From Classroom to Real Life: Contextual Learning in Science Education

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ABSTRACT

Science education aims to develop scientifically literate individuals who can understand, interpret, and apply scientific knowledge in everyday life. However, a persistent challenge in science education is the gap between students' conceptual understanding of scientific principles and their ability to apply those principles in real-world contexts. Many students successfully recall definitions, theories, and formulas for examinations but struggle to use scientific reasoning to explain everyday phenomena or solve practical problems. This study, From Classroom to Real Life: An Investigative Study in Contextual Learning in Science Education, examines the factors contributing to this theory-practice gap and explores the role of contextual learning in strengthening the connection between classroom knowledge and real-life application. Drawing upon constructivist, experiential, and situated learning theories, the study reviews relevant literature on contextual learning, inquiry-based learning, scientific literacy, and experiential education to understand how meaningful learning experiences can enhance knowledge transfer. The study identifies several challenges that limit the practical application of scientific knowledge, including teacher-centred instruction, examination-oriented assessment practices, restricted laboratory experiences, insufficient contextualization of scientific concepts, and limitations in teacher preparation and educational resources. It further demonstrates how real-life examples from physics, chemistry, biology, and environmental science can serve as effective entry points for scientific inquiry and conceptual understanding. The findings suggest that contextual, experiential, and inquiry-based learning approaches enable students to connect scientific concepts with their everyday experiences, thereby improving engagement, critical thinking, problem-solving abilities, and the application of knowledge in unfamiliar situations. The study also highlights the strong alignment between these approaches and the vision of the National Education Policy (NEP) 2020, which emphasizes experiential learning, scientific temper, critical thinking, and competency-based education. The study concludes that meaningful science education requires a shift from rote memorization to application-oriented learning. It recommends collaborative action from teachers, schools, curriculum developers, educational boards, and policymakers to create learning environments where scientific concepts are taught through real-life experiences, inquiry, experimentation, and reflection. Such an approach can transform science from a

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subject studied for examinations into a powerful tool for understanding the world, solving problems, and promoting lifelong scientific literacy.

Keywords: Contextual Learning, Science Education, Scientific Literacy, Experiential Learning, Inquiry-Based Learning, Knowledge Transfer, Real-Life Application, NEP 2020, Critical Thinking, Competency-Based Education.

1. Introduction

Science education plays a fundamental role in developing students' ability to understand the natural world, interpret evidence, and make informed decisions in everyday life. In an increasingly science and technology dependent society, scientific literacy extends beyond the memorisation of facts, definitions, and formulas. It involves the ability to apply scientific concepts to practical situations, evaluate evidence, solve problems, and understand the scientific principles underlying everyday experiences. However, an important challenge in science education is determining whether students can effectively transfer the knowledge acquired in classrooms to real-life contexts. The importance of this issue is reflected in the widely cited observation of astronomer Carl Sagan that science is a way of thinking rather than merely a body of knowledge. His broader concern about society's dependence on science and technology highlights the importance of developing meaningful scientific understanding. This perspective remains relevant to contemporary education, where students must learn not only what scientific concepts mean but also how those concepts explain the world around them.

Ideally, science education should enable students to connect theoretical knowledge with practical experience. Scientific principles are present in everyday activities, including cooking, household energy consumption, plant growth, human health, environmental changes, and the use of digital technologies. Nevertheless, students may learn to reproduce scientific definitions and solve familiar textbook problems without necessarily demonstrating the same understanding when confronted with practical situations. This raises an important educational question: To what extent does classroom-based scientific knowledge enable students to understand and address problems encountered in everyday life?

One way to examine this challenge is through the distinction between declarative knowledge and the ability to apply knowledge in context. Declarative knowledge refers to knowing facts, concepts, definitions, and principles. Although this knowledge forms an essential foundation for learning, its possession does not automatically ensure that students can recognise when or how to use it. Application requires learners to identify relevant information, connect concepts with specific circumstances, interpret observations, and use scientific reasoning to reach appropriate conclusions.

For example, a student may be able to define photosynthesis and reproduce its chemical equation but struggle to explain why a plant kept in unsuitable lighting conditions is growing poorly or why its leaves are wilting. Addressing such a question requires more than recalling a definition. It involves connecting knowledge of photosynthesis with factors such as light availability, water supply, and the plant's environmental conditions. This example illustrates the potential gap between knowing a scientific concept and using it to interpret a real-world phenomenon. The transfer of learning from one context to another is therefore a significant

consideration in science education. Students may develop an understanding of a concept within the structured environment of a classroom but experience difficulties applying it when the same principle appears in a different or less familiar situation. Knowledge transfer should not be assumed to occur automatically; it can be influenced by the nature of instruction, opportunities for practical engagement, prior knowledge, the relevance of learning activities, and the extent to which students are encouraged to make connections between scientific concepts and their surroundings.

