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The Disconnect Between Learning And Applying Algebraic Expressions And Identities In Real-Life Context

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ABSTRACT

Algebra is a fundamental branch of mathematics that enhances logical thinking, reasoning and problem-solving skills. Yet, many middle school students find it difficult to connect algebraic expressions and identities to real-life situations, making learning abstract and less engaging. To address this, an Action Research study was undertaken to bridge this gap through activity-based learning. The study involved 24 students of Class 8 from Kamadhenu Convent, Basavanagudi, Mysuru (Hebbal cluster, Mysuru North block). The tools used were a Pre-test, Post-test, observation checklist and student feedback form to assess understanding, participation and attitude before and after the intervention. The research had three phases: Pre-test, intervention through two real-life-based activities and Post-test. The Pre-test results showed 18 students scored above 10 out of 20, while 6 scored 10 or below. To support weaker learners and reinforce concepts for all, three activities-Algebra in Cooking, Match the Expressions and Algebra in Shopping were conducted. These activities encouraged students to observe, analyze and apply algebra in real contexts. The Post-test showed clear improvement among the 6 initially low scorers and further progress among the 18 others. Observation and feedback revealed higher engagement, confidence and motivation. Students stated that activities made algebra more practical, enjoyable and understandable. The findings confirm that activity-based learning effectively connects abstract algebra with real life, improving retention and application. It is suggested that teachers adopt real-life examples and interactive methods, while policymakers promote flexible, experiential curricula. The research concludes that such approaches make algebra more meaningful and engaging.

Keywords: Algebraic Expressions, Real-life learning, Activity-based learning, Identities, Student engagement, Experiential learning.

INTRODUCTION

Algebra is one of the most important branches of mathematics that helps students develop logical thinking and problem-solving skills. It plays a vital role in understanding patterns, relationships and real-life situations. However, many students find algebraic expressions and identities difficult to connect with their real-life experiences. They often learn the formulas and rules without realizing how these concepts can be used outside the classroom. This disconnects between learning and applying algebra makes the subject appear abstract and less interesting for learners. As a result, students may lose motivation, face difficulties in applying their knowledge and show lower academic performance.

To address this issue, the present action research focuses on creating meaningful learning experiences through two real-life-based activities such as Algebra in Cooking, Algebra in Shopping and one memorization activity -Match the Expressions. By linking classroom learning with practical examples, the study aims to make algebra more enjoyable, understandable and useful for students in their real life.

NEED AND IMPORTANCE OF THE STUDY

This study is important for several reasons:

1. It aims to bridge the gap between school mathematics and real-life situations, helping students see the practical value of algebra.
2. It seeks to enhance student's logical reasoning and analytical thinking skills through meaningful integration of algebra with real life situations.
3. It strives to make learning mathematics more interesting and relevant, so students are more motivated to engage with the subject.
4. It provides support to policymakers and teachers in designing algebra lessons based on real-life examples and activities, thus making teaching more effective.
5. It helps to reduce math anxiety and build student's confidence in handling real-life problems involving algebraic expressions and identities.

STATEMENT OF THE PROBLEM

Many 8^{th} grade students struggle to connect Algebraic Expressions and Identities with practical real-life applications. This shows a clear disconnect between learning the concepts in theory and using them in real-life.

OBJECTIVES OF THE STUDY

1. To identify the gap between students learning of Algebraic Expressions and Identities and their application in real-life.
2. To develop and implement activity-based strategies that make algebra more practical and engaging.
3. To evaluate the effectiveness of real-life based learning activities on improving student's understanding of algebraic expressions and identities.
4. To analyze how well student's grasp Algebraic concepts in real-life contexts.

5. To provide research-based recommendations for policy makers and teachers to make algebra teaching more meaningful and contextual.

