

Teaching Foundational Mathematics Through Stories

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Abstract

This study explores the role of Indian folktales in introducing foundational mathematical concepts to young learners. Analysing four stories from the Panchatantra and Jataka Tales, it identifies key mathematical themes, including measurement, estimation, spatial awareness, patterns, number sense and data handling. A month-long intervention in a government school with 20 students from Class 1, employed the Co-Equal Cognitive Integration Style, blending storytelling with interactive activities, like map-making and artistic representations. Findings indicate that students seamlessly integrated mathematical concepts with creative tasks, enhancing problem-solving skills, vocabulary and engagement. Storytelling effectively made abstract mathematical ideas tangible and enjoyable, fostering early numeracy skills. By embedding mathematics in culturally relevant narratives, the study highlights storytelling as a powerful pedagogical tool for conceptual understanding and creativity. It supports narrative-based learning as a dynamic, engaging approach to instruction in foundational mathematics.

INTRODUCTION

In today's fast-paced digital world, students require skills, like critical thinking, creativity and problem-solving to thrive in the twenty-first century (Suh & Seshaiyer, 2013). Mathematics,

especially in early education, plays a crucial role in developing these skills. However, traditional teaching methods often fail to engage students, making mathematics appear abstract and intimidating. To address this, educators are adopting innovative

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approaches like storytelling, which makes learning interactive and enjoyable.

While storytelling has long been used to teach values and life lessons, its potential for teaching mathematical concepts is often overlooked. Research indicates that stories help children grasp abstract ideas, like measurement, patterns and sequencing by placing them in relatable contexts (Van den Heuvel-Panhuizen et al., 2014; Casey et al., 2004). For instance, stories can transform lessons on counting or spatial awareness into engaging adventures, reducing mathematics anxiety and sparking curiosity.

In India, the National Education Policy (NEP) 2020 emphasises integrating Indian culture and the arts into education. Indian folktales, such as those from the *Panchatantra* and *Jataka Tales*, are rich in cultural and moral lessons, and contain hidden mathematical themes. This makes them ideal for teaching foundational mathematical skills in a culturally relevant and engaging manner.

This study explores how Indian folktales can teach concepts of foundational mathematics to young learners. By analysing four stories and conducting a month-long intervention with 20 students from Class 1, the research demonstrates how storytelling, combined with activities like map-making and artistic tasks, enhances mathematical understanding, creativity and problem-solving skills. The findings

highlight storytelling as a powerful tool for making mathematics more accessible and enjoyable, aligning with the NEP 2020 goals and offering a fresh approach to the early mathematics education.

OBJECTIVES

This research study aims to comprehensively investigate the multifaceted impact of integrating storytelling into mathematics education.

The specific objectives of the study are as follows:

1. To examine how combining storytelling with mathematics instruction influences the cognitive abilities of Class 1 students, particularly in reasoning, problem-solving and analytical thinking
2. To investigate how storytelling supports the learning and application of mathematical vocabulary, especially in solving word problems
3. To explore the role of storytelling in promoting socio-emotional growth, encouraging social interaction, logical reasoning and emotional involvement in the classroom
4. To evaluate the effectiveness of Indian cultural stories, such as *Panchatantra* and *Jataka Tales*, in improving students' knowledge of Indian culture and enhancing their understanding of the concepts of foundational mathematics

METHOD AND PROCEDURE

Procedure

The study lasted a month, involving 20 Class 1 students from a government school. Each of the four stories was covered over two days, with the first session focused on storytelling and the second on mathematics learning through Art Integrated Learning. This structured approach was applied to all four stories, allowing for an in-depth evaluation of the role of storytelling in learning mathematics.

Methodology

Four stories were chosen for content analysis within the realm of mathematics education for Class 1 students. These stories served as a practical tool for imparting mathematical concepts and terminology. Two distinct teaching techniques were employed for this purpose—the Storytelling Approach and the Co-equal Cognitive Integration Approach. Concise explanations of both of these methodologies are provided below.

