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Pedagogical Implications of Integrating Indigenous Games for Development of Foundational Numeracy Skills

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Abstract

Numeracy is essential for navigating daily tasks, such as managing finances, interpreting data, making decisions based on numerical information and understanding mathematical concepts in various fields. Developing strong numeracy skills is crucial for success in education, career and everyday life. In India, there are various initiatives and missions aimed at improving foundational numeracy skills among children. Such games often incorporate elements of numeracy in various ways. Such games play an important role in preserving cultural identity, transmitting cultural knowledge, promoting social cohesion and fostering a sense of belonging within indigenous communities. They also offer valuable opportunities for learning, skill development and intergenerational exchange. As such, indigenous games hold significance not only as forms of entertainment but also as integral components of indigenous cultural heritage and identity. These games, deeply rooted in cultural traditions, offer valuable opportunities for developing numeracy skills among participants. This paper highlights the integration of indigenous games, while inculcating numeracy skills among foundational level learners.

Introduction

In ancient times, people used to live full, rich and balanced lives. Their lives were not an endless round of day-to-day struggle for survival. Generally, there was plenty of time for reinforcing, adapting and developing their culture through recreational activities, such as songs, dances, storytelling and playing games. Local games were often very popular in India as they engaged children and adults

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for a longer duration. These games were generally played to promote agility, strength, balance, reflexes, hand-eye coordination, accuracy, strategy, intuition and patience, along with drawing joy, and developing skills of problem-solving, decision-making and managing interpersonal relations. Indigenous games teach valuable skills, combining mental and physical well-being (Dhanjal, 2022; Madondo & Tsikira, 2022). India has a rich culture, consisting of outdoor and indoor games. Some of the Indian games have also received international recognition.

Dealing with numbers and spatial understanding are an integral part of any communication and daily life discourse. Without being able to do basic calculations, a child cannot progress in the education system, or in life (Yekple et al., 2021). No doubt some skills develop naturally with the daily life experiences and the context in which a child grows, but a systematic intervention helps in building a strong understanding of mathematical ideas that lays a foundation for having better life skills like critical thinking, creativity, communication and problem-solving (Ball, Paris & Govinda, 2014).

> "Knowledge of India" will be incorporated in an accurate and scientific manner throughout the school curriculum wherever relevant; in particular, Indian Knowledge Systems, including indigenous, and indigenous ways of learning will be covered and included in mathematics, astronomy, philosophy, yoga, architecture, medicine, agriculture, engineering, linguistics, literature, sports, games, as well as in governance, polity, conservation.
>
> (Para 4.27, NEP 2020)

India has a rich tradition of nurturing the holistic development of children during their most formative years. In addressing the first eight years of a child's life, this holistic approach has a critical and positive lifelong influence on every aspect of a child's growth, health, behaviour and cognitive capabilities in the later years. The approach in the NCF-FS 2022 is also resonant with the *Panchakosha Vikas* (the development of the five sheaths of human personality), as elucidated in the *Taittiriya Upanishad*. The NCF-FS 2022 enunciates the five domains of learning, i.e., physical and motor; socio-emotional; cognitive; language and literacy; and cultural and aesthetic. The NCF-FS, which covers Classes 1 and 2, also articulates a play-based approach to learning. According to this approach, books form an essential part of the learning process; however, it is also important to understand that books are only one among many pedagogical tools and methods, including activities, toys, games, conversation, etc.

Why 'Numeracy' Skills Matter?

Numeracy refers to the ability to understand, interpret and work with numbers effectively. It encompasses basic mathematical concepts, such as addition, subtraction, multiplication, division, fractions, decimals, percentages, and more advanced skills like algebra, geometry and statistics. Numeracy is essential for navigating daily tasks, such as managing finances, interpreting data, making decisions based on numerical information, and understanding mathematical concepts in various fields (Madondo & Tsikira, 2022). Developing strong numeracy skills is crucial for success in education, career and everyday life (De Barros & Ganimian, 2023). In India, there are various initiatives and missions aimed at improving foundational numeracy skills among children. One notable initiative is the National Mission on Foundational Literacy and Numeracy (NMFLN), which was announced by the Government of India in 2020. The NMFLN aims to ensure that every child in the country achieves foundational literacy and numeracy by the end of Class 3 (approximately age 8).