PRIORITIZED CAUSES

1. **Weak arithmetic foundation:** This affects every algebraic calculation.
2. **Rote memorization instead of conceptual understanding:** Student's memorize formulas but don't understand how to use them.
3. **Abstract teaching methods without context:** Teaching algebra in isolation makes it confusing.
4. **Limited hands-on and experiential learning:** Lack of activities prevents students from internalizing concepts.
5. **Teachers unaware of practical strategies:** Teachers may not know how to connect algebra to real-life examples.

REVIEW OF RELATED LITERATURE

Rajakumari C. (2023), study titled *"Enhancing the understanding of algebraic identities among VII standard students through blended learning technique"* looked at how using both digital tools and classroom teaching can improve student's understanding of algebra. The research showed that blended learning increased student engagement and made abstract algebraic concepts easier to understand. Pre-test and post-test results confirmed that activity-based strategies combined with technology help clarify difficult topics.

Saxena, M. (2021), in her study titled *"Bridging the Gap between Abstract Algebra and Practical Application through Experiential Learning,"* explored how hands-on learning strategies help students internalize algebraic expressions and identities. Conducted with Grade 8 students in urban schools, the research incorporated real-world problem-solving tasks such as budgeting, cooking measurements and architectural patterns. The results revealed a significant improvement in students' ability to relate algebraic concepts to daily life situations. Pre-test and post-test scores showed clear conceptual growth, while student reflections indicated increased motivation, participation and confidence. The study concluded that experiential and context-based learning makes abstract algebra more tangible and meaningful, supporting deeper understanding and long-term retention.

Sharma, R. (2020), in the study *"Contextual Learning to Enhance Algebraic Thinking in Middle School,"* explored how real-life contexts like shopping discounts, recipes and travel budgets improve algebra learning. Using pre- and post-tests with Class 7 students, the study found increased engagement, better problem-solving skills and reduced math anxiety. It concluded that contextual learning makes algebra more relevant, understandable and applicable in daily life.

Ambika S. and others (2019), study titled *"Algebra in real life"* focused on making algebra relevant to student's everyday experiences. Examples like shopping-based problems and social media puzzles helped to make learning more interesting and meaningful. The study suggests that using relatable, practical examples can enhance engagement and help students apply algebra in real life.

Liljedahl, P. (2016), study titled *"Real-world applications in math class"* showed that embedding math problems in real-life scenarios like solving mysteries can increase student motivation and improve learning outcomes. Even challenging topics like exponential functions became easier to understand when taught in a meaningful, contextual way. The research highlights the importance of connecting algebra to real-life situations.

Locke, T., & Tailby S. (2016), study titled *"Developing algebraic understanding through talk and writing"* emphasized that structured discussions and writing activities can strengthen students' grasp of algebra. Over five weeks, students engaged in journaling, discussions and reflections, which made them more confident in applying algebraic reasoning. The study supports the idea that communicating mathematical ideas enhances learning, aligning with constructivist teaching approaches.

RESEARCH METHODOLOGY

This research was carried out using both quantitative and qualitative methods and therefore followed a mixed methods approach.

- ***Quantitative methods:***
  1. A pre-test and post-test design was used to measure student's achievement before and after the intervention.
  2. The marks obtained by students were analyzed to evaluate their learning gains and to check the effectiveness of the action plan.
- ***Qualitative methods:***
  1. Observations were recorded using checklist to evaluate student's engagement and participation during the activities.
  2. Student's reflections and feedback were collected to understand their perceptions and attitudes towards the activities and their progress in learning.

Research design:

An experimental research design was executed. It involved checking the student's knowledge through their Pre-test and Post-test results.

Research tools:

1. **Pre-test and Post-test questionnaires:** To assess the understanding of algebraic expressions and identities before and after the intervention.
2. **Observation checklist:** To record participation, interest and understanding during each activity.
3. **Feedback form:** To collect student's reflections and feedbacks about the activity-based approach.

Sampling design: 8th standard students of Kamadhenu Convent, located in the Basavanagudi area of Mysuru City, which belongs to the Hebbal Cluster of Mysuru North Block in Mysuru Division. The Size of the sample is 24 students, comprising both boys and girls.

