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Analyzing the benefits of using real-world examples in science lessons

Anuprita Patil and Sangeeta Gupta

Abstract
Science being an integral part of our lives, shapes the world we live in, from the technology to the natural phenomena we observe. Yet, in many classrooms, science is taught in a way that feels distant from reality, making it difficult for students to grasp it in real word relevance. With this purpose, the study aimed to explore how Teaching Practices with Real-Life Content (TPRLC) can make science more meaningful and connected to everyday experiences. This action research explores how incorporating real-world examples into science lessons can improve student's understanding, engagement, and retention of concepts. The study was conducted in a 7th standard, where conventional lessons were reimagined to include practical applications.
The effectiveness of this approach will be assessed through pre-tests, post-tests, classroom observations, and student and teachers feedback.
The findings have shown the effectiveness of real-world examples in enhancing science education as they help students connect abstract concepts to practical applications, making learning more meaningful and impactful. However, the study also identifies challenges, such as the need for teacher training and resource availability, which must be addressed for wider adoption.

Keywords: Real-life content, science education, student engagement, practical applications, teaching practices

Introduction

Science education plays an important role in developing analytical and critical thinking skills among students. However, many students find it difficult to relate abstract scientific concepts to their daily lives. Traditional teaching learning methods generally focus on rote learning than understanding the concepts. To overcome this problem, using real-world examples in science lessons will be of great help.

According to Blandford and Knowles (2009, p. 147) [17], when children are encouraged to think critically and explore subjects independently, they develop autonomy and self-reliance, fostering intrinsic motivation and enhancing their capacity to become self-directed learners. Empirical studies, such as those by Norman (2005), highlight the efficacy of this method, showing that it boosts student's interest in science while fostering engagement across various subjects, encouraging a more self-driven and enthusiastic attitude toward learning.

In many classrooms, science instruction is primarily teacher-centered, offering few opportunities for student-centered activities like hands-on experiments. This heavy reliance on conventional teaching methods often results in reduced student engagement and fewer chances for experiential learning. Paulo Freire envisioned education as a transformative force capable of empowering marginalized and underserved communities worldwide. He criticised conventional, teacher-centered methods for reinforcing systemic inequities and instead promoted a learner-centered approach based on dialogue and real-world experiences. According to Paulo Freire, education should be a collaborative and participatory process, enabling learners to actively contribute, express their perspectives, and relate knowledge to their personal contexts. This approach cultivates critical awareness, self-determination, and liberation, redefining education as a means for individuals and communities to address social injustices and actively shape their futures (Freire, 2018) [19]. Studies indicate that connecting scientific concepts to real-world contexts enhances students' comprehension, improves long-term retention of knowledge, and increases their active participation in the learning process (National Research Council, 2000) [22].

Despite the well-documented advantages of experiential and contextual learning, science education often remains heavily reliant on teacher-centered methods, with limited incorporation of real-world applications (Abrahams & Millar, 2008) [5]. A significant challenge lies in developing and implementing effective strategies to seamlessly integrate real-world examples into science curricula while evaluating their impact on student outcomes. This action research seeks to investigate the advantages of incorporating real-world applications into science education, focusing on their effects on student engagement, conceptual understanding, and problem-solving skills and thus help improve the teaching learning process.

Research Questions

1. How does incorporating real-world examples into science lessons influence student engagement when compared to conventional textbook-based instruction?
2. Does connecting scientific concepts to real-life scenarios enhance student's abstract comprehension of abstract or theoretical principles?
3. In what ways do real-world learning experiences improve students' ability to apply scientific knowledge to address practical challenges?
4. What instructional strategies are most effective for embedding real-world examples into the science curriculum without compromising academic depth?