The key objectives of the National Mission on Foundational Literacy and Numeracy include

1. developing and implementing effective teaching methods and learning materials for foundational literacy and numeracy;
2. strengthening teacher training and professional development programmes to improve pedagogical practices in teaching numeracy;
3. conducting regular assessments to monitor students' progress in acquiring foundational numeracy skills; and
4. providing support and resources to the States and Union Territories to implement effective numeracy programmes.

Additionally, various Non-Governmental Organisations (NGOs), educational institutions and community-based organisations in India are also actively involved in promoting numeracy skills among children, particularly those from disadvantaged backgrounds. These organisations often implement innovative teaching methods, conduct teacher training workshops, and provide learning materials to enhance numeracy education in schools and communities across the country. Overall, improving foundational numeracy skills is recognised as a critical priority in India's education system, and efforts are underway to ensure that all children have the opportunity to develop strong numeracy skills early in their academic journey.

Numeracy Skills and Indigenous Games

'Indigenous games' refer to games that have originated within a particular area and are specific to a particular indigenous culture or community. These games often have deep cultural significance and are passed down through generations as part of the cultural heritage of the community. Indigenous games are typically played within the context of social gatherings, ceremonies or everyday life, and they reflect the values, beliefs and practices of the indigenous people who play them (Pramanik & Bhattacharya, 2019; Olanrewaju, Suleiman & Abdulkareem, 2021). These games vary widely across different indigenous cultures and regions, encompassing a diverse range of activities, including sports, board games, physical challenges, storytelling games and more. Indigenous games often involve elements of strategy, skill, physical activity, cooperation and cultural expression. They may also incorporate natural materials, indigenous symbols or symbolic rituals that hold spiritual or ceremonial significance within the community. Examples of indigenous games include indigenous stickball games played by Native American tribes—Maori stick games like 'Ti Rakau' from New Zealand, Inuit string games such as 'Cat's Cradle', African board games like 'Mancala', and many others from indigenous cultures around the world.

Indigenous games play an important role in preserving cultural identity, transmitting cultural knowledge, promoting social cohesion and fostering a sense of belonging within indigenous communities (Hadebe-Ndlovu, 2022; Dhanjal, 2022). They also offer valuable opportunities for learning, skill development and intergenerational exchange. As such, indigenous games hold significance not only as forms of entertainment but also as integral components of indigenous cultural heritage and identity.

India has a rich diversity of indigenous games, each originating from various regions and cultural communities across the country. These games have been passed down through generations and continue to be played as part of cultural traditions and social gatherings. Kabaddi*, gilli danda,* kho-kho, kite flying*, pithhu,* etc., are few of the diverse indigenous games that are played across India. Each game reflects the unique cultural heritage and traditions of its region and community, and they continue to be cherished as integral parts of India's cultural identity.

Indigenous games often incorporate elements of numeracy in various ways. These games, deeply rooted in cultural traditions, offer valuable opportunities for developing numeracy skills among participants (Ball, Paris & Govinda, 2014). Let's discuss some ways in which indigenous games can contribute to the development of numeracy skills. Many indigenous games involve counting, whether it's counting steps, objects or points. Games like indigenous stick, dice games, or ring and pin games often require players to estimate distances or measure angles for successful gameplay. This fosters spatial reasoning skills and an intuitive understanding of the concept of measurement. Some indigenous games involve patterns and sequences, such as indigenous weaving games or string figure games. Players must follow or create specific patterns, enhancing their ability to recognise and replicate sequences, which is fundamental to numeracy. Games involving chance, like dice games or games of strategy, like 'chess variants', require players to understand probability and make strategic decisions based on numerical outcomes. This encourages critical thinking and problem-solving skills. In many indigenous games, players must quickly estimate quantities or perform mental calculations to make decisions during gameplay. This helps strengthen mental math skills and reinforces the concept of estimation.