PROCEDURE

1. **Pre-test:** A test was conducted to check the student's existing understanding of algebraic expressions and identities.
2. **Analysis of pre-test:** The results showed that many students found it difficult to solve application-based questions.
3. **Planning intervention:** Designed two activities that relate algebra to real-life contexts and one activity to memorize identities and apply them correctly.
4. **Implementation:** The activities were carried out within 30 minutes.
5. **Observation and support:** Participation of students was closely observed using checklist and gave support as needed.
6. **Post-test:** A same test was conducted again to compare the student's learning after the intervention.
7. **Result analysis:** The post-test results showed improvement in scores and participation, confirming that the activities were effective.
8. **Feedback form:** Student's shared their reflections and feedbacks about activity-based approach.

ACTION PLAN

Table-1: Details of Action Plan

Sl. No.	Activities name	Duration	Frequency	Remarks
1	Algebra in cooking	25 minutes	2 in a week	Students related algebra to daily life
2	Match the expressions	20 minutes	2 in a week	Helped students recall and apply identities
3	Algebra in shopping	20 minutes	1 in a week	Students enjoyed and actively took part

DESCRIPTION OF ACTION PLAN

1. Algebra in cooking:

In this activity, a simple recipe was chosen and the ingredient quantities were represented using algebraic terms like 2x or 3x. Here x was taken as a base measurement (e.g. 1/2 cup). Students were given situations such as "cooking for 4 people" and asked to substitute and calculate the actual quantities. This helped them see how algebra connects to real-life situations, especially scaling and proportions in cooking.

2. Match the Expressions:

This activity was carried out by preparing sets of cards - half contained standard algebraic identities (e.g. $(a+b)^2$) and the other half had their expanded forms ($a^2+2ab+b^2$). Students worked in groups to match the correct pairs within a time limit. After matching, they explained their reasoning. This helped them memorize the identities and apply them correctly in problem solving.

3. Algebra in Shopping:

This activity was conducted by preparing a mock shopping catalog with items labeled using algebraic variables like x and y students were given shopping lists and asked to write expressions such as 3x+2y representing the number of items they substituted values for the variables (e.g. x = ₹50, y = ₹30) and calculated the total cost. Discount situations were also included, where students applied percentage

reductions using algebraic expressions this activity helped them understand how algebra is useful in budgeting and shopping.

STATISTICAL ANALYSIS

The statistical represents the different data about the sample, the data includes marks of pre-test and post-test, test differences and percentage of improvement of the students (samples) after conducting the activities in order to reduce the difficulties in learning among the students.

Table -2: Details of samples test scores

Sl. No.	Samples	Scores		$T_2 - T_1$	Percentage of improvement
		Pre-Test (T_1)	Post-Test (T_2)		
1	Sample 1	13	18	5	25%
2	Sample 2	13	18	5	25%
3	Sample 3	13	17	4	20%
4	Sample 4	13	15	2	10%
5	Sample 5	09	14	5	25%
6	Sample 6	12	16	4	20%
7	Sample 7	14	19	5	25%
8	Sample 8	13	16	3	15%
9	Sample 9	12	14	2	10%
10	Sample 10	11	17	6	30%
11	Sample 11	11	14	3	15%
12	Sample 12	12	14	2	10%
13	Sample 13	12	15	3	15%
14	Sample 14	13	14	1	05%
15	Sample 15	13	15	2	10%
16	Sample 16	08	14	6	30%
17	Sample 17	09	15	6	30%
18	Sample 18	10	14	4	20%
19	Sample 19	15	18	3	15%
20	Sample 20	10	15	5	25%
21	Sample 21	13	17	4	20%
22	Sample 22	11	16	5	25%
23	Sample 23	06	14	8	40%
24	Sample 24	15	18	3	15%

Pre-Test:

Table-3: Frequency distribution table of Pre-test

Marks	Frequency (f)	Midpoint (x)	fx	Cumulative Frequency
1-5	0	3	0	0
6-10	6	8	48	6
11-15	18	13	234	24
16-20	0	18	0	24

Central Tendency: Mean = 11.75, Median = 11.65, Mode = 11.45

Post-Test:

Table-4: Frequency distribution table of Post-Test

Marks	Frequency (f)	Midpoint (x)	fx	Cumulative Frequency
1-5	0	3	0	0
6-10	0	8	0	0
11-15	13	13	169	13
16-20	11	18	198	24

Central Tendency: Mean = 15.29, Median = 15.11, Mode = 14.75

GRAPHICAL REPRESENTATION

The graphical representation is a diagrammatic depiction of impact of activity through the marks scored by samples from pre-test to post-test. Here x-axis is midpoints and y-axis is frequency.

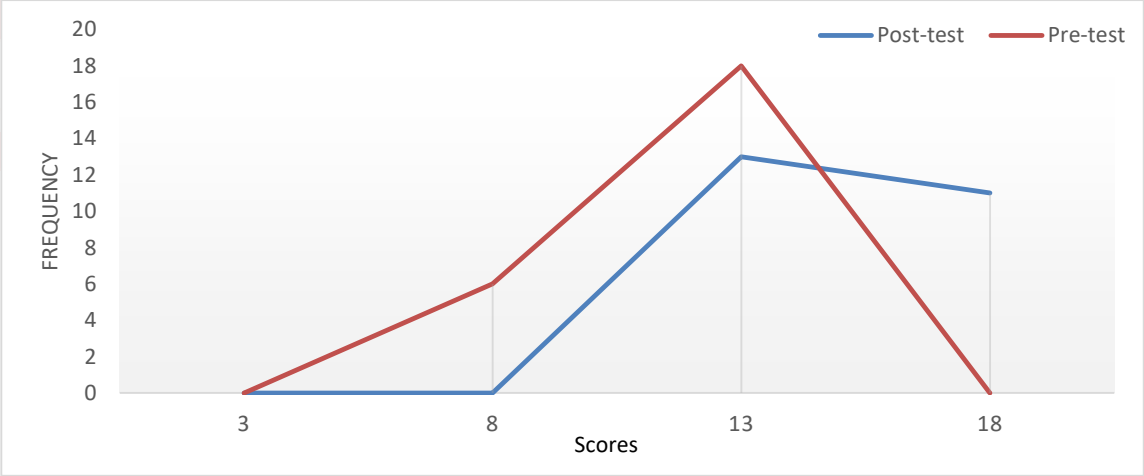

Figure-1: Line graph of Pre-Test and Post-Test Scores

INTERPRETATION OF RESULTS

In the beginning, a pre-test was given to 24 samples of Class 8 to check their understanding level of algebraic expressions and identities. The maximum marks were 20. Out of these:

- 18 samples scored above 10 marks, showing they had a basic understanding of the topic.
- 6 samples scored 10 or below, indicating they faced difficulty in learning and applying the concepts.

After identifying the weaker group, special activities and real-life applications (cooking examples, match the expressions and shopping bills with group discussions and problem-solving tasks) were conducted with them. At the same time, the rest of the samples also participated in the activities to ensure collective improvement. When the post-test was conducted:

- All 24 samples showed improvement in their scores compared to the pre-test.
- The 6 weaker samples showed a remarkable jump in their performance, gaining between 4 to 8 marks more in the post-test.
- The 18 samples who had already scored well also showed improvement. This proved that even samples who had some understanding benefited further when algebra was connected to real-life situations.

Overall class average rose significantly, which highlighted the effectiveness of activity-based learning in bridging the gap between textbook knowledge and real-life application.

In short, the data clearly showed that when algebra was taught not just as formulas but as something that can be used in real-life, samples became more confident, active and improved in their performance.

This way, the interpretation shows both the progress of the weaker group and the improvement of the stronger group, proving that the intervention was beneficial to all.