Contextual learning offers a promising approach to addressing this challenge by situating scientific concepts within meaningful, familiar, and authentic situations. Through observation, experimentation, problem-solving, discussion, and the investigation of everyday phenomena, students can be encouraged to connect abstract principles with practical experiences. Such approaches may help learners develop a deeper conceptual understanding and improve their ability to use scientific knowledge beyond the immediate context in which it was taught.

Despite the importance of contextual learning, further investigation is needed into how students understand scientific concepts, how effectively they apply them in everyday situations, and which teaching strategies may help bridge the gap between classroom learning and practical application. Examining this relationship is particularly important for developing science education that promotes understanding, reasoning, problem-solving, and scientific literacy rather than relying predominantly on the reproduction of textbook knowledge.

Against this background, the present study, titled From Classroom to Real Life: An Investigative Study in Contextual Learning in Science Education, seeks to investigate the relationship between students' conceptual understanding of scientific principles and their ability to apply those principles in real-life situations. It also aims to explore the role of contextual learning strategies in strengthening this connection. By examining the challenges associated with knowledge transfer and identifying opportunities for more meaningful learning experiences, the study seeks to contribute to the development of science education that is relevant, application-oriented, and responsive to the demands of everyday life.

2. Statement of the Problem

A major challenge in science education is the gap between students' understanding of scientific concepts and their ability to apply them in everyday situations. Although students may memorize definitions, explain theories, and perform well in examinations, they often struggle to connect scientific knowledge with real-life experiences. This raises an important question about whether science education develops practical understanding or primarily promotes theoretical learning.

Contemporary science education emphasizes scientific literacy, critical thinking, problem-solving, and evidence-based decision-making. However, traditional teaching methods often focus on textbook knowledge and examination performance, providing limited opportunities for students to explore the practical relevance of scientific concepts. As a result, learners may understand scientific principles in familiar classroom settings but fail to recognize or apply them in unfamiliar, real-world contexts. Previous research highlights the importance of connecting science learning with everyday experiences. Bennett, Lubben, and Hogarth (2007)

emphasized the educational value of context-based science teaching, while Derman and Senemoğlu (2021) reported difficulties among students in relating school science to daily life. These findings underline the importance of investigating knowledge transfer and contextual learning.

Therefore, this study examines the factors responsible for the gap between scientific understanding and real-life application. It aims to explore how contextual, inquiry-based, and experiential learning strategies can make science education more meaningful, practical, and relevant, enabling students to use scientific knowledge effectively in everyday life.

3. Review of Literature:

Science education aims not only to develop conceptual knowledge but also to enable students to apply scientific principles to real-life situations. However, research highlights a persistent gap between students' understanding of scientific concepts and their ability to apply them in everyday contexts. Existing literature emphasizes contextual, inquiry-based, and experiential learning as effective approaches to addressing this gap. This review examines the major theoretical foundations and research findings relevant to connecting classroom science with practical applications.

3.1 Theoretical Foundations

3.1.1 Constructivist Theory

Piaget (1952) emphasized that learners actively construct knowledge through interaction with their environment, while Vygotsky (1978) highlighted the importance of social interaction and guided learning. These perspectives suggest that students develop a deeper understanding of science when they connect new concepts with prior knowledge, practical experiences, and collaborative investigations.

Relevance: Constructivism provides a foundation for learning approaches that encourage students to explore, investigate, and relate scientific concepts to everyday experiences.

3.1.2 Experiential Learning Theory

Kolb (1984) proposed that learning develops through concrete experience, reflective observation, abstract conceptualization, and active experimentation. Practical experiments, demonstrations, and problem-solving activities enable students to connect theoretical knowledge with observable phenomena.

Relevance: Experiential learning explains how practical engagement and reflection can strengthen understanding and support the application of scientific knowledge.

3.1.3 Situated Learning Theory

Lave and Wenger (1991) argued that learning is closely connected to the social and practical contexts in which knowledge is acquired. Teaching science through authentic problems involving health, the environment, technology, and community life can make learning more meaningful.

