A Study of Effect of Toy Based Pedagogy on Achievement in Mathematics of Class 6th Students

A Dissertation Submitted to Barkatullah University, Bhopal in the partial fulfilment of the requirement for the degree of

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DECLARATION

I hereby declare that this study entitled, **"A Study of Effect of Toy Based Pedagogy on Achievement in Mathematics of Class 6th Students"** has been carried out by me during the academic years 2023-2025 in partial fulfilment of the requirement for the degree of Two-year M.Ed. course of Barkatullah University, Bhopal (M.P).

This study has been conducted under the guidance and supervision of Dr. Saurabh Kumar, Asso. Prof., Department of Education, Regional Institute of Education (NCERT), Bhopal (M.P.).

I hereby declare that the research work done by me is original. This dissertation has not been submitted by me for the award of any degree or diploma in any Institute/University.

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CERTIFICATE

This is to certify that **Archit Nema** student of two-year M.Ed. course in the year 2023-2025 of Regional Institute of Education, Bhopal has worked under my guidance and supervision for his dissertation **"A Study of Effect of Toy Based Pedagogy on Achievement in Mathematics of Class 6th Students".** This piece of research work is genuine and ready for submission and evaluation.

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CHAPTER-I

INTRODUCTION

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INTRODUCTION

1.1. INTRODUCTION

The evolution of pedagogical practices has been significantly influenced by advancements in cognitive psychology, educational technology, and socio-cultural shifts. Among the many innovative approaches to teaching and learning that have emerged in recent decades, toy-based pedagogy stands out as an experiential and learner-centered method that leverages the power of play to foster cognitive, emotional, and social development. Toy-based pedagogy refers to the integration of educational toys and play materials into the curriculum to enhance conceptual understanding and skill acquisition in a fun, engaging, and meaningful way. Rooted in constructivist learning theories, this pedagogical model emphasizes active learning, collaboration, creativity, and contextualization of abstract concepts (Piaget, 1952; Vygotsky, 1978).

The National Education Policy (NEP) 2020 of India emphasizes the importance of toy-based pedagogy, especially in the foundational years of education. Recognizing the value of play in early learning, NEP 2020 advocates for a curriculum that is flexible, multi-faceted, and play-based to foster holistic development. It encourages the integration of local and indigenous toys to connect children with their cultural heritage while making learning enjoyable and contextually relevant. By incorporating toys into the educational process, NEP 2020 aims to enhance cognitive, social, and emotional growth. The policy also highlights the need for teacher training in toy-based methods and promotes inclusive practices to ensure all children, including those with special needs, benefit from this engaging approach. Overall, NEP 2020 envisions a child-centered education system where toys and play a crucial role in creating a joyful and effective learning environment.

Toy-based pedagogy in mathematics leverages the natural curiosity and playfulness of children to teach complex concepts through interactive and hands-on activities. By using tools such as building blocks, abacuses, number puzzles, and measuring toys, educators can transform abstract mathematical ideas into tangible experiences. This approach not only makes learning enjoyable but also enhances comprehension and retention. For instance, children can learn about geometry and spatial relationships through constructing shapes with LEGO, or grasp basic arithmetic using counting toys and board games. Additionally, manipulatives like fraction circles and digital apps provide visual and tactile methods to explore fractions and decimals. Overall, toy-based pedagogy fosters a deeper understanding of mathematics by engaging students in meaningful, playful learning experiences.

Play refers to the activities that are freely sought by individuals or groups entirely for enjoyment. It has an important mechanism on a child's cognitive, social, and emotional development (APA Dictionary of psychology, 2022). Play assists children to gain self-regulation, language, Mathematics skills, and social and cognitive competencies (Copple &

Bredekamp, 2009; Sluss, 2005; Meaney et al., 2014). Children develop knowledge while they are playing which is why Montessori, Reggio Emilia, and Froebel considered play as an effective pedagogy for children's Learning (Sluss, 2005; Samuelsson & Carlsson, 2008). "Nazmin Sultana (2023)".

Toy-based pedagogy is increasingly being recognized as an effective and inclusive educational approach. It transforms learning into an interactive and joyful experience by incorporating toys, games, and manipulatives into the instructional process. These tools serve not merely as playthings but as cognitive and pedagogical aids that bridge the gap between theory and practice. Ailwood (2003) noted that structured play through educational tools can stimulate emotional, social, and intellectual development.

The integration of toys in the teaching-learning process is not merely an aesthetic enhancement of education; it is a strategic shift rooted in cognitive science and educational psychology. Ginsburg (2007) emphasized that play-based learning, especially when guided by an educator, can facilitate critical cognitive functions such as problem-solving, reasoning, and abstract thinking. The **National Education Policy (NEP) 2020** of India has underscored the importance of play-based and toy-based learning, especially in foundational and preparatory stages, thus institutionalizing its relevance in formal education (MoE, 2020).

1.2. CONCEPT AND DEFINITION OF TOY-BASED PEDAGOGY

Toy-based pedagogy refers to the **intentional, curriculum-aligned use of toys and play materials in teaching to foster academic, social, and emotional learning**. Unlike unstructured play, toy-based pedagogy has clear educational objectives and is planned to meet curriculum outcomes. Wood and Attfield (2005) define this approach as "a pedagogical framework that utilizes play materials for structured yet flexible learning experiences, aiming to develop a broad range of student competencies."

1.2.1. CHARACTERISTICS OF TOY-BASED PEDAGOGY

This pedagogical method exhibits several defining features:

- **Active Learning**: Students engage directly with materials, enabling deeper learning through discovery.
- **Multisensory Stimulation**: Toys engage multiple senses, helping to cater to diverse learning styles.
- **Collaborative Engagement**: Toys often promote peer interaction, fostering cooperation and communication.
- **Inclusivity**: Toy-based activities can be adapted for learners with varied needs and abilities (Saracho & Spodek, 1998).

1.2.2. TYPES OF EDUCATIONAL TOYS

Toys used in pedagogy can be broadly classified into:

- **Manipulatives**: Building blocks, counters, and tangrams used to teach math concepts (Clements & Sarama, 2007).
- **Puzzle Toys and Games**: Enhance logical reasoning and spatial awareness (Berk, 2009).
- **Cultural and Indigenous Toys**: Promote appreciation of local heritage and contextualized learning (Kumar, 2021).
- **Digital Toys**: Support interactive and tech-based learning through apps and robotic kits (Plowman & Stephen, 2005).

Each type of toy serves specific learning goals and can be selected based on curriculum needs, student level, and subject matter.

1.2.3 THEORETICAL FOUNDATIONS OF TOY-BASED PEDAGOGY

The effectiveness of toy-based pedagogy is supported by several foundational learning theories.

- **PIAGET'S CONSTRUCTIVIST THEORY**
  Jean Piaget's cognitive development theory posits that children actively construct knowledge through their experiences. According to Piaget (1952), toys provide the "tools for thinking" that enable children to manipulate their environment, thereby promoting schema development through assimilation and accommodation.
- **VYGOTSKY'S SOCIO-CULTURAL THEORY**
  Lev Vygotsky emphasized the role of social interaction and cultural tools in learning. Toys serve as **mediating tools** within a child's Zone of Proximal Development (ZPD), where learning is most effective when scaffolded by an adult or peer (Vygotsky, 1978). Collaborative play involving toys enables guided discovery and co-construction of knowledge.
- **GARDNER'S THEORY OF MULTIPLE INTELLIGENCES**
  Howard Gardner's theory (1983) proposes that intelligence is not singular but multifaceted. Toy-based activities can be designed to target various intelligences such as logical-mathematical (using number games), bodily-kinesthetic (using construction sets), and interpersonal (through cooperative games).
- **MONTESSORI METHOD**
  Maria Montessori advocated for structured, purposeful play through didactic materials, many of which resemble toys. Her method aligns with toy-based pedagogy in emphasizing hands-on learning, autonomy, and the child's natural drive for discovery (Montessori, 1912).

1.2.4. TOY-BASED PEDAGOGY IN THE INDIAN EDUCATIONAL CONTEXT

India's education system, marked by large class sizes and diverse learner needs, faces challenges in ensuring quality learning outcomes. Toy-based pedagogy offers a promising solution, especially in under-resourced and multilingual classrooms. Its application in Indian classrooms is supported by:

- **NEP 2020**: Calls for "discovery-based, discussion-based, and analysis-based learning" starting from foundational stages (MoE, 2020).
- **Toycathon 2021**: A national initiative to promote indigenous toy design aligned with educational objectives.
- **Experiential Learning Mandates**: CBSE and NCERT now encourage activity-based assessments and classroom practices (NCERT, 2019).

Kumar and Garg (2022) report that integrating locally made toys in rural classrooms not only improved attendance but also enhanced students' understanding of abstract topics such as fractions and symmetry.

1.3. RATIONALE

The rationale of a study outlines the reasons behind conducting research and provides a justification for the chosen topic and objectives. In the context of the study on the "**A Study of Effect of Toy Based Pedagogy on Achievement in Mathematics of Class 6th Students**."

The following rationales can be considered:

Integration of play based pedagogy in Education.

Enhancing mathematics Education.

Addressing diverse learning styles.

Promoting active engagement.

NEED AND SIGNIFICANCE OF THE STUDY

Engagement in mathematics is crucial for several reasons. Firstly, it addresses the diverse learning preferences of students, offering a potential avenue to cater to visual and auditory learners. Secondly, the use of Toy based pedagogy can significantly enhance engagement by presenting information in an interactive and captivating format, potentially making the learning experience more enjoyable. Thirdly, in the context of mathematics, which often involves complex calculation and skills concepts can provide a tangible and immersive learning experience, aiding comprehension. Additionally, exploring the impact of educational toys at this stage is essential for understanding how toys integration aligns with the developmental needs of students and contributes to their overall academic motivation and achievement. This study holds the promise of not only informing instructional practices but also contributing valuable insights to the ongoing discourse on effective pedagogy and educational innovation.

This study is significant in light of the growing recognition of experiential and toy-based learning as an effective pedagogical approach, especially in Mathematics education. Mathematics is often seen as a challenging and abstract subject, particularly at the middle school level. Toy-based pedagogy provides an engaging, hands-on method to simplify complex mathematical concepts, catering to diverse learning styles including visual, auditory, and kinesthetic learners. By incorporating educational toys and manipulatives into teaching, students can actively participate in their learning process, which enhances motivation, creativity, and conceptual clarity. The study gains further importance considering the recommendations of the National Education Policy (NEP) 2020, which advocates for the integration of play-based and activity-based learning in formal education, especially at the foundational and preparatory stages. In this context, the study not only explores the pedagogical effectiveness of toys in improving mathematical achievement but also supports national educational reforms aimed at holistic and inclusive learning. Furthermore, the research provides valuable insights for teachers, curriculum designers, and policy makers on how to utilize low-cost or indigenous toys to improve classroom engagement and learning outcomes. It contributes to the body of empirical research by providing data on the practical benefits of toy-based pedagogy in real classroom settings, thereby offering a strong foundation for further studies and policy implementation.