Literature Review

Research indicates that linking science concepts to everyday contexts not only makes the subject more relevant but also significantly boosts student motivation. Driver *et al.* (1994) [1] highlight that active participation through inquiry fosters critical thinking and problem-solving skills, leading to deeper learning. Similarly, The National Research Council (2000) [13] in its publication 'How People Learn' advocates for inquiry-based learning models that connect classroom theories with real-world situations, thereby making learning more engaging and meaningful for students. Hofstein and Lunetta (2004) [21] point out that hands-on laboratory work is vital in helping students bridge the gap between theory and practice. Bennett, Lubben, and Hogarth (2007) [16] found that when students see direct applications of scientific ideas in their surroundings, they develop a stronger interest and a more personal connection to the material. According to the study of Abrahams and Millar (2008) [5] found that practical, hands-on experiments help students better grasp and retain complex scientific concepts. Hattie (2009) [20] emphasizes that lessons which bridge theory and practice lead to deeper understanding and more enduring knowledge, as students are more likely to remember information when it relates to their lives. Similarly, Bell *et al.* (2010) [15] reveal that when students collaborate on inquiry-based projects, they develop critical thinking skills and maintain higher levels of engagement. Additionally, the National Research Council (2012) [13] emphasizes that education should mimic authentic scientific inquiry to effectively prepare students for real-world challenges. Bybee (2013) [18] adds that embedding everyday examples into STEM curricula not only demonstrates the relevance of scientific concepts but also inspires students to think innovatively.

Methodology

This study follows an action research approach to analyse how student-centered learning, experiential activities, and real-world applications enhance science education. To gather insights from both students and teachers, a survey was conducted, capturing their experiences, engagement levels, and perceptions of the newly introduced learning methods.

This study was conducted with the students of standard 7th B with the sample size of 40. Data collection will involve pre-tests and post-tests to evaluate changes in students' conceptual understanding, structured classroom observations to monitor levels of engagement, and student feedback surveys. The students will be taught the topic of Waste Water Management with real world examples like water pollution simulation, case study on local water issues and field trip to a water treatment plant.

Student Survey Questions

No.	Question
1	How interested are you in science lessons?
2	How often do you relate science concepts to real-life situations?
3	Do you feel confident applying science concepts to real-world problems?
4	Do activities help you learn best?
5	Do you believe understanding waste management is important?
6	How well do you understand the impact of waste on the environment?
7	How confident are you in explaining waste segregation to others?
8	How often do you practice waste segregation in daily life?
9	How important do you think recycling is for the environment?
10	Would you take part in a waste management initiative at school?