Relevance: Situated learning supports the integration of real-world contexts into science teaching.

3.2 Contextual Learning in Science Education

Bennett, Lubben, and Hogarth (2007) reviewed context-based and Science-Technology-Society (STS) approaches, highlighting their potential to improve students' interest in science and their understanding of its real-world relevance. Yager (1996) similarly emphasized the importance of connecting science education with societal and environmental issues. Johnson (2002) explained that contextual teaching and learning helps students relate academic concepts to their personal experiences.

Relevance: These approaches demonstrate the educational value of connecting scientific concepts with familiar situations, practical challenges, and community problems.

3.3 Inquiry-Based Learning in Science Education

Dewey (1938) emphasized inquiry and reflective thinking as essential elements of meaningful education. The National Research Council (2000) identified scientific questioning, investigation, evidence analysis, explanation, and communication as important components of inquiry-based science learning.

Minner, Levy, and Century (2010), in a review of 138 studies, found a positive relationship between inquiry-oriented science instruction and student learning outcomes, particularly conceptual understanding.

Relevance: Inquiry-based learning encourages students to investigate problems independently or collaboratively, develop scientific reasoning, and use evidence to explain real-world phenomena.

3.4 Experiential, Laboratory, and Field-Based Learning

Hofstein and Lunetta (2004) highlighted the educational value of well-designed laboratory activities in developing scientific understanding and reasoning. Rickinson et al. (2004) examined outdoor learning and reported benefits associated with student engagement, environmental awareness, and learning experiences. Knapp (2000) also discussed the educational potential of experiential programs in promoting practical understanding and problem-solving.

Relevance: Laboratory experiments, field visits, demonstrations, and community-based investigations can help students connect classroom theories with real-world observations and practical applications.

3.5 Scientific Literacy and Real-Life Application

Bybee (1997) emphasized that scientific literacy involves using scientific knowledge to make informed decisions, address problems, and participate responsibly in society. Scientific literacy therefore extends beyond memorizing facts to interpreting evidence, evaluating information, and applying scientific reasoning to everyday situations.

Relevance: This perspective establishes practical application as an important outcome of science education and supports evaluating students' ability to use scientific knowledge beyond examinations.

3.6 OECD and PISA Research

The Organisation for Economic Co-operation and Development (OECD), through its Programme for International Student Assessment (PISA), assesses students' ability to explain phenomena scientifically, evaluate scientific investigations, and interpret evidence for decision-making. This emphasis highlights the importance of applying scientific knowledge in unfamiliar and everyday contexts rather than relying solely on factual recall.

Relevance: The PISA framework provides a useful basis for examining whether students can transfer classroom learning to practical situations. However, specific assessment findings should be included when supported by the relevant PISA reports and data.

3.7 Research Gap and Relevance to the Present Study

The reviewed literature provides theoretical and empirical support for contextual, inquiry-based, and experiential approaches to science education. These approaches emphasize active participation, practical investigation, authentic problems, and the application of scientific reasoning.

However, the present study focuses specifically on investigating why students who demonstrate an understanding of scientific concepts may still struggle to apply them in everyday situations. It seeks to examine the factors contributing to this theory–practice gap and identify teaching strategies that can strengthen the transfer of scientific knowledge from the classroom to real life. The study therefore aims to contribute to science education by examining how meaningful contexts, practical experiences, inquiry-based activities, and problem-solving opportunities can improve students' ability to use scientific knowledge effectively in daily life.

4. Major Gaps in Science Education: Limitations in Teaching Methods, Assessment, Laboratory Activities, and Contextual Learning

Despite growing emphasis on scientific literacy and experiential learning, many students struggle to apply classroom knowledge to everyday situations. This theory-practice gap is associated with traditional teaching methods, examination-oriented assessment, limited practical investigations, insufficient contextual learning, and constraints related to teacher competence and educational resources. These interconnected factors are discussed below.

4.1 Limitations of Traditional Teaching Methods

Constructivist theory emphasizes active learning through exploration, discussion, and experience (Piaget, 1952; Vygotsky, 1978). However, teacher-centred instruction often prioritizes memorization over inquiry and practical application. Consequently, students may understand scientific concepts theoretically but struggle to use them to explain everyday phenomena or solve real-life problems. Aikenhead (2006) highlights the importance of connecting science education with practical and social contexts. Therefore, student-centred and

activity-based teaching is essential for bridging the gap between conceptual understanding and practical application.