1.4. STATEMENT OF THE PROBLEM

The present study entitled as "**A Study of Effect of Toy Based Pedagogy on Achievement in Mathematics of Class 6th Students.**"

1.5. OBJECTIVES OF THE STUDY

1.5.1. To compare the mean achievement scores in mathematics of students taught through Toy-based pedagogy and traditional method.

1.5.2. To compare the mean achievement scores in mathematics of students taught through Toy-based pedagogy and traditional method on the basis of gender.

1.6. HYPOTHESIS OF THE STUDY

1.6.1. There is no significant difference between the mean achievement scores in Mathematics of students taught through Toy-based pedagogy and traditional method.

1.6.2. There is no significant difference between the mean achievement scores in Mathematics of students taught through Toy-based pedagogy and traditional method on the basis of gender.

1.7. OPERATIONAL DEFINITION

Educational toys: Toys specially designed to convey educational content with the intention of facilitate learning.

Traditional Method: The traditional method refers to a method of problem-solving or decision-making that has been used for a long time and is considered conventional or established

Toy Based Pedagogy: Toy-based pedagogy refers to the intentional, curriculum-aligned use of toys and play materials in teaching to foster academic, social, and emotional learning.

1.8. DELIMITATION OF THE STUDY

The delimitations of the study are as follows-

- Experiment was conducted only in Demonstration Multipurpose School, Bhopal, M.P.
- Sample consists of Class 6^{th} studenty only.
- Instructional intervention of only 21 days was given by the researcher.

CHAPTER-II

REVIEW OF RELATED LITERATURE

CHAPTER-II

REVIEW OF RELATED LITERATURE

2.1. INTRODUCTION

Research takes the advantage of the knowledge which has accumulated in the past as a result of constant human endeavour. It can never be undertaken in isolation of the work that has already been done on problems which are directly or indirectly related to a study proposed by a researcher. A careful review of the research journals, books, dissertations, thesis and other sources of information on the problem to be investigated is one of the important steps in the planning of any research study.

The review of related literature helps the researcher to delimit and define his problem. It brings the researcher up-to-date on the work which others have done and thus to state objectives clearly and concisely. It helps the researcher avoid unintentional duplication of well-established findings. It gives an understanding of the research methodology which refers to the way the study is to be conducted. It helps to know about the tools and instruments to be used and also provides insight into statistical methods through which validity of results is to be established. The final and important specific reason for reviewing related literature is to know about the recommendations of previous researchers for further research which they have listed in their studies.

2.2. Theoretical Foundations and Global Perspectives

Jean Piaget (1952) emphasized that children acquire cognitive abilities through direct interaction with their environment. According to his theory, manipulating concrete objects plays a key role in helping children internalize abstract mathematical concepts. Hands-on materials such as blocks, counters, and geometric toys are especially effective in facilitating mathematical thinking and logical reasoning.

Jerome Bruner (1960) proposed the theory of representation, where learners construct knowledge through enactive (action-based), iconic (image-based), and symbolic (language-based) modes. His idea of discovery learning and scaffolding supports toy-based pedagogy, as children actively explore and construct understanding through structured play.

Maria Montessori (1964) introduced a hands-on, child-centered educational approach that emphasized learning through carefully designed didactic materials. Montessori materials, which qualify as structured educational toys, aim to develop sensory

awareness and early mathematical understanding through tactile and manipulative experiences.

Lev Vygotsky (1978) introduced the concept of the Zone of Proximal Development (ZPD), which highlights the importance of social interaction in learning. According to Vygotsky, learning occurs most effectively when children are supported by peers or adults within their ZPD. Toy-based activities often provide opportunities for collaborative learning, enabling students to extend their thinking through guided discovery.

Kersh, Casey, and Young (2008) found that children who engaged with construction toys such as LEGO demonstrated improved spatial reasoning and problem-solving abilities. These skills are critical in mathematical learning, particularly in geometry, measurement, and logical thinking.

Clements and Sarama (2009) established that early childhood mathematics programs incorporating structured toys and manipulatives significantly enhanced foundational mathematical skills. Their research supports the alignment of play-based activities with developmental learning trajectories in mathematics.

2.3. Empirical Studies in the Indian Context

Saravanan and Devi (2018) conducted a study on middle school students and found that the use of geometric toys significantly improved spatial reasoning and comprehension of shapes, angles, and symmetry. The study concluded that toy-based learning increased engagement and mathematical accuracy.

Kumari (2019) investigated the use of manipulatives among low-achieving students in arithmetic and observed that tools such as number lines, abacuses, and counters helped improve conceptual understanding and confidence. The study emphasized that toy-based methods are particularly beneficial for learners struggling with abstract content.

Pathania and Sinha (2020) undertook experimental research with Class 6 students and reported that those taught through toy-based methods showed superior performance in measurement and symmetry. The use of interactive tools and hands-on activities resulted in higher retention and conceptual clarity.

NITI Aayog (2020) highlighted the importance of promoting indigenous toys as part of educational reform. It encouraged the use of culturally relevant and locally produced toys in classrooms, aligning with the larger vision of integrating experiential and joyful learning.

NEP (2020) marked a significant policy shift by advocating activity-based, experiential learning across all levels of education. The policy recommends incorporating both traditional and modern educational toys to support learning across subject areas, especially in foundational numeracy.

NCERT (2021) released guidelines to encourage toy-based learning in formal education. The guidelines advocated for the use of low-cost, recyclable, and indigenous toys to make classroom learning more engaging and relatable, particularly in mathematics.

Gupta and Arora (2021) found that students in Delhi government schools taught using low-cost educational toys showed better understanding of number systems and geometry. The study emphasized that toy-based methods reduced anxiety and enhanced classroom participation.

India Toy Fair (2021) served as a platform to promote educational toys and highlighted innovations in play-based learning. The initiative stressed the value of integrating indigenous toys into formal curriculum to foster deeper learning and national identity.

CBSE (2022) implemented a pilot program integrating toys and games into the middle school mathematics curriculum. The initiative resulted in increased engagement, improved scores in topics like fractions and geometry, and positive feedback from both students and teachers.

2.4. RESEARCH GAPS IDENTIFIED

- Despite promising results, there are notable gaps in research:
- Few quantitative studies using standardized tests assess the direct impact of toy-based pedagogy on math achievement.
- Limited focus on middle school students, especially Class 6 learners.
- Lack of comparative studies between toy-based and traditional teaching methods in mathematics.
- Addressing these gaps can provide stronger evidence and guidelines for implementing toy-based pedagogy effectively in classrooms.

2.5. CONCLUSION

The reviewed literature strongly supports toy-based pedagogy as an effective approach to enhancing mathematics learning through active, concrete, and social experiences. Constructivist theories and Indian educational policies endorse such methods. Empirical studies from India and abroad validate the benefits of manipulatives and educational toys in improving student understanding and achievement. However, more focused research on Class 6 students and rigorous quantitative evaluation is needed, which this dissertation aims to provide.

CHAPTER-III

METHODOLOGY

CHAPTER-III

METHODOLOGY

3.1. RESEARCH METHOD

Before starting any work or investigation planning is must which enables the research investigator to proceed in a sequential and systematic way. The present study was **quantitative in nature, True experimental research design.** This design employed in the present study was **two group pre-tests and post-test** design with random sample.

The present study involves the study on **A Study of Effect of Toy Based Pedagogy on Achievement in Mathematics of Class 6th Students** of Bhopal District, M.P. and the investigator has made an attempt to find out the differences in the Academic Achievement among the students.

Experimental research study requires the construction of two different types of groups for experimentation. Accordingly **control group** (VI-A) and **experimental group** (VI-B) were constituted. The control group was taught in traditional method and the experimental group was taught by applying toy-based pedagogy.

This design is stronger than single group pre-test-treatment-post-test design. In the single group design, the children get exposure to both the methods of teaching, which would affect the effects of the experiment. After gaining knowledge through the literature related to the methods of teaching and the problem under study, the experimental procedure was executed.

Table-3.1: Design of the Study

Characteristics	Control Group	Experimental Group
Early Status	Class-VIA	Class-VIB
Treatment	Traditional Method	Toy Based Pedagogy
Terminal Status	Pre Test and Post Test	Pre Test and Post Test

3.2. VARIABLES OF THE STUDY

The present investigation is an attempt to determine **A Study of Effect of Toy Based Pedagogy on Achievement in Mathematics of Class 6th Students**.

The variables involved are:

- **Independent Variables:** The toy-based pedagogy involved in the teaching of mathematics was taken to be the independent variable in this study.
- **Dependent Variables:** The achievement in Mathematics was treated as the dependent variable in this study.

3.3. POPULATION

The present study was conducted on class-VI school students of M.P. state. Thus, in the present investigation the population refers to all the students from class-VI studying in Demonstration Multipurpose School, Bhopal.

3.4. SAMPLE

The present study is an experimental study concerned with the study of "A Study of Effect of Toy Based Pedagogy on Achievement in Mathematics of Class 6th Students of Bhopal District, M.P." Random sample technique is used for the present study. The researcher selected children of two sections belonging to the sixth standard DEMONSTRATION MULTIPURPOSE SCHOOL, BHOPAL as sample. It is an English medium school.

Section-A and Section-B were selected as control group and experimental group respectively. There were 20 students in control group and 20 students in experimental group. Both the groups were taught by the researcher only.

Table-3.2: Details of Sample

Group	Section	No. of Students
Control Group	VI-A	20
Experimental Group	VI-B	20

3.5. DATA COLLECTION

The data collection for the present study was carried out using a **true experimental design** to investigate a Study of Effect of Toy Based Pedagogy on Achievement in Mathematics

of Class 6th Students. A total of 40 students were randomly assigned to two groups: the **control group** (20 students) and the **experimental group** (20 students). The instructional content focused on three key topics from the Class 6 NCERT Mathematics curriculum — **Mensuration, Integers, and Symmetry**. The experimental group received instruction using **toy-based pedagogy**, incorporating educational toys, manipulatives, and activity-based learning strategies designed to enhance conceptual understanding. In contrast, the control group was taught using **traditional methods**. The total duration of the intervention was **21 days**, during which both groups received equal instructional time under similar classroom conditions. To measure students' academic performance, a standardized **achievement test** was administered as both a **pre-test and post-test** to assess prior knowledge and learning gains. The test was teacher-made, content-validated by subject experts, and aligned with the learning outcomes of the selected topics. The collected data was later analyzed to evaluate the impact of toy-based pedagogy on student achievement in mathematics.

3.6. TOOLS

Through the review related literature, the investigator identified that the teaching strategies effectively change the pupil's attitude towards Mathematics. So, the investigator developed the achievement test to measure the achievement scores. The following tools were used:

- Achievement Test in Mathematics

The Tool was validated by the Supervisor of the study.

3.7. ACHIEVEMENT TEST

An achievement test in Mathematics was constructed and validated by the investigator, in order to measure the level of achievement in Mathematics. The question paper contains three lesson of Mathematics Text book of standard VI. Total number of questions were 18. The test comprised of 27 marks and 45 minutes were given. Test was administered on both the groups.