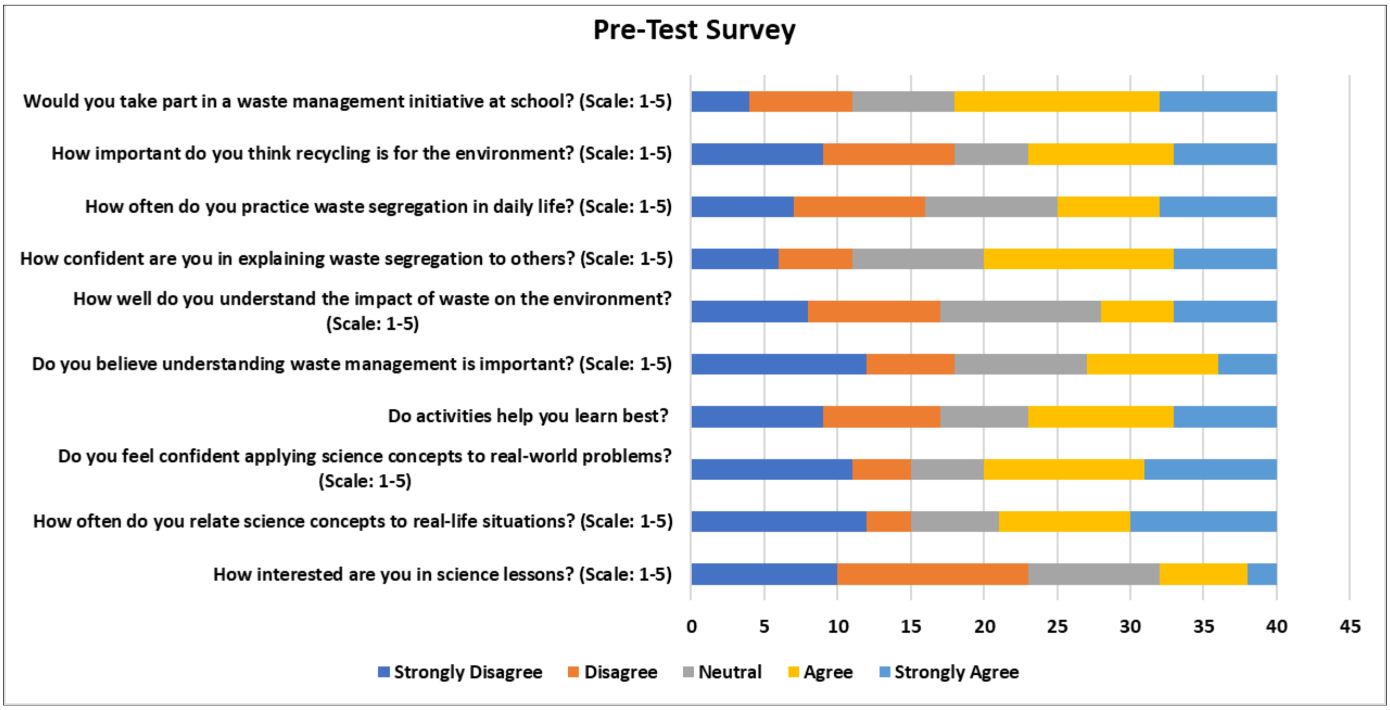
Teacher Survey Statements

No.	Statement
1	I integrate real-world examples into my science lessons.
2	I incorporate hands-on experiments and activities into my teaching.
3	My students actively engage in science discussions.
4	My students show interest in applying science concepts to real-world problems.
5	I use technology (videos, simulations, interactive tools) to enhance science learning.
6	I feel confident applying inquiry-based teaching methods in my lessons.
7	I assess student understanding through formative assessments (quizzes, discussions, reflections).
8	I observe increased student curiosity and engagement in science over time.
9	I face challenges in incorporating real-world applications into my lessons.
10	I would like more professional development opportunities to enhance real-world applications in my teaching.

Results

For the research, students of standard 7th B were selected with sample size of 40. The pre-test survey was conducted before the intervention to assess student's baseline understanding of waste management.