4.2 Limitations of Assessment Practices

Assessment practices strongly influence how students learn. Examinations that primarily emphasize memorization and factual recall may reward theoretical knowledge without adequately evaluating its practical application. Bybee (1997) and OECD (2019) emphasize scientific literacy as the ability to explain phenomena, interpret evidence, and apply scientific knowledge. Therefore, assessment should extend beyond written examinations to include problem-solving tasks, real-life applications, evidence-based reasoning, and unfamiliar situations.

4.3 Limitations of Laboratory Activities

Experiential Learning Theory emphasizes learning through experience, reflection, and experimentation (Kolb, 1984). Hofstein and Lunetta (2004) also highlight the educational value of laboratory activities in developing scientific understanding and reasoning. However, practical work that relies mainly on following predetermined instructions may restrict independent investigation and critical thinking. Therefore, laboratory activities should encourage students to formulate questions, test hypotheses, interpret results, and connect observations with real-life applications.

4.4 Lack of Contextual and Real-Life Learning

Situated Learning Theory emphasizes the importance of learning within meaningful contexts (Lave & Wenger, 1991). However, scientific concepts are often taught abstractly, with limited connections to students' everyday experiences. Context-based approaches can improve the perceived relevance of science and student engagement (Bennett, Lubben, & Hogarth, 2007). Therefore, integrating familiar situations involving health, environmental protection, household activities, and technology can help students recognize the practical value of scientific knowledge and transfer learning beyond the classroom.

4.5 Teacher Capacity and Resource Constraints in Science Education

Effective science education requires teachers who can integrate subject knowledge with appropriate teaching strategies, practical activities, and real-life examples. However, inadequate professional development, limited laboratory facilities, insufficient instructional materials, and restricted opportunities for field-based learning may hinder implementation. These constraints can reduce students' opportunities to engage in inquiry and experiential learning. Therefore, strengthening teacher training, providing appropriate educational resources, and promoting innovative instructional practices are essential for improving scientific understanding and practical application.

4.6 Synthesis

The theory-practice gap in science education arises from several interconnected limitations, including traditional teaching methods, recall-based assessment, restricted laboratory investigations, insufficient contextual learning, and inadequate teacher support and educational

resources. Together, these factors may prevent students from transferring classroom knowledge to everyday situations. Addressing these gaps through student-centred teaching, authentic assessment, inquiry-based practical work, contextual learning, and continuous teacher development is essential for strengthening scientific literacy and the practical application of scientific knowledge.

5. Real-Life Applications: Connecting Science Learning with Everyday Experiences

Contextual learning connects scientific concepts with everyday experiences, helping students understand how classroom knowledge applies to real-world situations. By exploring familiar activities and practical problems, learners can develop conceptual understanding, scientific reasoning, and problem-solving skills.

5.1 Physics: Understanding Everyday Motion and Energy

Physics concepts can be explained through familiar experiences, such as inertia when a bus suddenly stops, friction in bicycle brakes, sound reflection in enclosed spaces, and heat transfer through metal utensils. These examples help students understand the scientific principles governing motion, energy, and everyday interactions.

5.3 Biology: Connecting Science with Living Systems

Students can explore biological concepts by measuring heart rates before and after exercise, observing breathing changes during physical activity, examining plant growth under different conditions, and investigating nutrition and digestion. These activities connect biological knowledge with personal health, living organisms, and environmental awareness.

5.4 Environmental Science: Learning from Local Surroundings

Local environmental observations help students understand pollution, biodiversity, climate, and sustainability. Comparing temperatures under trees and on concrete surfaces, segregating household waste, monitoring water consumption, and observing local plant diversity encourage environmental responsibility and practical problem-solving.

5.5 Synthesis

Real-life applications transform science learning from memorizing facts into understanding and investigating everyday phenomena. Integrating familiar experiences into classroom teaching strengthens conceptual understanding, scientific inquiry, critical thinking, and knowledge transfer. Consequently, contextual learning helps students apply scientific knowledge beyond examinations and use it to interpret and address real-world challenges.

6. Role of Teachers: Practical Strategies for Contextual Science Teaching

Teachers play a critical role in helping students connect scientific concepts with everyday life. While curriculum reforms and assessment changes are important, meaningful science learning depends largely on classroom practices that encourage inquiry, observation, application, and reflection.