Indigenous games often carry cultural significance and may involve numerical elements that reflect indigenous knowledge or practices within a community. Engaging with these games can deepen participants' understanding of cultural numeracy and its relevance in daily life. Many indigenous games are communal activities that involve collaboration and sharing of knowledge among players. By playing these games together, participants can learn from one another and collectively build their numeracy skills in a culturally meaningful context. It provides rich opportunities for developing numeracy skills, while honouring cultural heritage and fostering community engagement. By incorporating these games into educational settings, educators can promote numeracy development in a culturally relevant and engaging way.

Objectives

The proposed project has the following objectives:

1. To improve numeracy skills, thereby developing the ability to think mathematically and taking logical decisions with reasoning
2. To strengthen the foundational numeracy of students
3. To strengthen the analytical skills and imagination of a child which makes a student better in decision-making
4. To motivate students towards learning numeracy using a fun-based approach

Research Methodology

It is widely recognised in literature that meaningful teaching and learning cannot be disconnected from the social interactions situated in learners' cultural frameworks. In this context, indigenous games can play a pivotal role in developing the numeracy skills (along with problem-solving, reasoning, critical thinking, hand-eye coordination, cooperation, collaboration, etc.) among learners, as these recreational activities had originated from a particular cultural group, community or people, and are different from mainstream sports. It requires minimal resources, and most of the resources can be developed with zero cost. During this project, the following indigenous games will be used with the students to enhance the basic numeracy/mathematical skills of the students:

snakes and ladders (सांप सीढ़ी)

ludo (लूडो)

hopscotch

hide and seek (लुक्का छिप्पी)

baadi-khel (बाड़ी खेल)

pithhu (पिट्ठू)

These indigenous games are integrated while teaching mathematics during the duration of the project. An experimental group of 15 students (10 students from Class 1 and five students from Class 2), along with a control group of eight students (five students from Class 1 and three students from Class 2) are selected for the said purpose. The learning outcomes (defined by NCERT) are identified for all the classes and further mapped with these games. A pretest (designed in collaboration with SCERT Uttarakhand) was conducted before implementation of the project to measure the status of identified learning outcomes for each student in each class. These test results are compared with the results obtained at completion of the project to assess the impact of using indigenous games while teaching mathematics.

Snakes and Ladders (सांप सीढ़ी) , and Ludo (लूडो)

The game of *saanp seedhi* (also known as 'Snakes and Ladders') holds several mathematical values, particularly for young children learning basic arithmetic and number sense. Here are some mathematical concepts that can be reinforced through playing *saanp seedhi:*

1. *Counting:* Players move their tokens based on the numbers rolled on the dice. This reinforces counting skills as players progress along the gameboard.
2. *Number recognition:* Players identify numbers on the gameboard and on the dice, helping them reinforce their ability to recognise numerals.
3. *Addition and subtraction:* When moving their tokens, players must add or subtract the number rolled on the dice from their current position. This helps reinforce basic addition and subtraction skills in a fun and engaging way.
4. *Probability:* Players have to anticipate which numbers are more likely to come up on the dice, based on the layout of the gameboard. This introduces basic concept of probability.
5. *Number patterns:* The layout of the gameboard, with its alternating rows of numbers, can help players recognise number patterns and sequences.
6. *Strategy and decision-making skills:* Players may strategise based on their current position on the board and the numbers they roll, deciding whether to aim for ladders to climb up faster or avoid snakes that may cause them to slide down.

7. *Turn-taking and fairness:* The game teaches the importance of taking turns and following rules, promoting social skills and fair play.

Overall, *saanp seedhi* and ludo can be a valuable tool for reinforcing foundational mathematical concepts in a fun and interactive way, making it particularly effective for young children learn basic arithmetic skills. Additionally, the game can help develop strategic thinking, social skills and sportsmanship, making it a well-rounded educational activity.

