International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

To Study the Effect of the Innovative Strategy " the Use of Interactive Simulations " in the Teaching of Mathematical Concepts to Elementary School Students, on their Academic Achievement

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Abstract

In the evolving landscape of education, traditional methods of teaching mathematics often fail to engage learners meaningfully. This study explores the impact of **interactive simulations** as an innovative teaching strategy to enhance **academic achievement and interest in mathematics** among middle school students. Grounded in the pedagogical vision of NEP 2020, which emphasizes conceptual understanding and experiential learning, the study was conducted using a **quasi-experimental single-group pre-test/post-test design**. A group of middle school students participated in a 10-day intervention module incorporating interactive simulations on core mathematical topics such as area, perimeter, integers, rational numbers, and 3D geometry. The analysis revealed a **statistically significant improvement** in post-test scores compared to pre-test scores, confirming the effectiveness of the intervention. The use of simulations enabled visualization of abstract concepts, fostered active learning, and promoted critical thinking. The study highlights the potential of technology-integrated strategies in transforming mathematics classrooms into more engaging and meaningful learning environments. This research not only affirms the positive impact of interactive simulations on student achievement but also advocates for their broader integration in mathematics instruction. It calls for **teacher professional development** in digital pedagogy and paves the way for **further research** at various educational levels.

Keywords: Interactive Simulations, Mathematics Teaching, Academic Achievement, Middle School, NEP 2020, Technology Integration

Introduction

Mathematics is not just a series of rote exercises performed in a classroom. Mathematics is something built into the fabric of reality: a collection of shapes, patterns, numbers and Mathematics is a living feature of the world we live in. The teacher should not just directly transact the knowledge to the learners, instead should focus on Cueing or nudging the children to discover the answers themselves - the role of a teacher being a facilitator. Emphasis should be on WHY, the reason behind the WHAT- posing open-ended questions and respecting all their ideas and appreciating them. In order to sustain the interest of students to learn Mathematics, we need to strategize our teaching using innovative techniques like flipped

classroom, collaborative learning, activity-based learning etc. by incorporating technology wherever possible. NEP 2020 emphasised on conceptual understanding rather than rote learning and learning -for-exams.

I chose to take up the innovative strategy " Interactive Simulations" which I thought, would be very useful for the present generation students to learn mathematics with more interest, enthusiasm and appreciation for the subject.

Objectives of the study :

1. To develop an innovative strategy module for teaching Mathematics to middle school students.
2. To study the impact of interactive simulations in the teaching of mathematics on the academic achievement of middle school students.

Hypothesis of the study :

There is a significant difference between the pre-test and post-test scores of the experimental group for academic achievement before and after the Intervention.

Design of the innovation :

The design adopted for the study is **Single group Quasi-experimental design.** Test/Intervention/Retest design was employed to see whether teaching Mathematics using Interactive Simulations helped in boosting the academic achievement of middle school students. This design aims to establish a cause and effect relationship between independent and dependent variables.

Independent Variable - Interactive Simulations

Dependent Variable - Academic achievement

The sample comprised of 20 students from Class 7 of St. Ann's School who were administered an intervention module of Interactive Simulations. Initially a pre-test was conducted for them and the question paper followed Bloom's Taxonomy. Then the intervention module of Interactive Simulations was administered for 10 days.

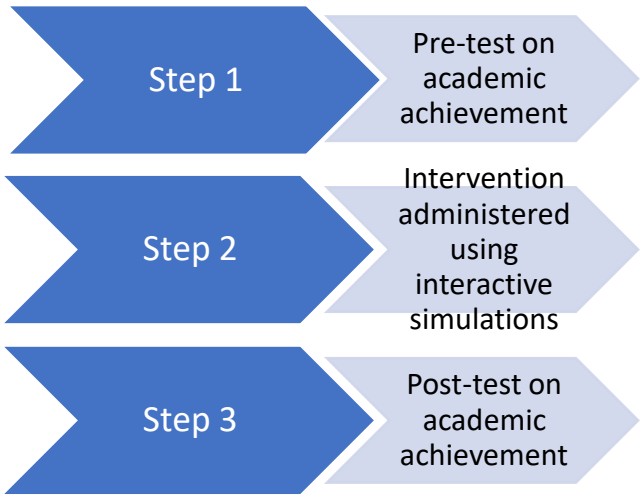


Fig 1: Design of the study

The day-wise intervention topics were as follows:
Day 1: Concepts of Area and Perimeter
Day 2: Perimeters of Square and Rectangle
Day 3: Areas of Square and Rectangle
Day 4: What are integers?
Day 5: What are rational numbers?
Day 6: Number line operations on integers
Day 7: Understanding 3D shapes.
Day 8: Dynamic illustrator- plotting points
Day 9: Some more problems on areas
Day10: Math magic problems on these topics
After 3 weeks, a parallel form of pre-test was administered as post-test on the same group of students to know the impact of this innovation on their academics. The quantitative change in their test scores was determined.

Description of the innovation:

- Interactive Simulations (Sims) are excellent tools to help support student learning. They are created to visualize math ideas. It makes students to easily understand the concepts and learn with interest.
- They are easy to access. Sims may facilitate the use of multiple representations, support students' efforts to construct their own knowledge, focus student attention on conceptual ideas, and allow immediate feedback. Though Sims offer great potential to benefit mathematics classrooms, it is how the teacher integrates this tool that will determine its effectiveness.
- These simulations and resources are generally available free. We can either create them or can use the readily available resources with various websites what they have already created.