3.8. DEVELOPMENT OF THE TEST

The test covers the chapter Mensuration, Symmetry, Integers. Research Supervisor's opinion was taken into consideration while developing the tool.

Table-3.3: Achievement test Questionnaire

Topic	Knowledge	Understanding	Application	HOTS	Total question
Mensuration	3 (1 marks)	1(1 marks)	1(2 marks)	1(3 marks)	6(9 marks)
Symmetry	3(1 marks)	1(1 marks)	1(2 marks)	1(3 marks)	6(9 marks)
Integers	3(1 marks)	1(1 marks)	1(2 marks)	1(3 marks)	6(9 marks)
Total questions	9(9 marks)	3(3 marks)	3(6 marks)	3(9 marks)	18(27 marks)

The test included two types of questions:

- **Multiple Choice Type question.**
- **One word question.**

3.9. ADMINISTRATION OF THE PRE-TEST

Before starting the treatment to experimental group and the control group, both groups were subjected to the pre-test and the scores of the pre-test were collected.

3.10. ADMINISTRATION OF THE POST-TEST

After giving the treatment of 21 days to the experimental group and the control group, both groups were subjected to the post-test and the scores of the post-test were collected.

3.11. PROCEDURE FOR DATA COLLECTION

The present study was conducted in two stage, in the initial stage the instructional material and the tools were prepared and in the final stage implementation on the group of 40 students of class-VI as mentioned earlier from which 20 students in control group and 20 students in experimental group.

The lesson plans for both control group and experimental group and achievement test are provided in the appendix.

3.12. STATISTICAL TECHNIQUES

In the present study, the relevant data obtained from the test scores of the pre-test and

post-test was analysed using different statistical techniques.

Mean and Standard Deviation were calculated to determine the central tendencies of the samples and to compare them.

Differential analysis provides inferences involving determination of statistical significance of difference between groups with reference to selected variables. To compare the difference between the means of the small sample, independent t-test was applied.

CHAPTER-IV

DATA ANALYSIS AND INTERPRETATION

CHAPTER-IV

DATA ANALYSIS AND INTERPRETATION

4.1. INTRODUCTION

This chapter deals with analysis and interpretation of the data collected. The collected data was subjected to appropriate statistical procedures. Based on these results the hypotheses are accepted or rejected. What is thus done in this chapter is analysing the data, testing the hypothesis and then interpreting the results, that is taking decisions regarding the rejection or acceptance of the hypotheses.

4.2. SCHEME OF ANALYSIS

The numerical data gathered by the investigator from the experimental and the control group was organised, analysed and interpreted using various statistical methods. Statistical data describes group behaviour or group characteristics abstracted from a number of individual observations that are combined to make generalizations possible.

In the present study the data was collected from 40 students of class-VI. Among them 20 students in control group and 20 students in experimental group. Their performances were also compared to find the effectiveness of toy-based pedagogy.

The collected data was analysed by employing statistical methods to arrive at meaningful conclusions. The data collected was subjected to appropriate statistical procedure to test the hypotheses with which the study was initiated.

Descriptive Analysis was done. It provided information about the nature of a particular group. To compare the two groups of children who were taught in two different methods in terms of their achievement, mean and standard deviations were calculated.

Researchers find it important to determine whether the difference between two means is known as t-test. In the present investigation, T-test was used to test the significance of the difference between the means of two samples taught by different methods. The details of the statistical technique employed for the analysis of data, result obtained through the analysis regarding the acceptance and rejection of hypotheses is presented below.

4.2.1. Testing of Hypotheses

The Hypotheses formulated was tested for significant relationship that existed in the mean difference in scores of the children taught by toy-based pedagogy and traditional method.

4.2.2. Statistical Presentation of Data

Objective-1: To compare the mean achievement scores in mathematics of students taught through Toy-based pedagogy and traditional method.

Ho: There is no significant difference between the mean achievement scores in Mathematics of students taught through Toy-based pedagogy and traditional methods.

Table No. 4.1: Mean, S.D, and t-value of experimental and control group student on pre-test and post-test scores on achievement in mathematics taught through Toy-based pedagogy and traditional methods.

Group	N	Mean score		Gain mean	SD		df	t value	p value	Remarks
		Pre	Post		pre	post				
Exp.	20	10.3	21.05	10.75	3.6143	3.17017	38	2.024	2.78E-07	P<0.05
Con.	20	8.1	15.75	7.65	3.43205	4.29044				

Interpretation

The mean gain score of the students in the experimental group is 10.75, which is higher than those of the mean gain score of the students in the control group i.e., 7.65. As the calculated value of 't' i.e., 2.024 is greater than table value at 0.05 level of significance for degree of freedom 38 i.e., 2.024, therefore, 't' value is **significant** and null hypothesis is **rejected.** Thus, it can be stated that there is a **significant difference** in the achievement scores of two groups i.e., taught by traditional method and toy-based pedagogy.

Conclusion

It is evident from the table that experimental group has mean gain scores more than that of control group. Therefore, it can be concluded that Toy Based pedagogy effective than the traditional method.

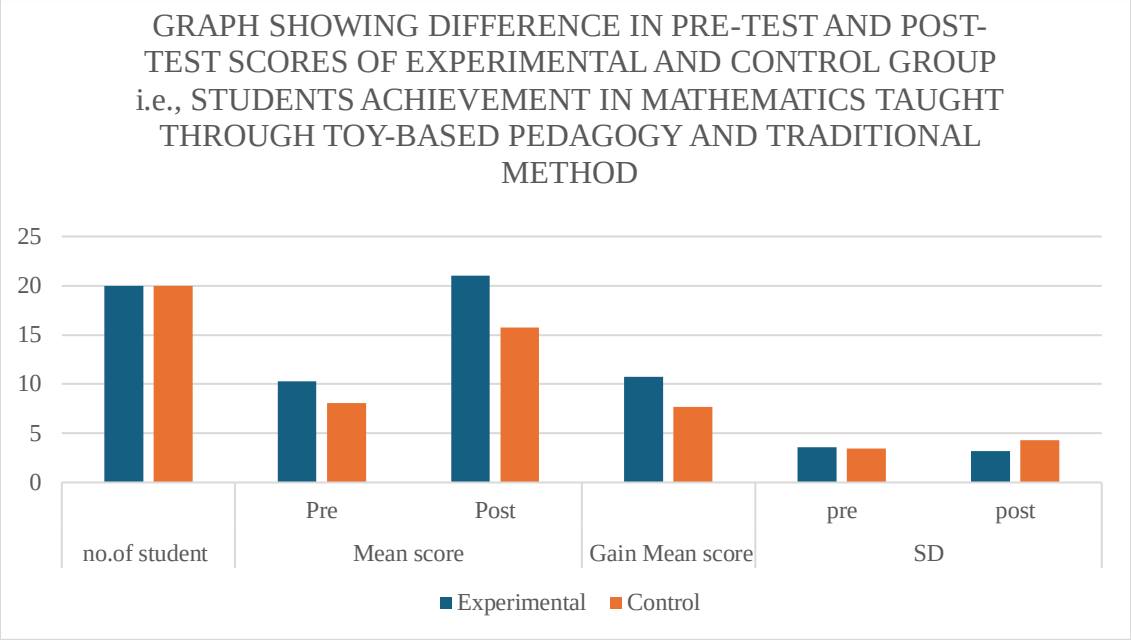

Figure 4.1 Graph showing difference in pre-test and post-test scores of experimental and control group i.e., student's achievement in mathematics taught through toy-based pedagogy and traditional methods.

Objective-2: To compare the mean achievement scores in mathematics of students taught through Toy-based pedagogy and traditional method on the basis of gender.

Ho: There is no significant difference between the mean achievement scores in Mathematics of students taught through Toy-based pedagogy and traditional method on the basis of gender.

Table No.4.2: Mean, S.D, and t-value on pre-test and post-test scores on achievement in mathematics taught through Toy-based pedagogy and traditional method on the basis of gender.

Gender	N	Mean		Gain mean score	SD		df	t value	p value	Remark
		pre test	post test		pre test	post test				
Male	23	9.956522	20.13043	10.17391	3.509445	3.817476	38	2.015368	4.55E-06	P<0.05
Female	17	8.176471	16.05882	7.882353	3.695188	4.602589		2.036933		

Interpretation

The mean gain score of the male students is 10.173, which is higher than those of the mean gain score of the female students 7.882. As the calculated value of 't' i.e., 2.015 is greater than table value at 0.05 level of significance for degree of freedom 38 i.e., 2.015, therefore, 't' value is **significant** and null hypothesis is **rejected.** Thus, it can be stated that there is a **significant difference** in the achievement scores on the basis of gender taught by traditional method and toy-based pedagogy.

Conclusion

It is evident from the table that Male has gain mean scores more than that of Female. Therefore, it is concluded that toy-based pedagogy and traditional method affect achievement score on the basis of gender.

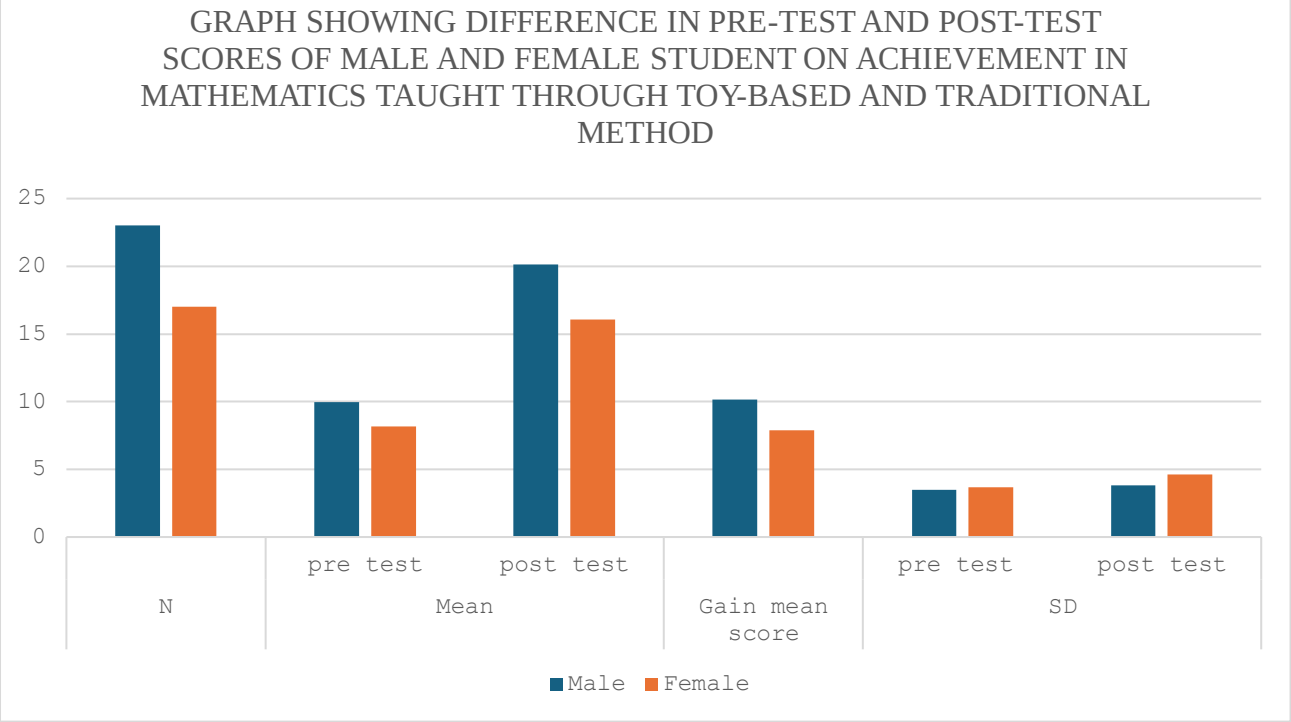

Figure 4.2 Graph showing difference in pre-test and post-test scores of male and female students on achievement in mathematics taught through toy-based pedagogy and traditional methods.