6.1 Using Everyday Phenomena as the Starting Point for Learning

Science teaching becomes more meaningful when lessons begin with familiar experiences rather than abstract definitions. Questions such as Why do we lean forward when a bus suddenly stops?, Why does an apple turn brown after being cut?, or Why are areas under trees cooler than concrete surfaces? stimulate curiosity and help students recognize the relevance of science in daily life.

Introducing concepts through real-world phenomena encourages learners to construct understanding from experience and supports the transfer of knowledge to new situations.

6.2 Promoting Inquiry-Based Learning

Teachers should encourage students to question, investigate, and explain phenomena rather than merely memorize information. Inquiry-based activities allow learners to make predictions, gather evidence, analyse observations, and communicate conclusions.

Simple investigations involving household materials, environmental observations, or community issues help students develop scientific reasoning, critical thinking, and problem-solving skills while strengthening conceptual understanding.

6.3 Using Local Resources and Encouraging Observation

Meaningful science learning does not always require sophisticated laboratories. Teachers can use locally available materials and encourage systematic observation of everyday phenomena through journals, discussions, and investigations.

Examples include exploring acids and bases using household substances, studying solutions through lemonade preparation, measuring heart rates before and after exercise, or comparing temperatures in different environments. Such activities demonstrate that scientific inquiry can occur in homes, schools, and communities.

6.4 Reimagining Assessment

Assessment should move beyond testing factual recall and include opportunities for students to explain phenomena, solve real-life problems, conduct investigations, and apply scientific concepts in unfamiliar situations.

Application-oriented assessments help evaluate scientific literacy and encourage learners to use knowledge meaningfully rather than focusing solely on memorization.

6.5 Professional Development for Teachers

Effective contextual science teaching requires continuous professional development. Training programmes should focus on inquiry-based instruction, experiential learning, authentic assessment, and the effective use of local resources.

Collaborative learning communities, action research, and the sharing of best practices can help teachers strengthen learner-centred approaches and confidently implement contextual science education.

6.6 Synthesis

Teachers are central to bridging the gap between classroom science and everyday life. By using real-world phenomena, promoting inquiry, utilizing local resources, adopting meaningful assessment practices, and engaging in professional development, teachers can create learning environments that foster scientific literacy, critical thinking, and lifelong learning.

7. NEP 2020 Perspective: Experiential Learning, Inquiry, Critical Thinking, and Competency-Based Education

The findings of this study closely align with the vision of India's National Education Policy (NEP) 2020, which advocates a shift from rote memorization toward conceptual understanding, inquiry, critical thinking, and competency-based learning. The policy emphasizes that education should enable learners not only to acquire knowledge but also to apply it effectively in real-life situations.

7.1 Experiential and Inquiry-Based Learning

NEP 2020 promotes learning through observation, experimentation, projects, field experiences, and investigation. It encourages teachers to create opportunities for students to explore phenomena, ask questions, collect evidence, and construct explanations.

The findings of this study support this approach by demonstrating that students develop deeper understanding when scientific concepts are introduced through familiar experiences and explored through hands-on inquiry. Activities such as investigating environmental conditions, analysing household chemical reactions, or measuring physiological changes during exercise make science more meaningful and engaging.

7.2 Critical Thinking and Competency Development

A key objective of NEP 2020 is the development of critical thinking, creativity, scientific temper, and problem-solving abilities. The policy emphasizes competencies such as application of knowledge, reasoning, communication, collaboration, and evidence-based decision-making.

The present study highlights the importance of these competencies in bridging the gap between conceptual understanding and practical application. Contextual learning encourages students to analyse observations, interpret evidence, evaluate alternatives, and apply scientific knowledge to real-world situations, thereby supporting competency development.

7.3 Assessment Reform and Real-Life Relevance

NEP 2020 advocates assessment practices that evaluate understanding, application, and higher-order thinking rather than memorization alone. Similarly, the findings of this study suggest that authentic assessments involving investigations, projects, real-life scenarios, and problem-solving tasks provide a more accurate measure of scientific literacy.

The policy also stresses the importance of connecting learning with local contexts, community experiences, and everyday life. This study reinforces that students develop stronger understanding when scientific concepts are linked to familiar situations and practical challenges.

7.4 Synthesis

The present study reinforces the central principles of NEP 2020. Both emphasize experiential learning, inquiry-based instruction, critical thinking, competency development, and authentic assessment as essential elements of effective science education. By connecting scientific concepts with real-life experiences, these approaches help transform science learning from memorization of content into meaningful understanding and practical application.