Hopscotch (इच्चिच दुच्चिच)

It is an indigenous outdoor game that involves hopping through a series of squares or spaces drawn on the ground. While it may not have direct mathematical components like counting or arithmetic as in other games, it still offers several mathematical benefits, particularly for young children. Here's how hopscotch can be valuable in achieving the learning outcomes associated with numeracy:

1. *Number recognition and sequencing:* Hopscotch typically involves numbered squares or spaces. Children must recognise these numbers and hop through them in the correct sequence, reinforcing their understanding of number order.
2. *Counting:* As children hop through the squares, they can count the number of spaces they move forward. This reinforces counting skills, especially when they skip numbers or count in multiples.
3. *Spatial awareness and coordination:* Hopscotch requires children to navigate a specific pattern of squares, while maintaining balance and coordination. This fosters spatial awareness and helps develop gross motor skills.
4. *Patterns and sequences:* Hopscotch often follows a specific pattern or sequence of squares. Children may notice and explore these patterns, such as alternating Colours or shapes, which can introduce basic concepts of patterns and sequences.
5. *Problem-solving and strategy:* Children may strategise their movements in hopscotch, aiming to reach the end, while avoiding stepping on lines or losing balance. This encourages problem-solving skills and critical thinking.
6. *Turn-taking and social skills:* Like many games, hopscotch involves turn-taking and interacting with peers. This promotes social skills, such as sharing, cooperation and sportsmanship.
7. *Creativity and customisation:* Children can customise their hopscotch layouts with different patterns, shapes or variations. This encourages creativity and allows them to explore mathematical concepts in a playful and personalised way.

While hopscotch may not have as explicit mathematical elements as in some other games, it still offers valuable opportunities for mathematical learning and development, particularly in the areas of number recognition, counting, spatial awareness and problem-solving. Additionally, its outdoor nature promotes physical activity and exploration, contributing to holistic development in children.

Hide-and-Seek (लुक्का छिप्पी)

While hide-and-seek is primarily a physical and social game rather than a mathematical one, it can still offer some indirect mathematical benefits, especially for children. Here are a few ways in which playing hide-and-seek can provide mathematical value:

1. *Spatial awareness:* Hiding and seeking requires players to understand and navigate their physical environment. Players must use spatial reasoning to find hiding spots or seek out hidden players, which can develop spatial awareness skills.
2. *Counting and number sense:* In some versions of the game, players may count while others hide or seek. This reinforces counting skills and basic numerical concepts. For example, players might count to a certain number before beginning the search or count the number of seekers to ensure everyone is ready.
3. *Estimation:* When seeking, players may need to estimate where the players might be hiding based on their knowledge of the hiding area and any clues that they find. This involves making educated guesses and refining search strategies, which are aspects of estimation.
4. *Strategy and problem-solving:* Both hiders and seekers engage in strategic thinking during the game. Hiders must choose effective hiding spots that are both well-concealed and easily accessible, while seekers must develop search strategies to efficiently locate hidden players.
5. *Spatial relationships:* Hide-and-seek can also help children develop an understanding of spatial relationships, such as distance, direction and proximity. Players may describe hiding spots using spatial language (For example, 'behind the tree', 'under the table', etc.), which reinforces spatial concepts.
6. *Turn-taking and fairness:* Like many games, hide-and-seek teaches the importance of taking turns and following rules. Players must wait their turn to hide or seek, promoting social skills and fair play.

Hide-and-seek provides opportunities for mathematical thinking and development, particularly in areas related to spatial reasoning, counting, estimation and problem-solving. Additionally, the game encourages physical activity, social interaction and imaginative play, all of which contribute to holistic development in children.

Badi Khel (बाड़ी खेल)

Badi khel is an indigenous Indian team sport that involves physical activity and strategic gameplay. While it may not have direct mathematical components, there are some indirect mathematical values that can be associated with playing *badi khel*:

1. *Spatial awareness: Badi khel* requires players to be aware of their position on the playing field and the positions of their opponents. This fosters spatial reasoning skills as players strategise their movements to avoid being tagged or caught.
2. *Counting and scoring:* Although the scoring system in *badi khel* may not involve complex arithmetic, players and spectators need to keep track of points scored by each team. This reinforces basic counting skills and helps develop an understanding of scoring.
3. *Probability and strategy: Badi khel* involves strategic decision-making, where players must assess the situation and choose the best course of action. This can involve anticipating opponents' moves, assessing risks and maximising opportunities, which indirectly involves the concepts of probability and strategy.
4. *Teamwork and cooperation: Badi khel* is a team sport that requires coordinated efforts among team members. Players must work together to achieve common goals, promoting teamwork, cooperation and communication skills.
5. *Physical fitness and measurement:* Participating in *badi khel* promotes physical fitness and involves elements of measuring distances, speeds and strengths, which are all concepts that can be explored mathematically.