Analysis and Interpretation:

Description	Sample size	Mean	Standard deviation	t-value	df	Significance level
Pre-test	20	3.25	2.14905			
Post-test	20	5.8	2.54641	5.82	19	Significant at 0.05 level

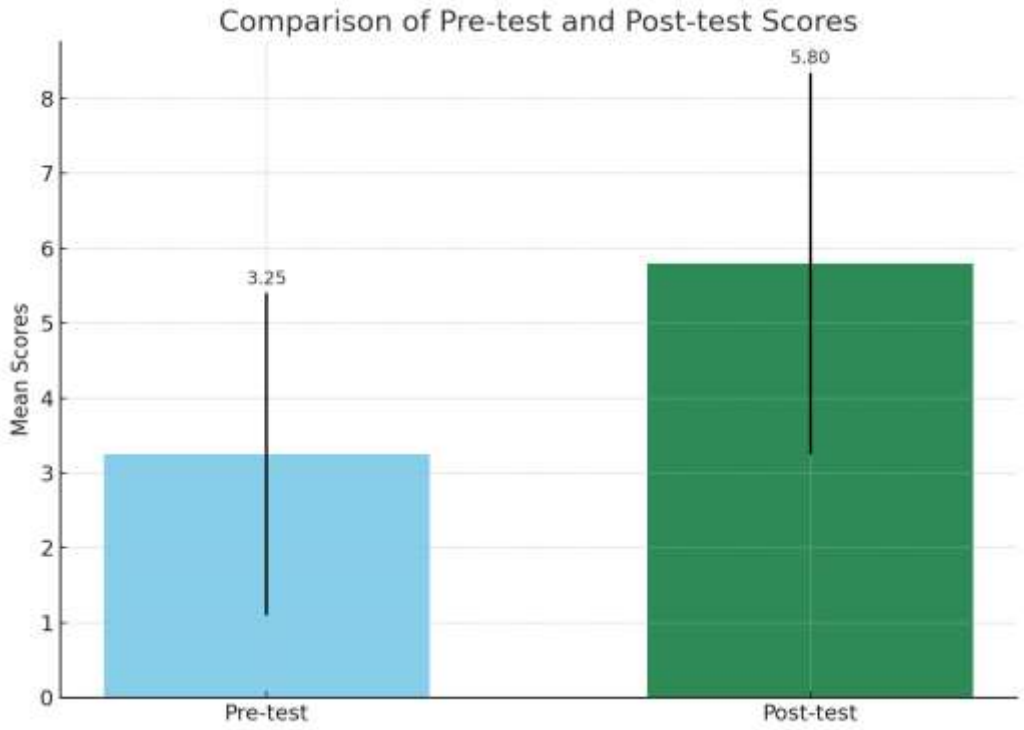
SD (2.54641) is greater than the pre-test SD (2.14905). The obtained t-value (df =19) 5.82 is greater than the t table value=2.093. Therefore, the hypothesis of the study is accepted, and null hypothesis is rejected. Therefore, there is a significant difference between the pre-test and post-test scores for academic achievement before and after administering the intervention.

Statistical Summary

- **Sample Size (N)**: 20 students
- **Pre-test Mean**: 3.25 (SD = 2.15)
- **Post-test Mean**: 5.80 (SD = 2.55)
- **t-value**: 5.82
- **Degrees of Freedom (df)**: 19
- **Significance Level**: The result is **statistically significant at the 0.05 level**.

Interpretation

Since the **t-value (5.82)** is large and the result is **significant at the 0.05 level**, we can conclude that:
There is a statistically significant improvement in students' scores from the pre-test to the post-test.
This suggests that the **intervention or teaching strategy** applied between the two tests (e.g., interactive simulations or another method) had a **positive effect on academic achievement**.



Here is the **graphical representation** of the data:

- The **bar chart** shows the **mean scores** for the pre-test and post-test.
- **Error bars** represent the **standard deviation**, indicating variability in scores.
- There is a clear increase in the mean score from **3.25 (Pre-test)** to **5.80 (Post-test)**, supporting the conclusion of improved performance after the intervention.

Outcome of the innovation:

After the study, it was clear that there was a significant improvement in the test scores after administering the interactive simulations in teaching mathematics.

Implications:

- The study helps in encouraging mathematics teachers to come out with innovative ideas to be incorporated in their teaching.
- The study showed that students enjoy learning Mathematics with more liking, interest, and readiness by using innovative teaching strategies rather than the traditional teaching methods.
- The learners, for sure, taste the essence and beauty of Mathematics.
- Children would be surprised to know about how Mathematics is everywhere around and how it plays a superior role over all other disciplines as Simulations promote the use of critical and evaluative thinking.

- It helps students develop logical reasoning, decision-making, critical thinking, and problem-solving skills, which in turn help them to handle problematic situations in real life too and lead a balanced life.
- The study promotes professional development of mathematics teachers.

Scope for further study:

The study can be extended to the students at high school, higher secondary and university level students. Efforts should also be put in training the teachers as to how to use these innovative teaching strategies based on technology.

Conclusion:

As it is clear from the study that teaching mathematics through interactive simulations enhances the interest of the learners towards Mathematics and keeps them engaged, it is highly recommended that every mathematics teacher should get updated with the changing times and make a move forward to develop great learners for a future Transformed India.

Web References:

1. https:// files.eric.ed.gov
2. https:// phet.colorado.edu
3. https:// www.geogebra.org
4. https:// www.olabs.edu.in