I. Storytelling Approach

It is an educational method that uses narratives to engage learners and introduce concepts in a way that is both relatable and enjoyable. For this research, four stories from the *Panchatantra* and *Jataka Tales* were chosen:

1. *The Four Friends*: A deer, crow, mole and tortoise collaborate to free the deer from a hunter's trap,

demonstrating teamwork and problem-solving.

2. *The Mice that Ate Iron*: Naduk uses clever reasoning to recover his iron rod and expose his friend's dishonesty.
3. *The Price Maker*: A greedy official is outsmarted by a horse merchant, illustrating fairness and value comparison.
4. *Beauty and Grey*: A wise deer's guidance helps Beauty protect his herd, while Grey's poor decisions lead to failure, teaching lessons in leadership and decision-making.

II. Co-Equal Cognitive Integration Approach

This approach merges art with the core curriculum, emphasising both cognitive development and creative expression. It connects mathematical concepts with artistic activities, promoting interdisciplinary learning and deeper understanding (Bresler, 1995).

A detailed analysis and the classroom follow-up activities based on the storytelling sessions are as follows:

Story 1: The Four Friends

1. **Distance**: The story introduced distance estimation through phrases like "lives deep inside a forest" (remote) and "didn't fly too far" (relative distance). The sentence "Ah! Came a voice from the bushes" suggested proximity, while the phrase "eyes fell on a slowly moving tortoise" emphasised

spatial awareness, integrating mathematical concepts.

Maths Class Engagement: Students learned about distance by tracking how far the crow flew to reach the tortoise. They counted steps or wing flaps, helping them practice counting, compare quantities (for example, ‘Who took more flaps or steps—the crow or the tortoise?’), and understood basic measurement in an engaging way. This addressed number sense and basic arithmetic concepts.

2. **Patterns:** “They would meet every afternoon” and “one day, the deer did not turn up” were observed for patterns, indicating a recurring event disrupted by an anomaly.

Maths Class Engagement: Students organised picture cards or illustrations depicting key events—such as the deer getting trapped, the crow discovering it, the mole digging a tunnel and the tortoise diverting the hunter—in the correct sequence. This activity enhanced their understanding of patterns and order, laying the groundwork for mathematical concepts, like number patterns and problem-solving.

3. **Data Handling:** The story involved the grouping of four friends— a deer, a crow, a mole and a tortoise, each with different attributes. This data-handling aspect contributed to the narrative.

Maths Class Engagement: Students classified the animals

by traits, grouping fast movers like the crow and deer separately from the slower ones like the mole and tortoise. They then counted and compared the groups using terms like more and less, strengthening their number sense and comparison skills.

4. **Spatial Understanding:** Spatial concepts were depicted through phrases and sentences, like “under a shady banyan tree”, “I think you better fly around”, “the hunter left the tortoise on the ground and ran towards the deer” and “she cried caw caw and flew away”. These descriptions helped in visualising the story’s spatial elements.

Maths Class Engagement: Students identified the positions of the crow, the tortoise, the mole and the deer, noting distances, such as the tortoise being far from the crow’s nest and the mole’s burrow near the pond. Through movement and object placement, they reinforced spatial concepts, like near and far, building foundational skills for mapping and problem-solving.

Story 2: The Mice that Ate Iron

1. **Length:** The concepts of length and distance are subtly incorporated into the story through phrases like “leave the city and find his fortune in a new place”, which implied a significant journey. The narrative also mentioned that

the protagonist “travelled far and wide”, emphasising the notion of distance.

Maths Class Engagement: Students used a wooden stick or ribbon to compare classroom objects. They placed it next to items, like a book, a pencil, and a bench, describing them as: “The book was shorter than the stick”, “The bench was longer than the stick” and “The pencil was almost the same length as the stick”.

This activity reinforced comparative length, using real objects and terms, like longer, shorter and same length.

