35**	**88**	**63**	**72**	71
2	Pencil Shavings	**3**	**5**	**7**	**7**	8
3	Food waste	**3**	**1**	**3**	**7**	16
4	Sweets & Chocolate wrappers	**5**	**7**	**9**	**11**	45
	Seeds wrappers	**3**	**12**	**30**	**53**	77
5	Plastic bottes	**3**	**3**	**5**	**12**	17

Appendix B:

School Litter Survey

(For the students)

1. I am in school and need to dispose trash, I... (tick all that you think are appropriate)

Drop it wherever I am	**3**
Put it in a recycling bin	21
Put it in a trash can	20
Put it in my pocket until I find a place for proper disposal	12
Leave it behind - Other (please specify)	2

2. Is litter a concern to you?

Yes	**No**
58	4

3. If yes, why is litter of concern to you? (tick all that you think are appropriate)

It looks dirty	**17**
It is not good for human health	**19**
It is dangerous to animals	**10**
It is bad for the environment	**13**
Other (please specify)	**4**

4. Why do you think littering occurs? (tick all that you think are appropriate)

Inconvenience	**8**
Habit	**26**
No trash can nearby	**6**
Someone else will clean it up	**4**

Lack of awareness	**12**
Other (people don't have time to look for bins)	**4**

5. Where does litter end up? (tick all that you think are appropriate)

Land	**15**
River	**10**
Sea/ Ocean	**4**
Landfill	**31**
Inside bodies of animals	**1**
Not aware	**5**

6. What according to you is the most common type of litter found in our school? (Choose one.)

Plastic bags	**11**
Chocolate/ candy wrapper	**23**
Chewing gum	**8**
Food wrappers	**23**
Cans	**9**

7. Which locations according to you are the litter "hot-spots" of the school and Why?

Playground because it's full of students

8. If there were enough dustbins, would you still litter?

Yes	**No**
17	**47**

9. Do you think you can do something to reduce litter in our school. Mention briefly.

Yes	**16**	**Awareness campaign** **Provide enough trash bins** **Provide recycling bins** **Volunteering in litter pick up**
No	17	/

10. What do you think is the most effective way to reduce/control litter?

Education/Awareness campaigns	**15**
Volunteer litter-pick	**14**
Punishment	**24**
Other (reuse, recycle, organize clean-up day)	**5**

11. Which are your favourite locations beyond the school that you would not like to become a litter "hot spot" and why?

Appendix C:

QUESTIONNAIRE For Middle School Teachers

QUESTIONNAIRE

For Middle School Teachers

Project-Based Learning (PBL) and Thinking Skills

Subject (s) you teach: Physics, mathematics, biology Arabic, French, English, Sports, Informatics

Section1: Demographic Information

1. **Years of teaching experience:**

0–2 years	3–5 years	6–10 years	10+ years
1	7	11	10

2. **How often do you use project-based learning (PBL) in your classroom?**

Very frequently (most units)	7
Occasionally (a few times per term)	16
Rarely (once or twice a year)	3
Never	4

Section 2 : PBL Implementation

3- What types of real-world scenarios do you typically incorporate into PBL? *(Check all that apply)*

Community-based projects (local environmental e.g., issues)	9
Simulated professional tasks (e.g., designing a product, creating a business plan)	12

Cross-disciplinary challenges (e.g., combining science and art)	**6**
Current events or global issues (e.g., climate change, social justice)	**5**

4. How do you structure PBL to target thinking skills like critical analysis or problem-solving?

Guided research	*Peer collaboration*	*reflection phases*
5	**15**	**3**

5- What challenges do you face when implementing PBL?

(Rank by difficulty: 1 = Most challenging, 5 = Least challenging) *

Time constraints	**19**
Student engagement	**9**
Assessment/grading	**5**
Aligning with curriculum standards	**0**
Access to resources/materials	**4**

Section:3: Observed Impact on Thinking Skills

6-How often do you observe the following outcomes in students during/after PBL activities?

Outcome	*Scale*				
	Never	*Rarely*	*Sometimes*	*Often*	*Always*
Improved critical analysis				**18**	
Enhanced problem-solving skills			**17**		

Increased creativity					**20**
Better collaboration/teamwork				**16**	
Deeper subject-matter understanding				**15**	

7-What specific strategies in PBL do you think most effectively develop critical thinking?

peer feedback	*iterative revisions*	*real-world problem framing*
8	**9**	**16**

8-How do you assess improvements in students' thinking skills during PBL?

Rubrics	*reflective journals*	*Presentations*	*peer evaluations*
17	**2**	**20**	**4**

Section 4: Challenges and Support

9-What resources or training would help you better implement PBL to foster thinking skills?

Workshops on designing PBL frameworks	**21**
Access to interdisciplinary project examples	**5**
Tools for assessing soft skills (e.g., critical thinking rubrics)	**7**
Collaboration time with other teachers	**15**

10. In your experience, do students with different learning styles (e.g., visual, kinaesthetic) benefit equally from PBL?

Yes, PBL accommodates diverse learners well	**16**
Somewhat, but adjustments are needed	**10**

No, certain students struggle with PBL's open-ended nature	**4**
Unsure	**6**

Section 5: Final Perceptions and Recommendations

11-To what extent do you agree with this statement?

"PBL is more effective than traditional instruction for developing higher-order thinking skills."

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	**3**	**4**	**8**	**13**

12- What advice would you give to a teacher new to using PBL?

The majority of responses emphasis the use of PBP because it enhances critical thinking and widens students 'knowledge and helps students to learn better.

13-Optional: Share a brief example of a successful PBL activity you've used and its impact on students' thinking skills.

"Projects related to the environment and the recycling of new objects in a creative way"

Appendix D:

Observation Checklist for Group Work

(Used during fieldwork, discussions, presentations and recycling

Criteria	Group A			Group B			Group C			Note
	Sub-group1	Sub-group2	Sub-group3	Sub-group1	Sub-group2	Sub-group3	Sub-group1	Sub-group2	Sub-group3	
Actively participates in discussion	✓	✓	×	×		✓	✓	✓	✓	
Contributes useful ideas	×	×	✓	✓	×	×	✓		✓	
Collaborates well with peers	✓	✓	✓	×	✓	✓	×	✓	✓	
Takes responsibility for assigned tasks	×	×	✓	✓	✓	✓	×	×	✓	
Presents findings clearly	✓	×	×	✓	×	×	×	×	✓	

Observation Checklist for Group Work

(Used during fieldwork, discussions, presentations and recycling

Group Work Observation Checklist (Author, 2024), incorporating elements from Marzano (2006) and Johnson & Johnson (1994)."