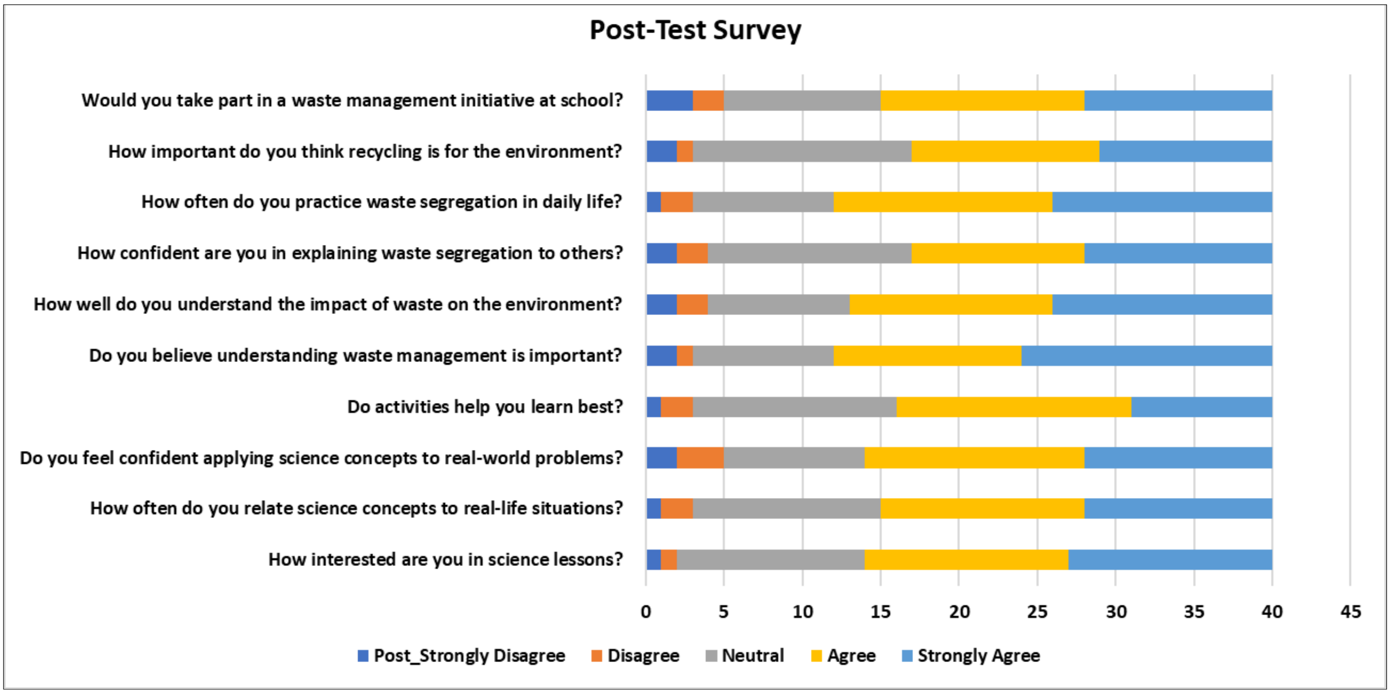
Pre-Test Survey Graph



The pre-test indicates that students had limited understanding and awareness of waste management concepts before the intervention.

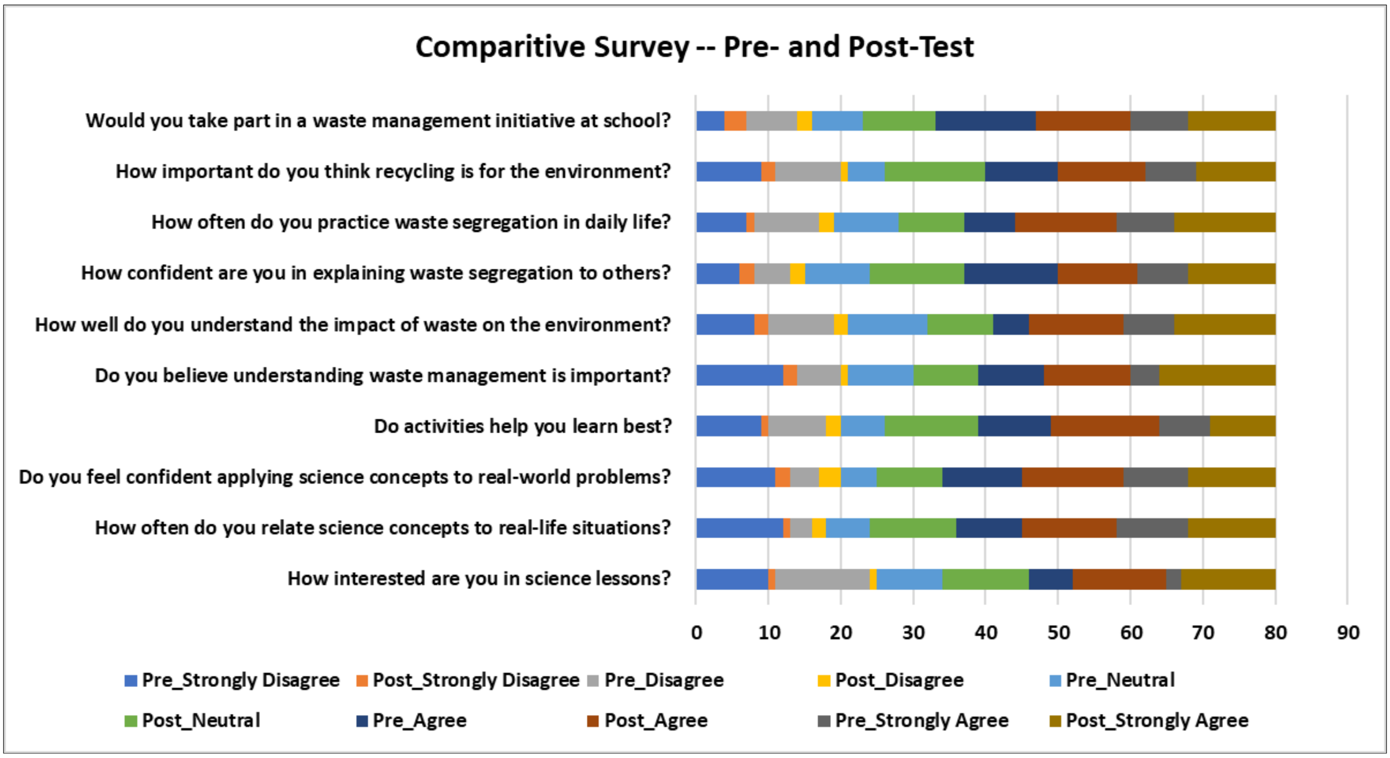
The learning outcomes were measured through a post-test using a Likert scale (1-5) will be conducted to evaluate students' understanding, awareness, and attitudes toward waste management.