2. **Time:** The concept of time was integrated into the story with phrases such as “Once there was a rich merchant” and “time passed”, indicating the progression of time. Additionally, phrases like “soon it was so bad” and “they talked for long” provided a sense of time duration within the narrative. The story also highlighted concerns related to time, such as “when Pindu didn’t return by evening, causing his father to worry”.

Maths Class Engagement: Students explored the concept of time by sequencing daily activities (For example, morning assembly before lunch) and using terms, like before, after and later. They also compared the duration of the tasks, such as clapping for five seconds versus standing still for 10 seconds, helping them

develop a basic understanding of time measurement.

3. **Weight:** The story introduced the concept of weight when describing that the protagonist was left with a ‘heavy iron beam’. This element contributed to the mathematical aspects of the narrative.

Maths Class Engagement: Students developed an understanding of weight by lifting and comparing objects like a book, a pencil and a bag. They identified which items felt heavier or lighter, and sorted them into groups. Through hands-on exploration and predicting weight differences before lifting, they reinforced the concepts of heavy and light in a practical and engaging way.

4. **Spatial Understanding:** The story integrated spatial concepts when a character said, “While we were coming, a hawk swooped down and carried the boy off”, illustrating movement and position.

Maths Class Engagement: Students drew a scene of the hawk carrying the boy, exploring concepts, like up, down, near, far, above and below. They then described positions and acted out the scene to reinforce spatial understanding.

Story 3: Beauty and Grey

1. **Counting and Division:** The story mentions a herd of a thousand deers, which the wise old deer

decides to divide into two groups of 500 each for his two sons, Beauty and Grey. This introduces the concept of counting and division.

Maths Class Engagement: Students used picture cards or counters, like pebbles, beads or paper cut-outs to represent a herd of deers. They counted a set of 10 or 20 deer counters aloud and then divided them into two equal groups, just like the wise old deer did in the story. As they separated the deers, they described their observations using terms, like more, less, equal and half. This hands-on activity helped them practise counting, grouping and early division in an engaging and interactive way.

2. **Comparison:** The story emphasises the difference in the number of deers that 'Beauty and Grey' successfully lead back after the harvest season. Beauty brings back all 500 deers, while Grey only survives the journey alone. This introduces the concept of comparison.
3. **Spatial Awareness:** The story talks about the deers moving from low lying farmlands to the high countryside and then back again. This introduces the concept of spatial awareness, understanding different geographical locations (lowlands, mountains, etc.) and the movement between them.

Maths Class Engagement: Students explored spatial

awareness by tracing the deers' movement between lowlands, mountains and farmland, using floor markers or drawings. The students moved step by step, describing their position with terms, like up, down, near and far. To reinforce learning, they also drew simple maps, marking key locations.

4. **Time Awareness:** The story mentions different times of the day, when the herds are moving—during the night, at dawn and dusk, and even in the broad daylight. This introduces the concept of time, understanding the different periods of the day.

Maths Class Engagement: Students worked with a clock model to mark and identify various times of the day mentioned in the story, such as dawn, dusk and night. They practised reading the clock and arranged events in order as per the time of day.

5. **Sequencing:** The story follows a sequence of events from the wise old deer deciding to retire and divide the herd for the journey of Beauty and Grey to the mountains and their return after the harvest season. This introduces the concept of sequencing events in a story.

Maths Class Engagement: Students organised picture cards or drawings depicting key events in the correct sequence, such as the deer dividing the herd, Beauty and Grey leading their groups,

the journey to the mountains and their return after the harvest.