4.3. DISCUSSION AND CONCLUSION

The present study aimed to examine the effectiveness of toy-based pedagogy in enhancing the achievement of Class 6 students in mathematics as compared to the traditional method. The analysis of data revealed that the students who were taught using toy-based pedagogy showed significantly higher gains in achievement scores than those taught through traditional methods. The study provides strong evidence that toy-based pedagogy is a more effective instructional strategy than traditional methods for teaching mathematics to Class 6 students. The experimental group outperformed the control group in terms of achievement scores, indicating that integrating educational toys and play-based strategies significantly enhances students' understanding and performance in mathematics. Additionally, the findings suggest that while gender-based differences exist, toy-based pedagogy benefits all learners and promotes equity in learning outcomes. The study reinforces the need for educators to adopt innovative and student-centered teaching approaches, particularly in subjects like mathematics that often pose learning challenges. It also highlights the importance of incorporating toy-based activities into the curriculum, training teachers in activity-based learning strategies, and providing institutional support for the implementation of such pedagogies. Overall, the study concludes that toy-based pedagogy not only improves academic achievement but also makes learning enjoyable, inclusive, and meaningful.

CHAPTER-V

RESULTS AND FINDINGS

CHAPTER-V

RESULTS AND FINDINGS

5.1. RESULTS

- As the calculated value of 't' i.e., 2.024 is greater than table value at 0.05 level of significance for degree of freedom 38 i.e., 2.024, therefore, 't' value is **significant** and null hypothesis is **rejected.** Thus, it can be stated that there is a **significant difference** in the achievement scores of two groups taught by traditional method and toy-based pedagogy. The mean gain score of the students in the experimental group is 10.75, which is higher than those of the mean gain score of the students in the control group i.e., 7.65.

- As the calculated value of 't' i.e., 2.015 is greater than table value at 0.05 level of significance for degree of freedom 38 i.e., 2.015, therefore, 't' value is **significant** and null hypothesis is **rejected.** Thus, it can be stated that there is a **significant difference** in the achievement scores on the basis of gender taught by traditional method and toy-based pedagogy. The mean gain score of the male students is 10.173, which is higher than those of the mean gain score of the female students 7.882.

5.2. MAJOR FINDINGS

- The findings of the study indicate that toy-based pedagogy is significantly more effective than traditional methods in improving the mathematics achievement of Class 6 students. The calculated *t*-value of 2.024 exceeded the critical value at the 0.05 level of significance for 38 degrees of freedom, leading to the rejection of the null hypothesis. This suggests a significant difference in achievement scores between the experimental group, which received toy-based pedagogy, and the control group, which was taught through traditional methods. The experimental group showed a higher mean gain score of 10.75 compared to 7.65 for the control group. This clearly reflects the positive impact of toy-based pedagogy on student learning.

- Additionally, the study found a significant difference in achievement scores based on gender. The *t*-value of 2.015 also surpassed the critical value at the 0.05 level of significance, resulting in the rejection of the second null hypothesis. This finding indicates that toy-based pedagogy and traditional methods influence male and female students differently. Male students achieved a higher mean gain score of 10.173 compared to 7.882 for female students.

5.3. EDUCATIONAL IMPLICATIONS OF THE STUDY

The findings of this study carry several important implications for educational practice, particularly in the context of teaching mathematics at the elementary level. For students, toy-based pedagogy offers an engaging and hands-on learning experience that helps them develop a deeper understanding of mathematical concepts. It fosters active participation, enhances motivation, and supports the development of critical thinking, creativity, and problem-solving abilities. For teachers, the study highlights the need to adopt innovative and student-centered instructional approaches that go beyond traditional rote learning. By integrating educational toys and manipulatives into lessons, teachers can make abstract ideas more concrete and relatable.

Teacher educators play a crucial role in preparing future educators to effectively implement toy-based strategies. Therefore, teacher education programs should include training on the use of educational toys, constructivist approaches, and reflective teaching practices. This ensures that teachers are equipped with the necessary pedagogical skills and confidence to create interactive and meaningful learning environments. Curriculum designers are also encouraged to integrate toy-based activities within the mathematics curriculum to align with diverse learning styles and developmental needs. Curriculum frameworks should support experiential learning by including activity-based lessons and assessments that promote holistic development.

For school administrators, the study underscores the importance of providing the necessary infrastructure and resources, such as access to educational toys and teacher training workshops. Administrators should foster a school culture that supports innovation in pedagogy and recognizes the value of interactive teaching methods. Additionally, policy-level support is essential to institutionalize toy-based pedagogy in mainstream education. Overall, the study reinforces the need for a collaborative effort among all stakeholders to create a dynamic, inclusive, and effective learning environment that enhances mathematical achievement and lifelong learning skills among students.

Several educational implications of this study given as follows:

5.3.1. For Students:

- Toy-based pedagogy enhances **conceptual clarity** and encourages students to engage with mathematics in an **enjoyable and meaningful** way.
- It supports **active participation**, which leads to better retention and understanding of mathematical concepts.
- The approach promotes **critical thinking**, creativity, and problem-solving skills through hands-on experiences.
- It caters to **different learning styles**, making mathematics more accessible and inclusive for all learners.

5.3.2. For Teachers:

- The study emphasizes the need for teachers to adopt **student-centered instructional strategies** like toy-based learning to improve classroom engagement and outcomes.
- Teachers should be encouraged to use **educational toys and manipulatives** to make abstract concepts more concrete.
- It highlights the importance of **flexibility and innovation** in teaching approaches to enhance learning effectiveness.
- Regular **reflection and assessment** of teaching strategies can help teachers optimize the use of toy-based methods.

5.3.3. For Teacher Educator:

- Teacher educators should incorporate **training modules on toy-based pedagogy** into pre-service and in-service teacher education programs.
- They must equip future teachers with the **skills to design, select, and use educational toys** effectively in the classroom.
- Emphasis should be placed on **constructivist learning theories**, experiential learning, and reflective teaching practices.
- Encouraging **action research and experimentation** with toy-based strategies during teacher training can build confidence and competence.

5.3.4. For Curriculum Designers:

- The study suggests integrating **toy-based and experiential learning activities** into the mathematics curriculum at the elementary level.
- Curriculum frameworks should encourage **activity-based assessments** that align with toy-based pedagogy.
- Learning outcomes should include **cognitive, affective, and psychomotor domains**, which are supported by interactive and playful methods.
- Curriculum materials can include **guidelines and examples** for using low-cost or locally available toys to ensure accessibility.

5.3.5. For Administrators:

- Administrators should facilitate the **availability of resources**, including educational toys and learning materials, in schools.
- They should organize **professional development programs** to support the implementation of toy-based pedagogy.
- Policies should promote **innovative teaching practices** that go beyond rote memorization and encourage conceptual learning.

- Monitoring and evaluation systems should be updated to **recognize and support creative pedagogical approaches** in schools.

5.4. SUGGESTION FOR FURTHER STUDIES

Looking to the constraints under which the study was concluded the findings do not warrant any generalization it is therefore felt that replication of this study on a large sample is requested to arrive at generalization, however studies may be undertaken on the followings:

- Adopt **toy-based and activity-oriented strategies** to make mathematics more engaging and relatable for learners.
- Utilize **low-cost or DIY toys** to ensure accessibility in classrooms with limited resources.
- Promote **constructivist learning** by encouraging students to explore, experiment, and reflect during toy-based activities.
- Integrate **real-life context** through toys to make abstract mathematical concepts tangible and easier to grasp.
- Provide opportunities for **collaborative learning** through group activities involving toys to build social and communication skills.
- Use toys not just as tools but as **pedagogical resources** for conceptual clarity and to stimulate higher-order thinking.
- Reflect regularly on the **effectiveness of toy-based strategies** and adapt methods based on student feedback and outcomes.
- Ensure inclusivity by designing activities that cater to **diverse learning styles and abilities**.

5.5. SUMMARY

This dissertation investigates the effectiveness of toy-based pedagogy in enhancing mathematics achievement among Class 6 students, focusing on key topics such as Mensuration, Integers, and Symmetry. Conducted using a true experimental design, the study involved 40 students from a Demonstration Multipurpose School in Bhopal, divided into control and experimental groups. The experimental group received instruction through toy-based pedagogy while the control group was taught using traditional methods. Pre-tests and post-tests were administered to assess learning

outcomes. Statistical analysis revealed that toy-based pedagogy significantly improved student performance, with the experimental group demonstrating higher mean gain scores than the control group. Additionally, a gender-based analysis showed that male students achieved slightly higher gains than female students, though both benefitted from the approach. The study concludes that integrating educational toys into mathematics instruction promotes active learning, conceptual clarity, and greater engagement. It supports the recommendations of NEP 2020 and suggests broader implementation of toy-based strategies in classrooms. The findings offer valuable insights for students, teachers, curriculum designers, and educational policymakers seeking innovative and inclusive pedagogical practices.

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APPENDICES

1. LESSON PLANS FOR CONTROL GROUP

LESSON PLAN-1 (CONTROL GROUP)

Date- 19th April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter-Mensuration

Topic- Perimeter

Learning Objectives:
By the end of this lesson, students will be able to:

1. Define the term "Perimeter."
2. Identify the perimeter of regular and irregular plane figures.
3. Apply perimeter formulas for squares, rectangles, and triangles.
4. Relate the concept of perimeter to real-life examples (fencing, boundary measurement).

Materials Required:

- Blackboard and chalk/whiteboard and markers
- Chart paper showing shapes like square, rectangle, triangle
- Ruler or measuring tape
- Cut-outs of regular plane figures
- NCERT Class 6 Mathematics textbook

Instructional Steps:

1. Introduction (5 minutes)

- Begin with a simple question: "If you wanted to build a fence around your garden, what would you measure?"
- Encourage students to share responses (e.g., sides of the garden).
- Link their responses to the concept of **Perimeter** – the distance around the boundary.
- Write the term "Perimeter" on the board and highlight its meaning.

