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A Pedagogical Inquiry Into Students' Difficulties In Translating Mathematical Knowledge To Real-World Use

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ABSTRACT

This study investigates students' difficulties in translating mathematical knowledge into real-world applications. Despite learning mathematical operations in schools, many students struggle to determine the appropriate operation in everyday contexts, which affects their confidence and problem-solving skills. Grounded in the objectives of NEP 2020, this pedagogical inquiry adopted a quantitative experimental design involving four 9th-grade students from Shri Gokula School, Mysuru. Through a structured action plan comprising five interactive and context-based activities-Money Exchange Game, Solve and Pass, Daily Life Math Hunt, Reverse Word Creation, and Explain Your Steps-the study aimed to bridge the gap between procedural knowledge and conceptual understanding. Statistical analysis showed a notable improvement in post-test scores compared to pre-test scores, indicating enhanced operational decision-making, conceptual clarity, and confidence in solving real-life mathematical problems. The findings emphasize the importance of incorporating real-life applications and learner-centered strategies in mathematics instruction.

Keywords: Real-Life Application, Problem-Solving, Conceptual Understanding, Pedagogical Strategies, Experimental Study, Word Problems, Mathematical Operations.

INTRODUCTION

Mathematics forms the foundation for logical reasoning and practical problem-solving in everyday life. However, many students, despite learning various mathematical operations in school, struggle to determine the appropriate operation to apply in real-life situations. This disconnect between procedural knowledge and practical application affects their confidence and problem-solving abilities. Traditional teaching methods often emphasize correct answers over understanding and application. Aligning with the National Education Policy (NEP 2020), this study seeks to investigate the causes of this difficulty and explore strategies to enhance students' conceptual understanding, confidence, and ability to apply mathematics meaningfully in daily life.

NEED AND IMPORTANCE OF THE STUDY

There is a growing need to bridge the gap between theoretical mathematical knowledge and its real-life application. Many students depend on rote procedures and struggle to interpret practical situations like shopping or budgeting. NEP 2020 emphasizes critical thinking and meaningful application of mathematics. Strengthening this connection makes learning relevant, builds problem-solving confidence, and prepares students for real-world challenges. Strong application skills also support higher education, professional success, and financial literacy, fostering overall holistic development.

STATEMENT OF THE PROBLEM

A Pedagogical Inquiry into Students' difficulties in translating Mathematical Knowledge to Real-World use.

CAUSES OF THE PROBLEM

1. Overemphasis on procedural practice in classroom instruction.
2. Limited exposure to real-life mathematical contexts.
3. Habitual rote memorization from early education.
4. Lack of conceptual understanding among learners.
5. Teaching often emphasizes correct answers over reasoning processes.
6. Insufficient connection between textbook problems and real-life scenarios.
7. Language barriers in interpreting word problems.
8. Limited opportunities for students to explain their reasoning.
9. Low interest or motivation in mathematics.
10. Mathematical anxiety experienced by students.

PRIORITIZED CAUSES

1. Lack of conceptual understanding among students.
2. Language difficulties arising in word problems.
3. Mathematical anxiety faced by learners.
4. Disconnect between real-life situations and textbook problems.
5. Overemphasis on procedural practice.
6. Teaching approaches prioritizing correct answers over reasoning.

OBJECTIVES OF THE STUDY

1. To identify the specific difficulties students face in selecting appropriate mathematical operations in real-life contexts.
2. To enhance students' ability to choose and apply the correct operation according to the problem.
3. To promote conceptual understanding over rote memorization.
4. To improve students' confidence and independence in solving practical mathematical problems.
5. To develop strategies that connect classroom mathematics to everyday life.
6. To help students understand the appropriate use of each mathematical operation.

7. To make mathematics learning meaningful and relevant for students.
8. To evaluate changes in students' performance before and after the intervention.

REVIEW OF RELATED LITERATURE

Banerjee, A., Duflo, E., Ganimian, A., & Walton, M. (2025). *Children's arithmetic skills do not transfer between applied and academic math.* This study highlights a significant gap between the arithmetic skills Indian children use in everyday life and those taught in formal school settings. Although students can handle real-world calculations, these abilities often fail to transfer to academic mathematics tasks. The findings emphasize the importance of aligning classroom instruction with practical contexts to strengthen conceptual understanding and enhance the meaningful application of arithmetic skills.

Gafoor, K. A., & Kurukkan, A. (2015). *Learner and Teacher Perceptions on Difficulties in Learning and Teaching Mathematics.* This study investigates the perceptions of students and teachers regarding the challenges faced in learning and teaching mathematics in Indian schools. It identifies key barriers such as conceptual gaps, overreliance on rote learning, lack of meaningful understanding, and ineffective instructional approaches. The findings emphasize the need for more learner-centered and conceptually rich pedagogical strategies to enhance mathematical comprehension and engagement.