Story 4: The Price Maker

1. **Money (Price):** The story explores value comparison when the Royal Price Maker prices a horse at “one cup of rice”. It emphasises transactions and money as an exchange medium, using key phrases to introduce monetary concepts to Class 1 students.
Maths Class Engagement: Students engaged in role-play as buyers and sellers, using play money or counters to simulate transactions from the story. They practised counting, adding and comparing values, asking questions like “How many cups of rice are needed to buy three horses?” This interactive activity reinforced basic arithmetic operations, like

- addition, subtraction, number comparison and number sense in a fun, hands-on way.
2. **Time:** The phrase “long ago and far away” introduces a temporal element, emphasising that this story is set in the past and the phrases indicate the concept of time.
Maths Class Engagement: Students created a timeline to situate the story in the past and compare it with the present-day events. They practised using terms, such as past, present and future to understand the sequence of time.
 3. **Pattern:** The story follows a pattern, where the king’s desire for greater profit leads to the appointment of a new price maker, creating a pattern of increasing greed.

Table 1
Mathematical Concepts and Foundational Skills Taught through Storytelling Activities

Story	Mathematical Concept	Foundational Skill	Activity	NCF-SE 2023 Alignment
<i>The Four Friends</i>	Counting, Measurement	Number sense, Non-standard units	Count animals (e.g., 4 animals), compare quantities	Number recognition, counting and non-standard measurement
	Addition/ Subtraction	Basic arithmetic	Calculate total legs (e.g., 4 animals counting legs.	Basic addition and subtraction

	Patterns	Pattern recognition	Sequence events (e.g., deer trapped, crow finds it, mole digs tunnel)	Identifying and extending patterns
<i>The Mice that Ate Iron</i>	Length, Time, Weight	Comparison, Sequencing	Compare lengths (e.g., book vs. stick), sequence daily activities	Comparing lengths, understanding time (before/after)
	Weight	Measurement	Compare weights (e.g., book vs. pencil), sort into heavy/light categories	Non-standard measurement (heavy/light)
<i>Beauty and Grey</i>	Division, Comparison	Number sense, Spatial awareness	Divide herds (deer into 2 groups), compare group sizes	Basic division, comparing quantities (more/less)
	Spatial Awareness	Movement	Trace the deers' journey on a map, use terms, like "up", "down", "near" "far"	Spatial relationships (near/far, up/down)
<i>The Price Maker</i>	Money, Patterns	Arithmetic, Pattern recognition	Role-play transactions (e.g., buy/sell goods), calculate prices	Basic arithmetic (addition/subtraction), identifying patterns
	Comparison	Value comparison	Compare prices (e.g., "How many cups of rice for 3 horses?")	Comparing quantities and values

ASSESSMENT

To assess the effectiveness of storytelling in teaching foundational mathematics, both formative and summative assessments were conducted. Formative assessments included observations during storytelling sessions, in which students' engagement and participation were monitored, as well as their ability to apply mathematical concepts in real-world scenarios derived from the stories. Summative assessments were conducted at the end of the intervention through quizzes and practical tasks that were directly tied to the stories. These tasks required students to apply mathematical concepts, such as counting, addition, subtraction and comparison in the context of the stories. The assessments were aligned with the NCERT guidelines for early mathematics education, which emphasise experiential learning and the integration of cultural contexts (National Steering Committee for National Curriculum Frameworks, 2023).

RESULTS AND DISCUSSIONS

Observations in a Class 1 classroom revealed that storytelling significantly enhances mathematical learning by transforming abstract concepts into tangible and engaging experiences. Through relatable narratives, stories provided a context-driven approach to counting, sequencing, measurement, pattern recognition and problem-solving, enabling children

to explore mathematical ideas naturally (Van den Heuvel-Panhuizen et al., 2014). Activities, such as measuring distances by counting steps, comparing weights and sequencing events allowed students to internalise mathematical concepts through real-life applications.

1. Storytelling Makes Mathematical Concepts Concrete

Sequencing and Patterns

Children developed a stronger understanding of ordering by organising story events in a logical sequence, a skill essential for numerical and time-based reasoning (Casey et al., 2004). For instance, in 'The Four Friends', students arranged picture cards to sequence key events, such as the deer being trapped, the crow discovering it and the mole digging a tunnel. This activity reinforced patterns and sequencing, which are foundational for advanced mathematical concepts, like number patterns and problem-solving (Van den Heuvel-Panhuizen et al., 2014).