2. Presentation/Explanation (15 minutes)

- Clearly define **Perimeter**: *"The total length of the boundary of a closed figure."*
- Introduce standard **formulas**:
  - **Square**: Perimeter = 4 × Side
  - **Rectangle**: Perimeter = 2 × (Length + Breadth)
  - **Triangle**: Perimeter = sum of the three sides
- Use shape cut-outs and chart paper to visually demonstrate the figures.
- Use ruler/measuring tape to measure real items (e.g., book cover or desk) and calculate their perimeter on the spot.

-

3. Illustration/Example (10 minutes)

- Solve examples from the textbook:
  - Example 1: A square with side 5 cm → 4 × 5 = 20 cm
  - Example 2: A rectangle with length 8 cm and breadth 3 cm → 2 × (8 + 3) = 22 cm
- Draw diagrams on the board and show step-by-step calculation.

4. Practice Activity (5 minutes)

- Ask students to solve two perimeter problems:
  - Find the perimeter of a rectangle with length 6 cm and breadth 4 cm.
  - Find the perimeter of a triangle with sides 4 cm, 5 cm, and 6 cm.
- Walk around the class to assist and check student responses.

5. Conclusion & Homework (5 minutes)

- Summarize:
  - Perimeter = boundary length.
  - Different shapes have different formulas.
- Oral recap quiz: "What is the perimeter of a square of side 7 cm?"
- **Homework**: Solve Exercise 10.1 from the NCERT textbook (selected questions).

LESSON PLAN-2 (CONTROL GROUP)

Date- 21st April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter-Mensuration

Topic- Area

Learning Objectives:

Students will be able to:

1. Understand and define the concept of **Area**.
2. Use formulas to calculate the area of squares and rectangles.
3. Differentiate between area and perimeter.
4. Solve textbook problems related to area using correct units.

Materials Required:

- Blackboard and chalk
- Grid paper or graph paper
- Chart displaying units of area (cm^2, m^2)
- NCERT Math textbook
- Shapes drawn on squared paper

Instructional Steps:

1. Introduction (5 minutes)

- Ask: "If you want to cover your book with paper, what would you need to measure – the boundary or the surface?"
- Lead students to understand **Area** refers to the *surface occupied*.
- Write the word "Area" on the board and define it as "the space enclosed within the boundary of a figure."

2. Presentation/Explanation (15 minutes)

- Define:
  - **Area of Square** = Side × Side
  - **Area of Rectangle** = Length × Breadth
- Demonstrate area using a piece of grid paper:
  - Count squares inside a rectangle – link counting to formula.
- Emphasize units of area: cm^2, m^2, etc.
- Write examples on the board and solve:
  - Square with side 6 cm → $6 \times 6 = 36\ cm^2$
  - Rectangle with L = 7 cm, B = 3 cm → $7 \times 3 = 21\ cm^2$

3. Illustration (10 minutes)

- Use grid paper to show how many 1-cm squares fill a rectangle.
- Encourage students to draw their own 4 cm × 2 cm rectangle and count squares.
- Solve one real-life example: "What is the area of a rectangular table top 1.2 m long and 0.8 m wide?"

4. Practice (5 minutes)

- Write two problems on the board and let students solve:
  - Area of square (side = 5 cm)
  - Area of rectangle (L = 9 cm, B = 4 cm)
- Discuss answers together.

5. Conclusion & Homework (5 minutes)

- Recap area formulas and differences from perimeter.
- Quick quiz: "Is area measured in cm or cm^2?"
- **Homework**: Solve Exercise 10.2 from the NCERT textbook.

LESSON PLAN-3(CONTROL GROUP)

Date- 22nd April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter-Mensuration

Topic- Area and Perimeter of Irregular Shapes

Learning Objectives:

Students will be able to:

1. Recognize and define **composite figures**.
2. Break down irregular shapes into regular ones for calculation.
3. Calculate area and perimeter of composite figures.
4. Apply area and perimeter formulas to real-life situations.

Materials Required:

- Blackboard and chalk
- Graph paper or squared paper
- Chart showing irregular shapes (L-shape, T-shape)
- Scissors and paper cut-outs
- NCERT Class 6 Math textbook

Instructional Steps:

1. Introduction (5 minutes)

- Ask: "How would we find the area of a garden that looks like an L-shape?"
- Show a simple irregular shape (like L) and ask how we might calculate it.
- Explain that irregular shapes can be divided into **known shapes** like rectangles/squares.

2. Presentation/Explanation (15 minutes)

- Draw an **L-shaped figure** on the board and explain how to divide it into two rectangles.
- Revisit area and perimeter formulas of rectangle and square.
- Show another example using graph paper – count unit squares if necessary.
- Introduce an example from the textbook and solve it step-by-step.

3. Illustration (10 minutes)

- Use a cut-out L-shape made of two joined rectangles. Cut them apart to show how composite shapes are broken down.
- Solve a sample:
    - L-shape: upper rectangle (4 × 2), lower rectangle (6 × 3).
    - Area = (4 × 2) + (6 × 3)
    - Perimeter = add all outer sides.

4. Practice (5 minutes)

- Distribute squared paper and ask students to draw a composite shape and calculate area & perimeter.
- Help students who struggle with breaking shapes down.

5. Conclusion & Homework (5 minutes)

- Reinforce the concept of breaking down figures.
- Recap both **area** and **perimeter** formulas.
- **Homework**: Solve 2 problems from Exercise 10.3 (NCERT) involving irregular figures.

LESSON PLAN-4(CONTROL GROUP)

Date- 23rd April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter- Integers

Topic- Introduction to Integers

Learning Objectives:
By the end of the lesson, students will be able to:

1. Understand and define integers.
2. Identify positive and negative integers on the number line.
3. Compare integers using the number line.

Materials Required:

- Blackboard and chalk
- Chart showing a vertical and horizontal number line
- Thermometer cut-out or image
- Flashcards of integers
- NCERT Class 6 Mathematics textbook

Instructional Steps:

1. Introduction (5 minutes):

- Begin with real-life examples involving temperature or bank balances (e.g., "If the temperature falls below 0, how do we show it?").
- Introduce the concept of **negative numbers**.
- Define **integers**: a set that includes all positive numbers, negative numbers, and zero.

2. Presentation (15 minutes):

- Explain:
  - **Natural numbers**: 1, 2, 3, …
  - **Whole numbers**: 0, 1, 2, 3, …
  - **Integers**: ..., –3, –2, –1, 0, 1, 2, 3, ...
- Use a number line drawn on the board to show placement of positive and negative integers.
- Explain that numbers to the right of 0 are positive and to the left are negative.

3. Illustration (10 minutes):

- Draw number lines and place given integers (e.g., –5, 3, 0, –1).
- Explain how to compare integers using the number line:
  - Example: $-3 < 0 < 2$
- Discuss real-life examples:
  - Thermometer readings: 5°C, –2°C
  - Bank balances: +100 and –50

4. Practice Activity (5 minutes):

- Ask students to answer questions orally:
  - Which is greater: –4 or –1?
  - Where would you place –3 on the number line?
- Let students come to the board and mark positions of given integers.

5. Conclusion & Homework (5 minutes):

- Recap: Integers include negative, positive numbers, and zero.
- Distribute a worksheet or assign **Exercise 6.1** (selected questions) from NCERT as homework.

LESSON PLAN-5(CONTROL GROUP)

Date- 24th April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter- Integers

Topic- Addition to Integers

Learning Objectives:
By the end of the lesson, students will be able to:

1. Add integers using the number line.
2. Apply rules of addition of integers with same and different signs.
3. Solve textbook and real-life problems involving addition of integers.

Materials Required:

- Blackboard and chalk/whiteboard and marker
- Number line chart
- Flashcards with integer addition problems
- NCERT Class 6 Mathematics textbook
- Notebook and pencil

Instructional Steps:

1. Introduction (5 minutes):

- Begin by recalling the concept of integers from the previous lesson.
- Ask students: "What happens when we go 3 steps forward and then 2 more steps forward?"
- Explain that **addition** of numbers is like moving forward or backward on a number line.

2. Presentation (15 minutes):

- **Case 1: Adding two positive integers**
  Example: 3 + 5 = 8 (move 5 steps right from 3)
- **Case 2: Adding two negative integers**
  Example: (–2) + (–3) = –5 (move 3 steps left from –2)
- **Case 3: Adding a positive and a negative integer**
  Example: (–4) + 6 = 2 (start from –4, move 6 steps right)
  Example: 5 + (–8) = –3 (start from 5, move 8 steps left)
- Use the **number line** to visually demonstrate each case on the board/chart.
- Emphasize the rule:
  - If signs are the same → Add and keep the sign
  - If signs are different → Subtract and keep the sign of the bigger number

3. Illustration (10 minutes):

- Work through examples on the board:
  - (–5) + (–3) = –8
  - 7 + (–2) = 5

- (–6) + 10 = 4
- (–3) + 3 = 0

4. Practice Activity (5 minutes):

- Write 4 problems on the board and let students solve in their notebooks:
  - (–2) + (–7)
  - 6 + (–4)
  - (–8) + 11
  - (–9) + (–1)
- Call 2–3 students to solve them on the board.

5. Conclusion & Homework (5 minutes):

- Recap key rules with examples.
- Emphasize real-life applications (e.g., gain/loss of points, temperature changes).
- **Homework**: NCERT **Exercise 6.2** – Questions based on addition of integers only.

LESSON PLAN-6(CONTROL GROUP)

Date- 25th April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter- Integers

Topic- Subtraction to Integers

Learning Objectives:

By the end of the lesson, students will be able to:

1. Subtract integers using the number line.
2. Understand and apply rules for subtracting integers.
3. Solve NCERT and real-life problems involving subtraction of integers.

Materials Required:

- Blackboard and chalk/whiteboard and marker
- Number line chart
- Integer subtraction flashcards
- NCERT Class 6 Mathematics textbook
- Graph paper (optional)

Instructional Steps:

1. Introduction (5 minutes):

- Ask students: "If I have ₹5 and I spend ₹8, what happens?"
- Lead into the idea of subtracting bigger numbers from smaller ones using negative numbers.
- Introduce the concept of **Subtraction of Integers**.

2. Presentation (15 minutes):

- Use the number line to show subtraction as *moving to the left*.
- Explain:
  - $7 – 3 = 4 \rightarrow$ Move 3 steps left from 7
  - $(–2) – 3 = –5 \rightarrow$ Move 3 steps left from –2
  - $4 – (–3) = 4 + 3 = 7 \rightarrow$ *Subtracting a negative = adding the positive*
- Emphasize the rule:
  - **a – b = a + (–b)**
  - Subtracting an integer = adding its additive inverse

3. Illustration (10 minutes):

- Solve step-by-step:
  - $(–5) – (–2) = (–5) + 2 = –3$
  - $(–3) – 6 = –9$
  - $6 – (–4) = 10$

    - $(-7) - (-3) = -4$
- Show transitions using a number line.