8. Proposed Educational Framework: Connecting Scientific Concepts with Real-World Problems

Based on the findings of this study, a Real-Life Inquiry-Based Science Learning Framework (RIBSLF) is proposed to bridge the gap between classroom science and students' everyday experiences. The framework is grounded in the principle that meaningful learning occurs when scientific concepts are introduced through familiar phenomena, explored through inquiry, and applied to real-world situations.

The RIBSL framework consists of five interconnected stages:

1. Observe Real-Life Phenomena
Learning begins with students' observations of everyday events occurring at home, in school, or within their communities. Teachers introduce concepts through authentic questions such as "Why do you lean forward when a bus brakes?", "Why does an apple turn brown?", or "Why do you feel sleepy after a heavy lunch?". These phenomena stimulate curiosity and create relevance for learning.

2. Ask Questions and Generate Explanations
Students are encouraged to share their ideas, predictions, and prior knowledge about the observed phenomenon. This stage promotes critical thinking and helps teachers identify students' existing conceptions and misconceptions.

3. Investigate through Hands-On Activities
Scientific concepts are explored through simple investigations using locally available materials. Examples include testing the pH of household substances using turmeric indicator, preparing lemonade to understand solutions and saturation, measuring heart rate before and after exercise, or comparing temperatures under trees and concrete surfaces. These activities allow students to learn science through direct experience.

4. Connect Scientific Concepts to Everyday Life

Teachers guide students in linking their observations and investigations to formal scientific principles. Rather than teaching concepts in isolation, scientific ideas are presented as explanations for everyday events and real-world challenges.

5. Apply Learning to Real-World Problems
Students use their scientific understanding to analyze local issues and make informed decisions. They may investigate environmental concerns, health-related questions, energy

use, waste management, or community challenges. This stage develops scientific literacy, problem-solving abilities, and responsible citizenship.

Expected Outcomes

- The proposed framework is expected to:
- Increase student engagement and motivation in science learning.
- Improve conceptual understanding by connecting abstract ideas with tangible experiences.
- Foster inquiry, critical thinking, and problem-solving skills.
- Enhance scientific literacy and evidence-based reasoning.
- Promote the application of science to personal, societal, and environmental issues.

By positioning students' daily experiences as the starting point for learning, this framework transforms science from a collection of textbook facts into a meaningful tool for understanding and improving the world around them. In this model, students' homes become learning spaces, their communities become contexts for investigation, and real-life problems become opportunities for scientific inquiry and innovation.

9. Recommendations: Actions for Teachers, Schools, Curriculum Developers, Examination Boards, and Policymakers

The findings of this study indicate that the gap between students' scientific understanding and their ability to apply knowledge in everyday life cannot be addressed through classroom instruction alone. Meaningful change requires coordinated efforts from teachers, schools, curriculum developers, examination boards, and policymakers to create learning environments that promote conceptual understanding and practical application.

9.1 For Teachers

Teachers should move beyond content transmission and create learning experiences that connect scientific concepts with students' daily lives. Lessons should begin with familiar phenomena, observations, and real-world questions rather than abstract definitions and formulas. Questions such as Why do you lean forward when a bus suddenly stops?, Why does bread rise?, Why does an apple turn brown?, or Why do we feel sleepy after a heavy meal? can stimulate curiosity and encourage scientific thinking.

Teachers should incorporate investigations, discussions, problem-solving activities, and practical experiments using locally available materials. They should encourage students to observe their surroundings, ask questions, collect evidence, and explain everyday phenomena using scientific reasoning. Classroom questioning should shift from "What is the correct answer?" to "Where do you see this concept in real life?" and "How can science explain this phenomenon?"

9.2 For Schools

Schools should foster a culture where scientific exploration, experimentation, and critical thinking are valued alongside academic achievement. Learning should extend beyond textbooks and classrooms to include school gardens, playgrounds, laboratories, local communities, and natural environments.

Schools should support project-based learning, outdoor education, science clubs, community investigations, environmental monitoring activities, and interdisciplinary projects. Opportunities should be provided for students to engage in authentic scientific practices such as observing, measuring, analysing, investigating, and communicating findings. Such experiences can strengthen the connection between classroom learning and real-world application.

9.3 For Curriculum Developers and Examination Boards

Curriculum frameworks should emphasize conceptual understanding, practical application, and problem-solving rather than excessive content coverage. Scientific concepts should be introduced through meaningful contexts and everyday experiences that are relevant to students' lives and local environments.