Measurement and Comparison

The narratives allowed children to explore measurable quantities, such as distance, weight and duration. In 'The Mice that Ate Iron', students compared the length of objects using a stick, describing them as longer, shorter or 'the same length'. Storytelling serves as an effective teaching method, enabling young learners to grasp complex concepts in a clear, concrete

and relatable manner Ranganath, 2023, p. 12). These hands-on activities made abstract ideas, like measurement and comparison more accessible and concrete (Gadanidis & Hoogland, 2003).

2. Mathematical Vocabulary Emerged Naturally

Storytelling naturally facilitated the development of mathematical vocabulary. Terms such as before, after, near, far, more, less, equal, heavy and light became meaningful as children encountered them in a context (Roberts & Stylianides, 2013).

Contextual Learning

In 'Beauty and Grey', students used words like 'more' and 'less' to compare the number of deers in each herd. Expressions like 'double' and 'half' were seamlessly integrated into numerical comparisons, enhancing students' ability to communicate mathematically (Borasi et al, 1990).

3. Stories Enhanced Problem-Solving and Numeracy

Narratives such as 'The Mice that Ate Iron' introduced concepts of length and time measurement through activities like estimating distances and sequencing events using clocks. Narratives that incorporate movement like characters journeying between locations can serve as effective tools for teaching measurement and spatial awareness.

Real-world Applications

Through storytelling, concepts such as estimating distances and comparing lengths become more concrete and engaging (Ranganath, 2023, p. 25). Students applied logical reasoning and problem-solving skills to the real-world scenarios, such as calculating how long it took for the merchant to travel 'far and wide'. These tasks reinforced their understanding of time duration and distance.

4. Maths Learning Intertwined with Values

Stories connected mathematical thinking with ethical reasoning. For example, trade-based narratives like 'The Price Maker' encouraged discussions on fairness, equal sharing and division (Toor & Mgombelo, 2015).

Ethical Reasoning

Students role-played as buyers and sellers, using play money to simulate transactions and calculate prices. This activity not only reinforced basic arithmetic but also helped students apply logical decision-making to the real-life situations.

5. Post-story Activities Strengthened Cognitive and Social Skills

Beyond mathematical understanding, storytelling supported cognitive and social-emotional development. Tasks such as mapping story events, sequencing actions and measuring objects promoted collaboration,

critical thinking and reasoning skills (Baker, 2013).

Collaboration and Critical Thinking

In ‘The Four Friends’, students collaborated to create a map of the forest, using terms like near and far to describe spatial relationships. Visualising story events improved spatial reasoning, helping children transition from intuitive to structured mathematical thought.

6. Improved Engagement and Participation

Storytelling made learning interactive, with students eagerly engaging in mathematical concepts—counting wing flaps in ‘The Four Friends’ and comparing lengths in ‘The Mice that Ate Iron’.

7. Reduced Mathematics Anxiety and Increased Confidence

Storytelling created a stress-free learning space, making maths enjoyable. In ‘The Price Maker’, a hesitant student, excitedly playing a

merchant, exclaimed, “I got it right!” Similarly, in ‘Beauty and Grey’, a shy student proudly stated, “This is equal!” while grouping counters, showcasing growing confidence.

CONCLUSION

In summary, storytelling emerged as a powerful pedagogical tool, making learning maths more engaging, contextual and accessible. By bridging the gap between abstract mathematical principles and real-life experiences, storytelling fostered both social-emotional growth and mathematical fluency (Baker, 2013). By embedding mathematical problems within the narrative framework of the stories, students were able to connect abstract mathematical ideas to relatable, real-world scenarios, making learning more meaningful and engaging. This approach not only deepened students’ understanding of concepts in foundational mathematics but also nurtured their creativity, problem-solving abilities and enthusiasm for learning.

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