4. Practice Activity (5 minutes):

- Write problems on the board and let students solve:
    - $5 - (-3)$
    - $(-6) - 2$
    - $(-4) - (-1)$
    - $3 - 7$
- Review the answers together and clarify misconceptions.

5. Conclusion & Homework (5 minutes):

- Recap: To subtract an integer, **add its opposite** (additive inverse).
- Emphasize direction and signs.
- **Homework**: NCERT **Exercise 6.2** – Questions focused on **subtraction of integers only**.

LESSON PLAN-7(CONTROL GROUP)

Date- 26th April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter- Symmetry

Topic- Introduction to Symmetry

Learning Objectives:
By the end of this lesson, students will be able to:

1. Understand the concept of symmetry.
2. Define a line of symmetry.
3. Identify symmetrical figures and draw lines of symmetry.

Materials Required:

- Blackboard and chalk
- A4 sheets, scissors, and mirror
- Paper cutouts of shapes (square, triangle, circle, butterfly, etc.)
- NCERT Class 6 Mathematics textbook
- Ruler and pencil

Instructional Steps:

1. Introduction (5 minutes):

- Begin with real-life examples (butterfly wings, leaves, human face).
- Ask: "What do both sides of a butterfly look like?"
- Introduce the term **symmetry** — when one half is the mirror image of the other.

2. Presentation (15 minutes):

- Define **Symmetry**: A figure is symmetrical if it can be folded in such a way that both parts match exactly.
- Define **Line of Symmetry**: The line that divides the shape into two mirror-image halves.
- Draw various shapes on the board (rectangle, square, triangle) and demonstrate lines of symmetry.

3. Illustration (10 minutes):

- Show paper folding activity: Fold square and triangle cut-outs to find symmetry.
- Demonstrate using mirror for vertical and horizontal symmetry.
- Ask students to observe and identify symmetry in alphabets (A, M, O, B, etc.)

4. Practice Activity (5 minutes):

- Distribute paper cutouts. Ask students to fold and draw the line of symmetry.
- Let them try simple shapes from the textbook.

5. Conclusion & Homework (5 minutes):

- Recap: Symmetry means balance; line of symmetry divides a shape equally.
- Homework: **NCERT Exercise 13.1** (selected questions).

LESSON PLAN-8(CONTROL GROUP)

Date- 28th April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter- Symmetry

Topic- Lines of Symmetry in Regular Shapes

Learning Objectives:
By the end of the lesson, students will be able to:

1. Identify symmetrical and asymmetrical figures.
2. Determine the number of lines of symmetry in regular shapes.
3. Draw all possible lines of symmetry for basic geometrical shapes.

Materials Required:

- Blackboard and chalk
- Chart of regular shapes (equilateral triangle, square, rectangle, circle)
- Paper cutouts
- Mirror, ruler, compass
- NCERT Class 6 textbook

Instructional Steps:

1. Introduction (5 minutes):

- Recap previous lesson.
- Show different shapes and ask: "How many ways can this shape be folded into halves?"

2. Presentation (15 minutes):

- Explain with examples:
  - **Equilateral Triangle** – 3 lines of symmetry
  - **Square** – 4 lines
  - **Rectangle** – 2 lines
  - **Circle** – Infinite lines
- Contrast with **Scalene triangle, trapezium** — no symmetry.
- Draw each on the board and draw lines of symmetry with a ruler.

3. Illustration (10 minutes):

- Show on the board: draw and divide shapes.
- Use mirror to demonstrate reflection along each line.
- Let students try drawing lines of symmetry in their notebooks.

4. Practice Activity (5 minutes):

- Give figures from the textbook and ask students to draw all lines of symmetry.
- Ask 2–3 students to come up to the board and do the same.

5. Conclusion & Homework (5 minutes):

- Recap: Lines of symmetry vary with shape.
- Homework: NCERT **Exercise 13.2** (selected figures)

LESSON PLAN-9(CONTROL GROUP)

Date- 29th April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter- Symmetry

Topic- Reflection Symmetry

Learning Objectives:
By the end of the lesson, students will be able to:

1. Understand mirror reflection as a form of symmetry.
2. Identify figures that show mirror symmetry.
3. Complete the reflection of a figure using a mirror line.

Materials Required:

- Blackboard and chalk
- Small mirrors
- Graph paper
- Worksheets with incomplete mirror images
- NCERT Class 6 textbook

Instructional Steps:

1. Introduction (5 minutes):

- Ask: "Have you seen how your face appears in the mirror?"
- Discuss how mirror images are reversed, yet symmetrical.
- Introduce **mirror symmetry** — when one side reflects the other.

2. Presentation (15 minutes):

- Define **mirror line** or **axis of symmetry**.
- Demonstrate with examples: letters like A, B, D, M, O, etc.
- Show reflection of a simple shape across a vertical or horizontal line using the mirror.

3. Illustration (10 minutes):

- Use graph paper and draw half a shape (e.g., triangle) beside a vertical line.
- Reflect and draw the mirror image on the other side.
- Use mirrors to check alignment.

4. Practice Activity (5 minutes):

- Distribute graph paper with half shapes and ask students to complete the figure.
- Use mirrors to verify their symmetry.

5. Conclusion & Homework (5 minutes):

- Recap: Mirror symmetry reflects one half into the other.
- Homework: NCERT **Exercise 13.3** – mirror reflection questions.

2. LESSON PLANS FOR EXPERIMENTAL GROUP

TOY-BASED PEDAGOGY LESSON PLAN-1

Date- 19th April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter-Mensuration

Topic- Perimeter

Learning Objectives:

- Define perimeter as the distance around a closed figure.
- Calculate the perimeter of square, rectangle, and triangle using formula and measurement.
- Apply perimeter to real-life scenarios using toys and manipulatives.

Materials Needed:

- Toy train tracks (can be arranged in different shapes)
- Rulers, measuring tapes, strings
- Geometric toy blocks (square, rectangle, triangle)
- Worksheets for practice

5E Model Detailed Breakdown:

1. Engage

- **Activity:** Show a **toy train track set** arranged in a square or rectangular shape on the table. Ask,
  "If we want to put lights all around this track, how much wire will we need?"
- **Purpose:** This real-world scenario grabs attention and motivates students to think about the perimeter as "the distance around."
- **Discussion:** Allow students to discuss and share guesses, reinforcing curiosity.

2. Explore

- **Activity:** Distribute **toy blocks** of different shapes (square, rectangle, triangle).
- Students measure each side using a **ruler or string**, mark measurements, and add side lengths to find the perimeter.
- **Group Work:** Let students work in pairs and compare results.
- **Observation:** Teacher walks around to observe how students measure and calculate.

3. Explain

- **Teacher Explanation:** Define perimeter as "the total length around a closed figure."
- Write formulas on the board:
  - Square: Perimeter = 4 × side length
  - Rectangle: Perimeter = 2 × (length + breadth)
  - Triangle: Perimeter = sum of all three sides
- Show worked examples using toy block measurements from the explore phase.

4. Elaborate

- **Activity:** Students create a **toy garden or fenced area** using LEGO blocks or matchboxes on the table.
- They use **colored string or ribbon** to "fence" around the toy garden and measure the length of the string used.
- **Challenge:** Ask, “If we wanted to put a fence around your garden, how many meters of wire will we need?”
- Connect this to the perimeter concept in a concrete way.
- **Extension:** Measure real-world objects like the classroom door frame, books, or desks for perimeter.

5. Evaluate

- Provide a worksheet with questions like:
    - Find the perimeter of a square with side 7 cm.
    - Calculate perimeter of a rectangle with length 10 cm and breadth 5 cm.
    - A triangle has sides 3 m, 4 m, and 5 m. Find its perimeter.
- Collect and review answers, giving feedback.

TOY-BASED PEDAGOGY LESSON PLAN-2

Date- 21st April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter-Mensuration

Topic- Area of Rectangles and Squares

Learning Objectives:

- Understand the concept of area as "the space covered inside a figure."
- Calculate area of rectangles and squares using formulas.
- Visualize and relate area using toy blocks.

Materials Needed:

- LEGO blocks or square tiles
- Graph paper
- Rulers
- Toy mats or cardboard rectangles

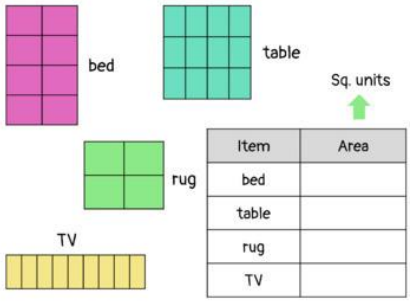
5E Model Detailed Breakdown:

1. Engage

- Show a **LEGO base mat** of a certain size and ask,
  "How many LEGO blocks will cover this mat completely?"
- Encourage students to guess and discuss how to find the answer.

2. Explore

- Provide students with LEGO blocks or square tiles and graph paper.
- Ask them to **cover a rectangle drawn on graph paper** using tiles and count how many tiles fill the space completely.
- Students record the number of tiles and compare with others.
- Use rulers to measure length and breadth of the rectangles on the paper.



Item	Area
bed	
table	
rug	
TV	

3. Explain

- Define area as “the amount of surface covered by a shape.”
- Write formulas:
    - Square: Area = side × side
    - Rectangle: Area = length × breadth
- Connect counting of tiles to multiplication (length × breadth).

4. Elaborate

- **Activity:** Students design a “toy carpet” or “floor mat” for a toy house using colored tiles or LEGO blocks.
- Calculate the area of their design using the formula.
- Extend by asking, “If each tile costs Rs 5, how much will it cost to buy enough tiles for your carpet?” (Integrating math with real life).
- Let students share their designs and calculations with the class.

5. Evaluate

- Worksheet problems:
    - Calculate the area of a rectangle with length 8 cm and breadth 6 cm.
    - Find the area of a square with side 9 cm.
    - Draw rectangles on graph paper and find the area by counting squares and then by formula.
- Discuss answers.

TOY-BASED PEDAGOGY LESSON PLAN-3

Date- 22nd April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter-Mensuration

Topic- Area of Irregular shapes

Learning Objectives:

By the end of the lesson, students will be able to:

- Understand the concept of irregular shapes.
- Estimate and calculate the area of irregular figures by decomposing them into regular shapes.
- Apply their understanding using toy-based and hands-on activities.

Materials Required (Toy-Based Resources):

- Toy mats with irregular shapes printed on them
- Geoboards or dot grids
- LEGO blocks and square tiles
- Graph paper
- Rulers and pencils
- Toy furniture pieces (miniature beds, tables, etc.)
- Cardboard cutouts of irregular shapes

5E Instructional Model:

1. Engage – 5 minutes

- **Activity:** Show a **miniature toy room layout** with irregular floor shapes using toys (e.g., a bed and a cupboard with L-shaped or combined shapes).
- Ask:

"If we want to lay carpet on this toy floor, how can we find the area it covers when the shape is not regular like a rectangle?"

- Students will observe and predict how they might measure such areas.