Textbooks should include real-life case studies, problem-solving tasks, investigative activities, and opportunities for reflection. Assessment systems should move beyond testing memorization and factual recall to evaluating students' ability to apply concepts, analyse situations, interpret evidence, and solve authentic problems. Learning outcomes and assessment practices should align with the goals of competency-based education.

9.4 For Policymakers

Policymakers should prioritize science education reforms that support meaningful learning and knowledge application. Professional development programmes should equip teachers with the skills needed to facilitate active learning, design authentic learning experiences, and assess higher-order thinking skills.

Investment should be directed toward strengthening laboratory facilities, developing low-cost teaching resources, supporting field-based learning, and creating opportunities for school-community partnerships. Policies should encourage flexibility in curriculum implementation so that teachers can connect science learning with local issues, environmental challenges, and community needs.

Educational reforms should focus not only on improving examination performance but also on developing learners who can make informed decisions, solve problems, and participate responsibly in society.

9.5 Towards a Vision of Meaningful Science Education

Science education will become truly effective when students are able to recognise scientific principles in the world around them and apply their knowledge to everyday situations.

Achieving this goal requires classrooms where curiosity is encouraged, questions are valued, investigations are common, and learning is connected to real-life experiences.

When teachers, schools, curriculum developers, examination boards, and policymakers work collectively towards this vision, science can move beyond being a subject that students study for examinations. Instead, it can become a way of understanding the world, solving problems, and making informed decisions. In such an educational environment, students' everyday experiences become meaningful learning opportunities, their communities become learning spaces, and science becomes a powerful tool for lifelong learning and responsible citizenship.

10. Conclusion: Key Findings, Implications, and Future Directions

This study, From Classroom to Real Life: An Investigative Study in Contextual Learning in Science Education examined the relationship between students' conceptual understanding of scientific principles and their ability to apply those principles in everyday situations. The review of literature, theoretical perspectives, and analysis of current classroom practices revealed that a significant gap often exists between knowing scientific concepts and using them meaningfully in real-life contexts. While many students can recall definitions, formulas, and scientific explanations, they frequently encounter difficulties when required to apply this knowledge to practical problems, daily observations, and unfamiliar situations.

The findings indicate that this theory-practice gap is influenced by several interconnected factors, including traditional teacher-centred instruction, examination-oriented assessment practices, limited opportunities for practical investigation, insufficient contextual learning experiences, and constraints related to teacher preparation and educational resources. Together, these factors restrict students' opportunities to develop scientific reasoning, problem-solving abilities, and the capacity to transfer knowledge from classroom settings to real-life situations.

The study further highlights that contextual approaches provide effective pathways for bridging this gap. The literature consistently demonstrates that students develop deeper understanding when scientific concepts are introduced through familiar phenomena, explored through investigation, and connected to meaningful situations. Everyday experiences provide valuable contexts through which learners can construct scientific understanding and recognize the relevance of science in their lives. Such approaches enhance conceptual learning while supporting curiosity, critical thinking, collaboration, and evidence-based reasoning.

An important contribution of this study is the proposed Real-Life Inquiry-Based Science Learning Framework (RIBSLF), which provides a practical model for connecting classroom science with everyday experiences through observation, questioning, investigation, conceptual understanding, and application. The framework aligns closely with the vision of the National Education Policy (NEP) 2020, which emphasizes conceptual understanding, competency development, critical thinking, and authentic assessment (Government of India, 2020). By positioning students' lived experiences as the foundation of learning, the framework offers a practical strategy for making science education more relevant, meaningful, and learner-centred.

The implications of this study extend to multiple stakeholders. Teachers must create opportunities for observation, questioning, reflection, and application of concepts. Schools

should provide environments that support practical engagement and meaningful learning experiences. Curriculum developers and examination boards should design learning outcomes and assessment practices that emphasize understanding and application rather than memorization. Government of India, 2020; National Research Council, 2012). Policymakers should strengthen teacher professional development, improve access to educational resources, and support educational practices that connect learning with local contexts and societal needs (Government of India, 2020; UNESCO, 2024).

Future research should examine the implementation and effectiveness of the proposed framework across different educational levels, school systems, and cultural contexts. Further studies may explore the role of technology-enhanced learning, community partnerships, citizen science projects, and indigenous knowledge systems in strengthening contextual science education. Additional research is also needed to investigate how sustained teacher professional development can support the successful integration of application-oriented science teaching in everyday classroom practice.