At last Researcher gathered feedback from the selected samples to determine the impact of three activities on their learning outcomes.

RESEARCH FINDINGS

1. In the pre-test, out of 24 samples, 18 samples scored above 10 marks showing they had some understanding of algebraic expressions and identities, while 6 samples scored 10 or below, that shows samples have poor foundation in basic arithmetic, lack of real-life examples and limited hands-on experience.
2. After conducting activity-based learning (like algebra in cooking, match the expressions and algebra in shopping), all samples improved in the post-test. This proved that connecting algebra to real-life made the subject more meaningful and easier to apply.
3. The 6 weaker samples who struggled initially showed the most visible growth. Ranging between 20% and 40%.
4. The 18 samples who already performed well in the pre-test also benefited. This highlighted that even above average samples deepened their understanding when algebra was related to real situations.
5. The class average improved notably from pre-test to post-test, showing that the activities did not just help a few samples but uplifted the learning of the entire group.
6. Samples expressed that they enjoyed learning algebra when it was taught through real-life examples instead of just formulas. This made them feel more confident in applying mathematics outside the classroom.

IMPLICATIONS OF THE ACTIVITIES

1. **Algebra in Cooking**
   - Samples learned how algebra can be used in daily tasks like measuring ingredients and scaling recipes.
   - They understood the importance of proportions and quantities in real-life situations.
   - This activity showed that mathematics is not only in textbooks but also in the kitchen, making it easier for them to relate learning with daily family life.

2. **Match the Expressions**
   - Samples practiced algebraic identities in a fun and interactive way through card-matching.
   - This helped them memorize and recall identities easily, not by rote learning but by understanding.
   - Group work during this activity-built teamwork, reasoning and discussion skills among samples.

3. **Algebra in Shopping**
   - Samples experienced how algebra is useful in budgeting and calculating total costs.
   - They learned to apply algebra for discounts, percentages and price comparisons, which are essential life skills.
   - This activity encouraged them to see mathematics as a practical tool for smart decision-making in real-life.

When algebra was taught through cooking, matching expressions and shopping samples began to see mathematics as a living subject connected to their real world. These activities helped remove the fear of algebra and built confidence to apply it in practical situations. The overall implication is that activity-based learning bridges the gap between classroom knowledge and real-life application, making samples not only better learners but also smarter problem solvers in their daily lives.

SUGGESTIONS

For Policy Makers

1. **Make textbooks more real-life oriented:** NCERT and state-level authorities can add more examples in the textbooks that connect algebra with cooking, shopping, sports and daily tasks.

2. **Encourage activity-based learning:** Policies should promote teaching through practical activities rather than only lecture and formula-based methods.

3. **Provide training for teachers:** Regular workshops can be arranged to guide teachers on how to use creative methods and real-life applications in teaching mathematics.

4. **Reduce textbook overload:** Simplify explanations and avoid too much abstract content so that all students, including average learners, can understand.

For Teachers

1. **Relate lessons to daily life:** Teachers should use simple activities like cooking measurements, shopping bills and puzzles to make algebra interesting and meaningful.

2. **Encourage group learning:** Activities like matching expressions or solving riddles in teams help students build confidence and support each other.

3. **Continuous observation:** Teachers should maintain observation checklists of unit test, formative assessment and summative assessment to track progress and provide special support to students who face difficulties.

4. **Use technology for better understanding:** Incorporate educational videos, math apps, digital simulations and smartboard demonstrations to make algebra more visual, interactive and easier to understand.

5. **Motivate all learners:** Even students who score well need practice with real-life applications, so activities should include the entire class, not just weaker students.

6. **Collect feedback:** Listening to student's opinions after activities helps teachers improve their methods and make learning more student-friendly.

CONCLUSION

In conclusion, this research reinforces that when algebra is taught through real-life applications, it transforms from a difficult abstract concept into an engaging, relatable and enjoyable subject that empowers students to think logically and apply knowledge confidently in their real lives.

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