Gafoor, K. A., & Shabir, M. K. (2015). *Relating Difficulty in School Mathematics to the Nature of Mathematics: Perceptions of High School Students from Kerala.* This study examines how the inherent nature of mathematics contributes to students' learning difficulties. It highlights that the abstract and formal structure of mathematical concepts, combined with limited connections to real-life contexts, poses significant challenges for learners. The research underscores the need for instructional practices that make mathematics more meaningful, contextual, and accessible to enhance students' conceptual understanding and engagement.

Verchaffel, L., Greer, B., & De Corte, E. (2000). *Making Sense of Word Problems.* This study explores the discrepancy between students' problem-solving abilities and their capacity to apply mathematical knowledge in authentic, real-life contexts. It highlights how traditional mathematics instruction often prioritizes formal algorithms and routine procedures over meaningful understanding. As a result, students may correctly perform calculations but struggle to interpret and solve realistic problems, emphasizing the need for instructional approaches that integrate conceptual understanding with practical application.

RESEARCH METHODOLOGY

In the present study, Quantitative research method with experimental research design is used.

Sampling: The sample consists of 4 students studying in 9^{th} Standard of Shri Gokula School, Kuvempunagar of Mysuru City, which belongs to Kuvempunagar Cluster, South Block of Mysuru District.

Research Tool: Researcher developed Questionnaire for Pre-Test and Post-Test. Questionnaire consists of only objective type questions with the maximum marks of 20.

PROCEDURE

The following phases have been involved in the present action research:

1. Finding the problem and selection of school for action research study
2. Preparation of Pre-test and Post-test Question paper
3. Conducting Pre-test
4. Identifying the Sample
5. Designing and adopting frequent practices
6. Conducting Post-test
7. Comparing the performance of the students in Pre-test and Post-test
8. Enlisting the Findings
9. Stating Research based suggestions

To substantiate the above phases, the researcher conducted the Pre-test to check the prior knowledge of the students on applying fundamental operations in real life. On this basis the researcher conducted 5 activities to eradicate the misconceptions and enhance the understanding and application level of the students followed by the post-test to know the effectiveness of the strategies.

ACTION PLAN

Table 1: Details of Action Plan

Sl. No.	Activities	Duration	Days
1	Money exchange game	30 mins	1
2	Solve and pass	30 mins	1
3	Daily life math hunt	20 mins	2
4	Reverse word creation	30 mins	1
5	Explain your steps	30 mins	1

DESCRIPTION OF ACTION PLAN:

Activity 1: Money Exchange Game

This activity aimed to enhance students' ability to apply appropriate operations in real-life financial scenarios. Students participated in a simulated market, buying and selling items with play money, calculating totals, giving change, and determining balances. They were required to decide which operation (addition, subtraction, multiplication, division) to apply at each step. By engaging in this interactive and practical experience, students not only reinforced their computational skills but also developed financial literacy, problem-solving strategies, and confidence in handling real-life monetary situations.

Activity 2: Solve and Pass

To promote conceptual understanding and independent problem-solving, students worked in groups to solve mathematical problems on slips of paper, passing each slip to peers for verification and continuation. Each student had to analyze the problem, determine the correct operation, and explain their reasoning to the next

student. This collaborative approach encouraged critical thinking, peer learning, and accountability, as students reflected on their own understanding while evaluating others' work. It also allowed teachers to identify misconceptions and guide students toward deeper comprehension.

Activity 3: Daily Life Math Hunt

This activity focused on linking classroom mathematics to everyday experiences. Students were tasked with observing their environment to identify and document examples of mathematical operations in daily life, such as shopping, budgeting, cooking, or planning travel. They presented their findings to the class, explaining the operation used, why it was appropriate, and how it related to the real-life scenario. By actively seeking out mathematics in context, students strengthened their problem recognition skills, reinforced conceptual understanding, and appreciated the practical relevance of classroom learning.

Activity 4: Reverse Word Creation

To develop analytical thinking and problem interpretation, students were given solutions and tasked with creating corresponding real-life word problems. For example, if the answer was a total cost, they had to determine the quantities, context, and operations needed to arrive at that result. This reverse-engineering approach required them to think critically about the reasoning behind each operation, improved their ability to generalize concepts to new scenarios, and enhanced creative problem formulation skills. It also encouraged them to recognize the logical structure underlying everyday mathematical problems.

Activity 5: Explain Your Steps

Aimed at fostering reflection and confidence, students solved problems and then explained each step, either verbally or in writing, highlighting why they chose specific operations. This activity emphasized the importance of the process over the final answer, encouraged metacognition, and provided opportunities for self-assessment. By articulating their reasoning, students developed clarity in thought, improved communication skills, and built confidence in tackling unfamiliar problems. Teachers could also use these explanations to address misconceptions, provide targeted feedback, and strengthen conceptual understanding.