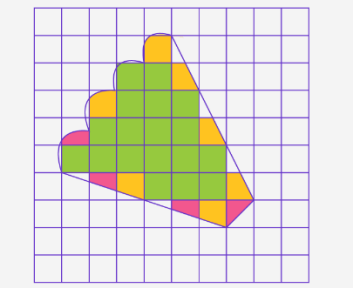
2. Explore – 10 minutes

- Give each student a cardboard cutout of an **irregular shape** (composed of combinations of squares and rectangles, like an "L" shape).
- Provide **graph paper** and ask students to **trace the shape**.
- Let them **count squares** to estimate the area. Teach them to count:
    - Full squares as 1 sq unit.
    - Half or almost full as ½ sq unit.
- Alternatively, give a **Geoboard** to create irregular shapes using rubber bands and count grid units.

3. Explain – 10 minutes

- Explain that **irregular shapes** can be broken into **smaller regular shapes** like rectangles and squares.
- Demonstrate with an example:
  Break an "L" shape into two rectangles, calculate area of each, and add.
- Introduce and write the strategy:

"To find the area of an irregular shape, divide it into regular shapes, calculate each, then add them together."



4. Elaborate – 15 minutes

- **Toy-Based Activity:** Provide students with **LEGO boards**. Ask them to build a structure of an irregular shape using colored LEGO pieces.
- Instruct them to break their shape into measurable squares or rectangles and **calculate total area**.
- Challenge them with:

"You are an interior designer. Calculate how much space your toy furniture occupies on this oddly-shaped toy floor!"

- Extension task: Use **toy garden plots** with curved boundaries approximated using grid-based estimation (half and full squares).

5. Evaluate – 5 minutes

- Provide students a **worksheet** with 3–4 irregular shapes.
- Ask them to:
  - Divide shapes into regular components
  - Calculate total area
- Quick oral quiz:
  - What is the strategy to calculate area of irregular shapes?
  - Why do we break the shape into rectangles/squares?

TOY-BASED PEDAGOGY LESSON PLAN-4

Date- 23rd April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter-Integers

Topic- Introduction to Integers

Learning Objectives:

- Understand positive and negative integers.
- Locate and represent integers on a number line.
- Compare and order integers.

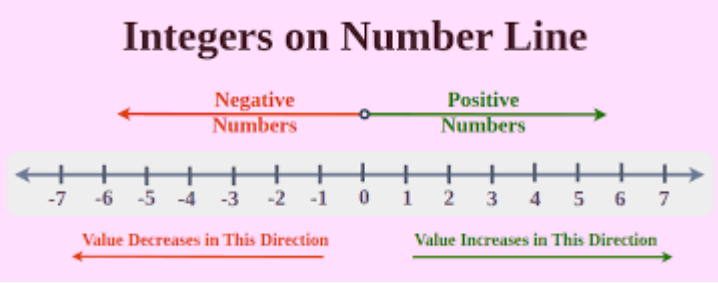
Materials Required:

- Toy cars labeled with integers
- Floor or wall-mounted number line (or long chart paper with numbers marked)
- Flashcards with numbers
- Magnetic number line board and counters

5E Model:

1. Engage (5 mins)

- **Activity**: Use **toy cars** labeled with positive and negative integers.
- Arrange a **floor number line** from -10 to +10.
- Ask: *"If a toy car is parked at 0 and moves 5 steps backward, where will it land?"*
- Let students predict, sparking curiosity.



2. Explore (10 mins)

- Distribute integer cards to students.
- Students walk along the number line placing their toy/car based on the number they hold.
- They physically compare positions on the line.

3. Explain (10 mins)

- Explain integers using real-life examples: temperature, bank transactions.
- Define:
    - Positive numbers (above 0)

    - Negative numbers (below 0)
    - 0 as the origin
- Teach rules for comparing integers using the number line.

4. Elaborate (15 mins)

- **Game**: "Integer Hop" – One student says a number, the other must jump to its opposite.
- Use magnets on a whiteboard number line to show additions and subtractions of integers visually.

5. Evaluate (5 mins)

- Quick oral quiz using flashcards.
- Ask students to arrange a given set of integers in ascending/descending order.

TOY-BASED PEDAGOGY LESSON PLAN-5

Date- 24th April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter-Integers

Topic- Addition of Integers

Learning Objectives:

- Understand and apply rules for addition of integers.
- Use toy-based tools and a number line to visualize addition.
- Solve addition problems involving integers in real-life contexts.

Materials Required (Toy-Based Resources):

- Integer floor mat or large number line (–20 to +20)
- Toy figures (soldiers, animals, cars, etc.)
- Integer flashcards (+ve and –ve numbers)
- Stackable blocks or cubes (different colours for + and –)
- Toy tokens or coins (red for –ve, green for +ve)
- Word problem cards

5E Instructional Model

1. Engage (5 minutes)

- **Activity**: Story Prompt using toy soldiers
  "Captain Aman moves forward (+5 steps) to attack. Then, a retreat is ordered, and he steps back (–3 steps). Where is he now?"
- **Demonstration**: Use a toy soldier on a **floor number line** to act this out.
- **Discussion Prompt**:

"What happens when you add a positive and a negative number? Can we predict the outcome?"

2. Explore (10 minutes)

- Students are given:
  - **Integer flashcards**
  - **Toy tokens** (red = negative, green = positive)
  - **Stackable blocks** (+1 = green block, –1 = red block)
- **Activity**: In pairs, students:
  - Pick two integer flashcards
  - Use colored blocks to build each number
  - Combine them and count net total (e.g., 5 green + 3 red = +2)
- Let students explore various combinations, such as:
  - (+3) + (–1)
  - (–4) + (+2)
  - (–3) + (–2)

3. Explain (10 minutes)

- Explain rules for addition of integers:
  - **Same signs**: Add absolute values, keep the sign.
    → (–4) + (–3) = –7
  - **Different signs**: Subtract smaller absolute from larger and keep the sign of the larger.
    → (+5) + (–3) = +2
- **Visual Demo**: Use **toy counters on a board** or **colored tokens** to show that:
  - Green cancels out red (and vice versa)
  - The net result reflects what's left
- **Draw a number line** on the board and show movement for + and – additions.

4. Elaborate (15 minutes)

- **Game**: **"Integer Race"**
  - Each student gets a toy car on a floor number line.
  - Draw two integer cards → sum them → move the car accordingly.
  - Objective: Reach the farthest positive position in 5 rounds.
- **Real-Life Role Play**:
  - Give students toy coins to simulate:
    - Earning money (+)
    - Losing money or spending (–)
  - Ask:
    "If you had ₹10 and spent ₹6, how much left?" → (+10) + (–6) = +4
- **Extension Task**:
  Design your own integer addition word problem using the toy figures or coins.

5. Evaluate (5 minutes)

- **Worksheet**: Includes problems like:
  - (–7) + (–5) = ?
  - (+8) + (–3) = ?
  - Real-life scenarios (money, temperature, etc.)
- **Exit Ticket**: One question each:

"If I add –6 and +4, what is the result?"

TOY-BASED PEDAGOGY LESSON PLAN-6

Date- 25th April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter-Integers

Topic- Subtraction of Integers

Learning Objectives:

- Understand and apply rules of subtracting integers.
- Visualize subtraction using number lines and toy models.
- Solve subtraction problems in real-life contexts.

Materials Required (Toy-Based Resources):

- Floor or wall-mounted number line (from –20 to +20)
- Toy soldiers or cars
- Integer flashcards (positive and negative numbers)
- Stackable color blocks (green for +, red for –)
- Play money or integer chips
- Integer operation spinners

5E Instructional Model

1. Engage (5 minutes)
Activity:
Tell a story:
"Riya has ₹5 (represented as +5). She gives ₹3 to her brother. What operation is this? What will be the result?"
Demonstration:
Use **play money/toy coins** to show this exchange and initiate the concept of subtraction.
Ask:
What happens when we subtract a positive from a positive? What if we subtract a negative?

2. Explore (10 minutes)
Materials:
Integer flashcards, toy soldiers, number line mats.
Activity:

- Distribute flashcards with subtraction expressions like (+5) – (+3), (–2) – (–4), (+3) – (–5).
- Let students walk on a number line mat with a **toy soldier** starting at the first number.
- They perform subtraction by moving **backward for +**, and **forward for –** (subtracting a negative means going right).

Discussion Prompt:
What pattern do you see when subtracting a negative number?

3. Explain (10 minutes)
Concept Clarification:

- Show that **subtraction is the addition of the additive inverse**.
    - (+5) – (–3) = (+5) + (+3)
    - (–2) – (+4) = (–2) + (–4)

Rule Summary:

- Subtracting a positive: move left
- Subtracting a negative: move right

Demonstration with blocks:

- Green = +1 block, Red = –1 block
- Model the subtraction of different integers physically.

4. Elaborate (15 minutes)
Toy-Based Game: "Integer Treasure Hunt"

- Setup: A number line board with treasure spots marked.
- Task: Students pick integer subtraction cards and solve to move closer to the treasure.
- Bonus: "Subtract a negative" card moves them forward faster.

Toy Spinner Activity:

- Spin two integers and a sign.
- Subtract using chips and explain reasoning.
- Work in pairs for discussion and support.

Real-Life Role Play:

- Use play money:
    - "You have ₹7. You owe ₹3. What's your actual wealth?"
    - Subtraction modeled as loss or debt recovery.

5. Evaluate (5 minutes)
Worksheet:

- Mix of numerical and story-based problems like:
    - (–3) – (–5) = ?
    - (+7) – (+2) = ?
    - "If a submarine is at –15 meters and it ascends 5 meters, where is it now?"

Exit Question (Verbal or Written):
"What is the result of (–6) – (–4), and how do you know?"

Word Problems for Practice:

1. Rahul is at –7 on a number line. He moves to the right by subtracting –3. Where is he now?
2. You had a loss of ₹5, but then subtracted a loss of ₹3 (–5 – (–3)). What's your net loss?
3. Temperature was –2°C in the morning. It dropped by 4°C more. What's the new temperature?

TOY-BASED PEDAGOGY LESSON PLAN-7

Date- 26th April, 2025

Subject- Mathematics

Duration-40 minutes

Age level- 12 to 14 years

Class -VI

Name- Archit Nema

Chapter-Symmetry

Topic- Introduction to Symmetry

Learning Objectives

By the end of this lesson, students will be able to:

- Understand the concept of symmetry and line of symmetry.
- Identify symmetrical objects in their surroundings.
- Create symmetrical patterns using toys.
- Reflect on the importance of symmetry in design and nature.

Materials Required:

- Mirror toys (small handheld mirrors)
- Paper cutouts of symmetrical shapes (butterfly, heart, star, leaf)
- Symmetry pattern cards (printed or laminated)
- Coloured pencils or markers (for folding and drawing symmetry lines)
- Worksheet for marking lines of symmetry

5E-Based Lesson Plan

Phase	Description
Engage	Show a butterfly cutout and fold it to spark curiosity: "What do you notice?" Let them use mirrors to explore real objects (leaf, coin, etc.). 
Explore	Students use symmetry cards and fold them or place mirrors to find the **line of symmetry**. Use folding and mirror reflection activities.