Post-Test Survey Graph



The post-survey indicates that students experienced a significant improvement in their understanding, engagement, and practical application of waste management concepts.

Pre-Test vs. Post-Test Comparison Graph

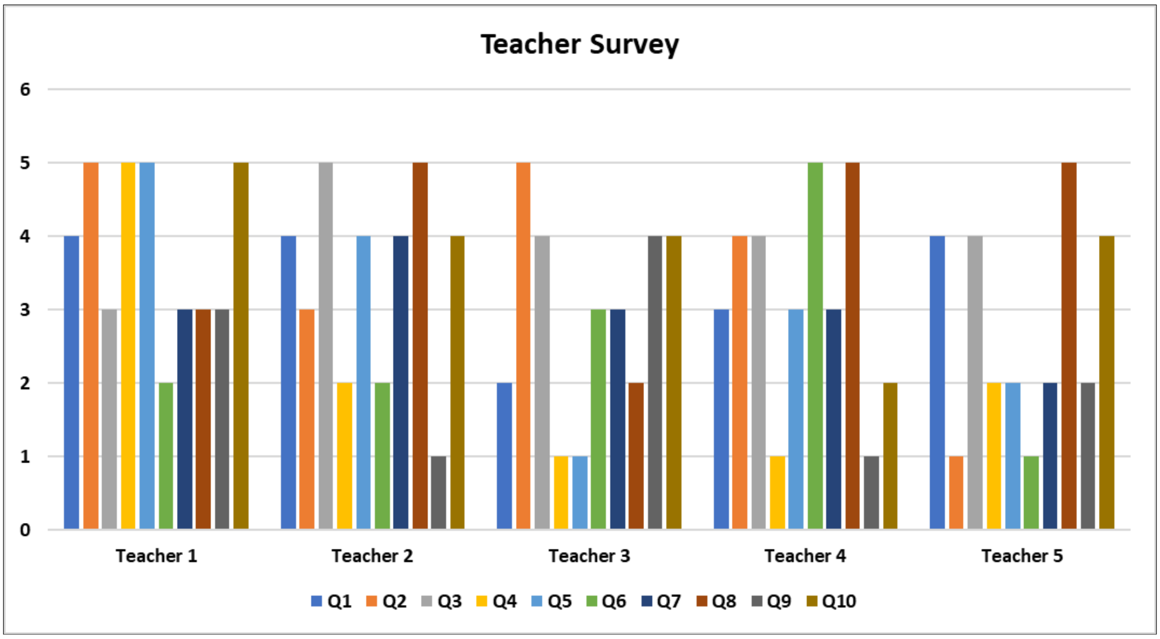


The improvement indicates that the use of real-world examples in teaching waste management was effective.