Badi khel offers valuable opportunities for cognitive and social development, including spatial awareness, strategic thinking, teamwork and physical fitness. Additionally, engaging in sports like *badi khel* promotes a healthy and active lifestyle, which contributes to the overall well-being.

Pithhu (पिट्ठू)

Pithhu (also known as *lagori*) is an indigenous Indian outdoor game that involves knocking down a stack of flat stones or tiles by throwing a ball at them. *Pithhu* offers some mathematical benefits, particularly for young children. Here's how *pithhu* can provide mathematical value:

1. *Spatial awareness:* Players need to accurately judge distances and angles when throwing the ball at the stack of stones. This fosters spatial awareness and helps develop hand-eye coordination.

2. *Counting and scoring:* The game often involves keeping track of points scored by each team. Players count the number of times they successfully knocked down the stack of stones, reinforcing basic counting skills and understanding of scoring.
3. *Estimation and prediction:* Players may need to estimate the trajectory of the ball and predict where it will land in order to knock down the stack of stones. This involves making educated guesses and refining throwing techniques—aspects of estimation and prediction.
4. *Mathematical language:* Players may use mathematical language, such as 'distance', 'angle', 'trajectory', and 'force' when discussing strategies or evaluating their throws.
5. *Problem-solving and strategy: Pithhu* involves strategic thinking, where players must adjust their throwing techniques based on the position of the stack of stones and their opponents' moves. This promotes problem-solving skills and critical thinking.
6. *Social interaction:* Like many outdoor games, *pithhu* encourages social interaction and cooperation among players. Players may discuss strategies, take turns throwing, and collaborate to achieve a common goal, fostering teamwork and communication skills.

Pithhu offers valuable opportunities for cognitive and social development, including spatial awareness, estimation, problem-solving, teamwork and physical fitness. Additionally, playing indigenous games like *pithhu* preserves cultural heritage and promotes outdoor play, which are important aspects of childhood development.

Implementation

With the above proposed indigenous games, the exposure has been given to 18 Class 1 students and five Class 2 students. The pretest (before starting the project) has been conducted with a survey tool developed and tested by SCERT Uttarakhand to measure the level of foundational numeracy throughout the State of Uttarakhand. The same pretest has been conducted on six Class 1 students and Class 2 students each from another school, who have not been exposed to the above mentioned indigenous games during the project duration. After completion of the project, a post test has been conducted and the results have been compared with the pretest scores to observe any level of improvement in the identified learning outcomes with reference to foundational numeracy.

Results/Outcomes

Assessment is a key component of learning, because it helps students learn and also enables teachers to change the pedagogy as per the learners' needs. When students are able to see how they are doing in their learning journey, they are able to determine whether or not they understand the course material. Assessment can also help motivate students. During this project, a systematic assessment of students was performed—Stage 1, before starting the project (Pretest) and Stage 2 in the second week (March 2024) of project execution (Post test). The assessment was performed on various 'numeracy' parameters prescribed in the Learning Outcomes at the Elementary Stage[1] document (NCERT, 2017).

Learning Outcomes for Class 1

1. Classifies objects into groups based on a few physical attributes, such as shape, size and other observable properties (LO 1.1)
2. Works with numbers 1 to 20 (LO 1.2)
3. Applies addition and subtraction of numbers 1 to 20 in daily life (LO 1.3)
4. Recognises numbers up to 99 and writes numerals (LO 1.4)
5. Describes the physical features of various solids/shapes in his/her own language. For example, a ball rolls, a box slides, etc. (LO 1.5)
6. Estimates and measures short lengths using non-uniform units, like a finger, hand span, length of a forearm or footsteps, etc. (LO 1.6)
7. Observes, extends and creates patterns of shapes and numbers. For example, arrangement of shapes, objects, numbers, etc. (LO 1.7)