Phase	Description
Explain	Teacher explains symmetry and **line of symmetry** with visuals and real-life examples (human face, Taj Mahal). Show how mirror line divides shape into two equal halves.
Elaborate	Using toys like magnetic pattern blocks, students create symmetrical patterns and identify axes of symmetry. Group activity: "Find symmetry in classroom objects."
Evaluate	Worksheet: Mark lines of symmetry in given shapes. Quiz with toy shapes: “Symmetrical or Not?” Peer review of pattern block designs.

TOY-BASED PEDAGOGY LESSON PLAN-8

Date- 28th April 2025 **Subject-** Mathematics

Duration-40 minutes **Age level-** 12 to 14 years

Class -VI **Name-** Archit Nema

Chapter-Symmetry

Topic- Line of Symmetry in Regular Shapes and Reflection Symmetry

Learning Objectives:

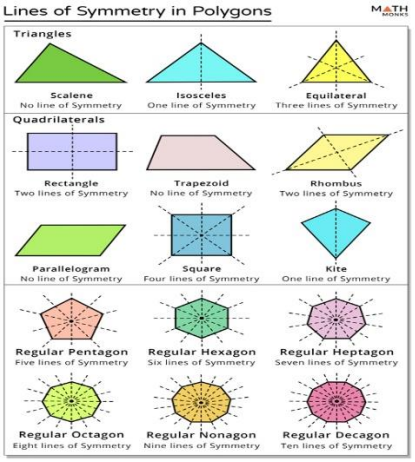
- Understand what a line of symmetry is.
- Identify and draw lines of symmetry in regular shapes (square, rectangle, equilateral triangle, regular hexagon).
- Explore symmetrical properties using toys and manipulatives.

Materials Required:

- Paper cutouts of regular shapes (square, rectangle, equilateral triangle, regular hexagon)
- Handheld mirrors
- LEGO blocks or magnetic tiles
- Whiteboard and markers
- Worksheets on lines of symmetry

5E Lesson Plan with Toy-Based Activities

Stage	Teacher's Role & Activity	Student Activity	Materials/Toys
Engage	Show physical models or cutouts of regular shapes (square, rectangle, equilateral triangle). Ask: "Can these shapes be folded so that both halves match exactly?"	Observe and respond; discuss prior knowledge of symmetry in shapes.	Paper cutouts of regular shapes, mirrors
Explore	Let students fold paper shapes along different lines to find lines of symmetry. Use mirrors to verify if halves match perfectly.	Fold and test lines of symmetry on shapes; use mirrors to confirm symmetry.	Paper shapes, handheld mirrors
Explain	Demonstrate on the board the number of lines of symmetry in each regular shape: - Square: 4 lines - Rectangle: 2 lines - Equilateral Triangle: 3 lines - Regular Hexagon: 6 lines	Watch demonstration; note down and ask questions about symmetry lines.	Whiteboard, marker, chart with shapes

Stage	Teacher's Role & Activity	Student Activity	Materials/Toys
			
Elaborate	Use LEGO blocks or magnetic tiles to build regular shapes and draw or place lines of symmetry on them. In groups, students identify and mark lines of symmetry on toy models.	Build shapes using blocks; mark symmetry lines; discuss with peers.	LEGO blocks/magnetic tiles, paper, markers
Evaluate	Distribute worksheet with various regular and irregular shapes. Ask students to draw all lines of symmetry for regular shapes and explain why irregular shapes have none or fewer lines.	Complete worksheet; explain answers orally or in writing.	Worksheet sheets, pencils

TOY-BASED PEDAGOGY LESSON PLAN-8

Date- 29th April 2025 | **Subject-** Mathematics

Duration-40 minutes | **Age level-** 12 to 14 years

Class -VI | **Name-** Archit Nema

Chapter-Symmetry

Topic- Reflection Symmetry

Learning Objectives:

By the end of the lesson, students will be able to:

- Define **Reflection Symmetry**.
- Identify figures with reflection symmetry.
- Create figures using reflection symmetry with the help of mirrors and toy tools.

Teaching-Learning Materials (TLM):

- Small mirrors
- Symmetry viewer toy (cardboard setup with L-shaped mirrors)
- Tangram sets
- Ink stamp blocks and ink pads
- Graph paper
- Coloured paper cut into half-designs
- Geometry box

5E Model Lesson Flow

Phase	Teacher's Role	Student's Role
Engage	Show a capital letter "M" and its mirror image using a mirror. Ask: “Does it look the same?”	Observe and answer. Predict what other letters would look like in a mirror.
Explore	Provide students with: a mirror, tangrams, and half-figures. Ask them to place the mirror along one side and observe.	Use mirror to complete the image. Explore reflection in simple shapes and letters.
Explain	Introduce the term “Reflection Symmetry” — a figure has reflection symmetry if one half is a mirror image of the other.	Note key points; explain reflection symmetry using their own shapes.
Elaborate	Provide students with half-patterns on graph paper and ask them to complete the other side using reflection. Use ink stamps to design symmetrical patterns.	Complete the patterns; create their own reflection art using stamps or tangrams.
Evaluate	Distribute a worksheet with half-completed shapes/letters. Ask students to draw their reflection-symmetrical counterpart.	Attempt and complete the worksheet. Present one of their symmetrical designs.

Sample Activities:

1. Mirror Drawing Activity (Toy-Based)

- **Material:** Half-butterfly design, mirror viewer
- **Instruction:** Place mirror on the axis and observe complete butterfly.
- **Outcome:** Understand mirror-based reflection symmetry.

2. Tangram Challenge

- **Material:** Tangram sets
- **Instruction:** Create a shape. Now replicate its mirror image.
- **Outcome:** Explore spatial arrangement and symmetry through hands-on play.

3. Ink Stamp Pattern Design

- **Material:** Stamp blocks and pads
- **Instruction:** Press a design on the left, now reflect it on the right side of the axis.
- **Outcome:** Understand symmetrical positioning and stamping accuracy.

Learning Outcomes (as per NCERT):

- Students will identify and describe reflection symmetry in various figures.
- Students will construct figures showing reflection symmetry using paper-folding, mirrors, and tools.
- Students will demonstrate creativity using symmetrical patterns in art and mathematics.

Assessment Techniques:

- **Formative Assessment:**
  - Observation during mirror activity
  - Oral Q&A during the class
  - Peer feedback on symmetrical artwork
- **Summative Assessment:**
  - Completion of worksheet
  - Drawing and labeling line of reflection
  - Verbal explanation of what reflection symmetry means

Extension/Home Activity:

- Draw your name in capital letters and test which letters have reflection symmetry.
- Observe and record symmetrical objects at home (e.g., utensils, decorations, leaves).

Evaluation Scale of the Achievement Test

Archit Nema
M.Ed IVth Sem

Dr. Saurabh Kumar
(Associate Professor)
Department of Education, RIE Bhopal

Regional Institute of Education (RIE), Bhopal

Name:

Class:

Sec:

Gender:

Date:

Section	Total Question	Marks per Question	Total Marks	Marks Obtained
Knowledge based	9	1	9	
Understanding based	3	1	3	
Application based	3	2	6	
HOTS based	3	3	9	
Total	18		27	

Remarks and Teacher's Feedback

Strengths: _____

Areas for Improvement: _____

Teacher's Signature: _____

Achievement Test

Topics

1. Mensuration
2. Symmetry
3. Integers

Class: 6th

Skills

1. Knowledge: Recall facts, definitions, formulas, and properties.
2. Understanding: Comprehend and explain concepts.
3. Application: Solve problems using the concepts in practical situations.
4. Higher Order Thinking Skills (HOTS): Analyze, evaluate, and solve complex problems.

Skill-Wise Distribution of Questions

Topic	Knowledge	Understanding	Application	HOTS	Total question
Mensuration	3 (1 marks)	1(1 marks)	1(2 marks)	1(3 marks)	6(9 marks)
Symmetry	3(1 marks)	1(1 marks)	1(2 marks)	1(3 marks)	6(9 marks)
Integers	3(1marks)	1(1 marks)	1(2 marks)	1(3 marks)	6(9 marks)
Total questions	9(9 marks)	3(3 marks)	3(6 marks)	3(9 marks)	18(27 marks)

Skill-Wise Distribution

Marks Distribution:

1-mark questions: 12

2-mark questions: 3

3-mark questions: 3

Total Marks: 27

Duration: 40 min

General Instructions:

1. All questions are compulsory.

2. Each MCQ has four options. Choose the correct answer.

3. Write all answers neatly.

Section A: Knowledge-Based Questions (1 Mark Each)

1.Formula of perimeter of rectangle is

a) lxb b) 2x(l+b)

c) l+b d) 2x(l-b)

2. Find the perimeter of a square with side 6 cm.

a) 36 cm b) 12 cm

c) 24 cm d) 18 cm

3. A rectangle has length 10 cm and breadth 4 cm. What is its perimeter?

a) 40 cm b) 28 cm

c) 20 cm d) 41 cm

4. How many lines of symmetry does a square have?

a) 1 b) 2

c) 4 d) 6

5. A circle has how many lines of symmetry?

a) Infinite b) 1

c) 2 d) 3

6. Which of the following shapes does not have a line of symmetry?

a) Equilateral triangle b) Rhombus

c) Parallelogram d) Rectangle

7. Simplify (-7+1).

a) -6 b) -3

c) 17 d) -17

8. What is (-5) + (-6)?

a) 11 b) -1

c) -11 d) 1

9. Which number is its own additive inverse?

a) 0 b) -1 c) 1 d) None of these

Section B: Understanding-Based Questions (1 Mark Each)

10. A rectangle has length 15 cm and breadth 8 cm. Find its perimeter.

a) 46 cm b) 23 cm

c) 30 cm d) 38 cm

11. A figure has 6 lines of symmetry. Name a possible shape.

a) Hexagon b) Square

c) Equilateral Triangle d) Circle

12. Find the result of (-8) + 5 – (-3).

a) 0 b) -10

c) 5 d) None of these

Section C: Application-Based Questions (2 Marks Each)

13. A square has a side length of 10 cm. Find its area and perimeter.

a) Area = 100 cm^2, Perimeter = 40 cm

b) Area = 50 cm^2, Perimeter = 20 cm

c) Area = 40 cm^2, Perimeter = 100 cm

d) Area = 20 cm^2, Perimeter = 80 cm

14. If a mirror is placed along the vertical line of the letter M, what will the reflection look like?

a) Same as M b) Like W

c) Like N d) Like A

15. Solve (-10) + (-12) – (-5).

a) -10 b) -17

c) -20 d) 15

Section E: HOTS Questions (3 Marks Each)

16. A rectangular garden is 20m long and 10m wide. Apath of 20m is built around it. Find the area of the path.

17. Draw a regular pentagon and show all its lines of symmetry.

18. A submarine is at -350 meters below sea level. It ascends by 120 meters, then descends by 50 meters. What is its final position?