A paired sample t-test was used to compare student's responses before and after the intervention across five response categories. The results showed clear improvements in participant's perceptions and attitudes after the program as per the table below:

Scale	t-value	p-value
1- Strongly disagree	7.49	0.000037
2- Disagree	5.2	0.00056
3- Neutral	-3.16	0.0116
4- Agree	-3.41	0.0078
5- Strongly agree	-5.06	0.00069

Teacher Survey Graph



The teacher survey revealed a strong interest in professional development to enhance teaching practices, particularly in integrating real-world applications, which many found challenging. Teachers observed increased student curiosity and engagement when using hands-on activities, real-world examples, and technology like videos and simulations. They expressed confidence in inquiry-based teaching and frequently used formative assessments to gauge student understanding. Overall, while teachers are effectively employing student-centered and technology-driven methods, there is a clear need for further training and resources to better connect science concepts to practical, real-life scenarios, ultimately improving student learning outcomes.

Findings from the observations of students

The findings of this study observed an average post-test score increased by around 20% over the pre-test results. Observational data indicated a 30% higher participation rate in group discussions and hands-on activities among students. Students were more engaged compared post teaching the topic with activities. Many students expressed that real-life examples made abstract concepts more relatable.

Additionally, feedback from both students and teachers will be gathered through structured interviews to gain qualitative insights into their experiences and the effectiveness of the teaching methods. This combination of quantitative (Likert scale) and qualitative (survey and interviews) approaches ensures a comprehensive evaluation of how well students have understood the topic and how the teaching strategies have impacted their learning experience.

Findings from the feedback of teachers: According to teachers, noted increased enthusiasm, more spontaneous questions, and greater overall classroom interaction and observed that students were more likely to work collaboratively and take initiative during experiments. They also highlighted that lesson planning became more innovative and student-centered. Some teachers faced logistical challenges (e.g., coordinating field trips) and noted the need for additional support and resources to implement such strategies effectively.

Discussion

This action research project highlight the power of real-world examples in making science lessons, particularly waste management, more engaging and meaningful for Grade 7 students. By connecting classroom learning to everyday life, students not only understood the concepts better but also felt more motivated to apply what they learned in their daily routines. The pre- and post-test results clearly indicate that students made significant progress in their understanding of waste management, and the feedback from both students and teachers reinforces the value of this approach.

The survey results highlight several key areas of interest and concern among teachers. The expressed need for more professional development suggests that teachers are eager to enhance their skills and stay updated with effective teaching strategies. Addressing these needs could lead to improved teaching practices and better student outcomes. While they appreciated how these methods made lessons more engaging, they also highlighted the need for more resources and training to implement them effectively.

Despite the positive outcomes, there were some hurdles. Teachers noted that preparing real-world examples and hands-on activities required extra time and effort. Additionally, some felt they needed more training to use these methods confidently. These challenges suggest that while the approach is effective, it requires support and planning to be implemented successfully.

Conclusion: This action research project demonstrates that using real-world examples in teaching waste management improved students' learning, engagement, and interest. The pre-and post-test results, along with the feedback from students and teachers, clearly show that this approach works.

However, the study also reveals some limitations like small sample size, less duration and applying to only one topic do not help in generalizations of the findings. Teachers reported challenges in implementing real-world examples due to a lack of resources and training. This suggests that while the approach is effective, it requires additional support to be widely adopted.

Future studies could involve a larger group of students and cover more topics in science to see if the same approach works across different subjects. Providing training and resources to teachers will help them use real-world examples more effectively and confidently in their lessons. While there are challenges to address, the benefits of this approach make it a promising way to transform science education and make it more relevant and useful in day to day life.

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