DATA ANALYSIS

Table 2: Statement of Students Performance

Sl. No.	Name of the Students	Scores		Difference	% of improvements
		Pre -Test	Post-Test		
1	Student-A	08	16	08	40
2	Student-B	06	15	09	45
3	Student-C	04	11	07	35
4	Student-D	08	13	05	25

GRAPHICAL REPRESENTATION

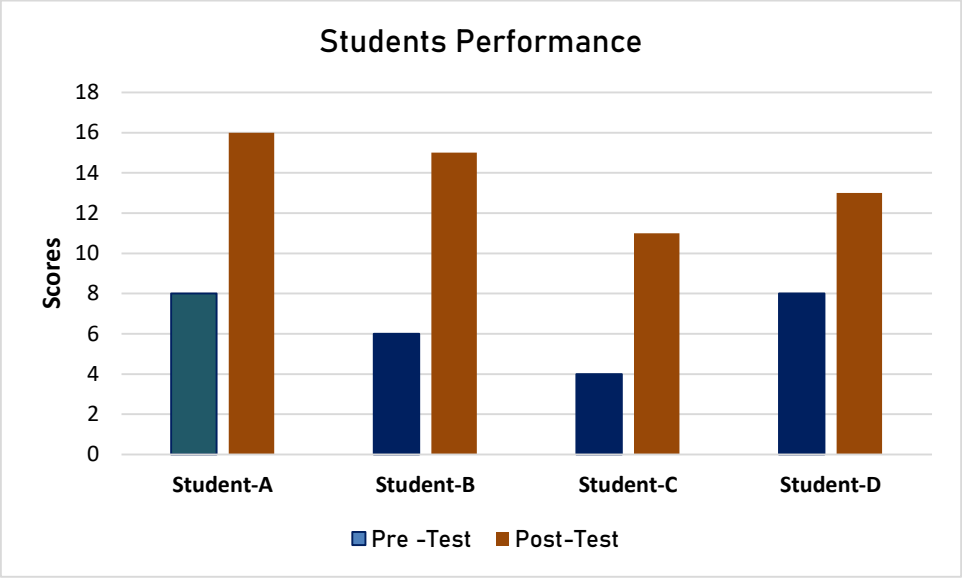

Fig1: Graph showing the effectiveness of the Action Plan

INTERPRETATION

The analysis of test results revealed that the average **pre-test** score of the learners was **6.5**, showing that students initially struggled to apply correct mathematical operations in problem situations. After the implementation of the intervention, there was a notable rise in the average **post-test** score to **13.75**, indicating a clear improvement in understanding and application. The comparison between pre-test and post-test results suggests that the teaching strategies adopted were effective in strengthening conceptual clarity and overall performance in mathematics.

FINDINGS

1. After the action plan, students showed a clear improvement in understanding which mathematical operation to use in a given situation.
2. Students gradually developed the ability to choose the correct mathematical operation after participating in simple and engaging activities.
3. During the money exchange game, students faced difficulty to apply addition and multiplication to the real-life situations.
4. In Daily life math hunt activity, the main difficulty was to identify relevant situations and choosing the correct operation.
5. Students were able to develop confidence in the solve and pass activity and also that activity improved their speed in solving the problems.
6. Reverse word creation and Explain your steps together strengthened their thinking, helped them recall concepts more quickly, and encouraged them to express their mathematical thought process clearly.
7. Overall, the students showed noticeable improvement in problem-solving accuracy and understanding.

SUGGESTIONS

1. Continue using simple, interactive activities to help students identify and apply the correct mathematical operations.
2. Include more real-life examples in lessons so that students can relate classroom concepts to their daily experiences.
3. Encourage students to explain their reasoning while solving problems to strengthen understanding and logical thinking.
4. Use collaborative activities like Solve and Pass or group discussions to build confidence and peer learning.
5. Give regular, practical exercises focusing on both the problem-solving process and the final answer to reinforce learning and develop deeper conceptual clarity.
6. Maintain a supportive and engaging environment to reduce fear or hesitation in mathematics.
7. Implement similar interventions in other topics to gradually improve overall mathematical problem-solving skills.

CONCLUSION

From this study, it is clear that students can improve their ability to apply mathematical operations when they are actively involved and encouraged to think for themselves. The activities helped them understand concepts better, gain confidence, and feel more interested in mathematics. They began to relate what they learn in class to their everyday lives, making math feel more practical and meaningful. Overall, the action plan made learning enjoyable, helped students think critically, and showed that even small, well-planned interventions can make a noticeable difference in how students approach mathematics.

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