In conclusion, science education must move beyond the transmission of isolated facts towards the development of learners who can use scientific knowledge to understand, interpret, and improve the world around them. When students are encouraged to connect scientific concepts with their daily experiences, science becomes a meaningful tool for inquiry and problem-solving rather than information memorized for examinations. (Government of India, 2020). Effective science education is achieved when learners recognize that science is embedded in their homes, communities, environments, and everyday lives. Through contextual learning, science becomes a foundation for lifelong learning, informed decision-making, and responsible citizenship (Bybee, 1997; Government of India, 2020; UNESCO, 2024)

References

Aikenhead, G. S. (2006). Science education for everyday life: Evidence-based practice. Teachers College Press.

Bennett, J., Lubben, F., & Hogarth, S. (2007). Bringing science to life: A synthesis of the research evidence on the effects of context-based and STS approaches to science teaching. Science Education, 91(3), 347-370. https://doi.org/10.1002/sce.20186

Bybee, R. W. (1997). Achieving scientific literacy: From purposes to practices. Heinemann.

Derman, İ., & Senemoğlu, N. (2021). Seventh-grade students' levels of associating science courses with real life. *Education and Science, 46*(206), 107–129. https://doi.org/10.15390/EB.2020.9178

Dewey, J. (1938). Experience and Education. New York: Macmillan Company

Government of India, Ministry of Human Resource Development. (2020). National education policy 2020. Government of India. https://www.education.gov.in

Hofstein, A., & Lunetta, V. N. (2004). The laboratory in science education: Foundations for the twenty-first century. Science Education, 88(1), 28-54. https://doi.org/10.1002/sce.10106

Johnson, E. B. (2002). Contextual teaching and learning : what it is and why it's here to stay. Corwin Press.

Knapp, C. E. (2008). Place-based curricular and pedagogical models: My adventures in teaching through community contexts. In D. A. Gruenewald & G. A. Smith (Eds.), Place-based education in the global age: Local diversity (pp. 3–20). Lawrence Erlbaum Associates.

Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. Prentice Hall.

Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge University Press.

Minner, D. D., Levy, A. J., & Century, J. (2010). Inquiry-based science instruction: What is it and does it matter? Results from a research synthesis years 1984 to 2002. Journal of Research in Science Teaching, 47(4), 474-496.

National Research Council. (2000). Inquiry and the national science education standards: A guide for teaching and learning. National Academy Press.

National Research Council. (2012). A framework for K-12 science education: Practices, crosscutting concepts, and core ideas. The National Academies Press. https://doi.org/10.17226/13165

Organisation for Economic Co-operation and Development (OECD). (2019). PISA 2018 assessment and analytical framework. OECD Publishing. https://doi.org/10.1787/b25efab8-en

Organisation for Economic Co-operation and Development (OECD). (2023). PISA 2025 science framework (draft). OECD Publishing.

Piaget, J. (1952). The origins of intelligence in children. International Universities Press.

Rickinson, M., Dillon, J., Teamey, K., Morris, M., Choi, M. Y., Sanders, D., & Benefield, P. (2004). *A Review of Research on Outdoor Learning*. Unknown Publisher.

Sagan, C. (1995). *"The demon-haunted world: Science as a candle in the dark*." ("The Demon-Haunted World: Science as a Candle in the Dark") Random House.

Tonje Tomine Seland Strat, Ellen Karoline Henriksen & Kirsti Marie Jegstad (2024) Inquiry-based science education in science teacher education: a systematic review, Studies in Science Education, 60:2, 191-249, DOI: 10.1080/03057267.2023.2207148

UNESCO. (2024). Insights from the science of learning for education: Leveraging scientific knowledge for innovations in teaching and learning. UNESCO Publishing.

Urdanivia Alarcon, D. A., Talavera-Mendoza, F., Rucano Paucar, F. H., Cayani Caceres, K. S., & Machaca Viza, R. (2023). Science and inquiry-based teaching and learning: A systematic review. Frontiers in Education, 8, Article 1170487. https://doi.org/10.3389/feduc.2023.1170487

Walan, Susanne & Mc Ewen, Birgitta. (2017). Primary Teachers' Reflections on Inquiry- and Context-Based Science Education. Research in Science Education. 47. 10.1007/s11165-015-9507-5.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Harvard University Press.

Yager, R. E. (1996). Science/technology/society as reform in science education. State University of New York Press.