Table 1
Performance of Experimental Group for Class 1

Name of the Student	Score (Experimental Group)	LO 1.1	LO 1.2	LO 1.3	LO 1.4	LO 1.5	LO 1.6	LO 1.7	LO 1.8	LO 1.9	TOTAL	%
Aadi	Pretest Score	2	2	1	1	1	2	0	0	0	9	67
	Post-test Score	2	2	2	2	2	2	1	1	1	15	
Aarohi	Pretest Score	2	2	2	2	2	2	1	1	1	15	20
	Post-test Score	2	2	2	2	2	2	2	2	2	18	
Adarsh	Pretest Score	1	1	1	1	1	1	0	0	0	6	83
	Post-test Score	2	2	1	2	1	1	1	1	0	11	
Akshay	Pretest Score	1	2	1	1	0	1	0	0	0	6	83
	Post-test Score	2	2	2	1	1	1	1	1	0	11	

[1]https://ncert.nic.in/pdf/publication/otherpublications/tilops101.pdf

Ambika	Pretest Score	2	2	1	1	2	1	1	1	1	12	33
	Post-test Score	2	2	2	2	2	1	2	2	1	16	
Ameer	Pretest Score	1	1	0	1	0	0	0	1	0	4	75
	Post-test Score	2	2	1	1	0	0	0	1	0	7	
Aradhya	Pretest Score	2	2	2	1	1	1	1	2	1	13	38
	Post-test Score	2	2	2	2	2	2	2	2	2	18	
Arushi	Pretest Score	1	2	1	1	1	1	0	0	1	8	50
	Post-test Score	2	2	2	1	1	2	1	0	1	12	
Manavi	Pretest Score	1	2	1	1	1	1	0	1	0	8	50
	Post-test Score	2	2	2	1	1	2	1	1	0	12	
Paridhi	Pretest Score	1	1	1	0	0	1	1	0	1	6	83
	Post-test Score	1	1	1	1	1	2	2	1	1	11	
Priyanshu	Pretest Score	1	2	1	2	2	0	1	0	0	9	44
	Post-test Score	2	2	2	1	2	2	1	0	1	13	
Saksham	Pretest Score	2	1	2	1	1	1	0	0	0	8	38
	Post-test Score	2	2	2	2	1	1	1	0	0	11	
Shivansh	Pretest Score	1	2	1	1	2	2	1	0	0	10	60
	Post-test Score	2	2	2	2	2	2	2	1	1	16	
Shreya	Pretest Score	1	2	1	1	1	1	0	0	0	7	71
	Post-test Score	2	2	2	2	1	1	1	1	0	12	
Shweta	Pretest Score	2	2	2	2	2	2	1	1	1	15	20
	Post-test Score	2	2	2	2	2	2	2	2	2	18	
Soriya	Pretest Score	1	2	1	2	2	0	1	0	0	9	33
	Post-test Score	2	2	1	2	2	1	1	0	1	12	
Surabhi	Pretest Score	2	2	1	1	2	2	1	1	1	13	31
	Post-test Score	2	2	2	2	2	2	2	2	1	17	
Vaibhav	Pretest Score	2	2	1	1	1	2	1	0	0	10	50
	Post-test Score	2	2	2	2	2	2	1	1	1	15	
Average (Increase in Performance)												51.6

Table 2
Performance of Control Group for Class 1

Name of the Student	Score (Control Group)	LO 1.1	LO 1.2	LO 1.3	LO 1.4	LO 1.5	LO 1.6	LO 1.7	LO 1.8	LO 1.9	TOTAL	%
Shaurya	Pretest Score	1	2	1	2	2	1	1	0	0	10	30
	Post-test Score	2	2	1	2	2	2	1	1	0	13	
Anmol	Pretest Score	2	1	2	1	1	1	0	0	0	8	38
	Post-test Score	2	2	2	2	1	1	1	0	0	11	
Nidhi	Pretest Score	1	2	1	1	1	1	0	1	0	8	50
	Post-test Score	2	2	2	1	1	2	1	1	0	12	
Vipin	Pretest Score	2	2	2	1	2	1	1	0	0	11	8
	Post-test Score	2	2	2	2	2	1	1	0	0	12	
Rohit	Pretest Score	1	2	2	2	1	1	0	0	0	9	44
	Post-test Score	2	2	2	2	2	1	1	0	1	13	
Ankit	Pretest Score	1	2	2	2	1	1	1	1	1	12	25
	Post-test Score	2	2	2	2	2	2	1	1	1	15	
Average (Increase in Performance)												32.5

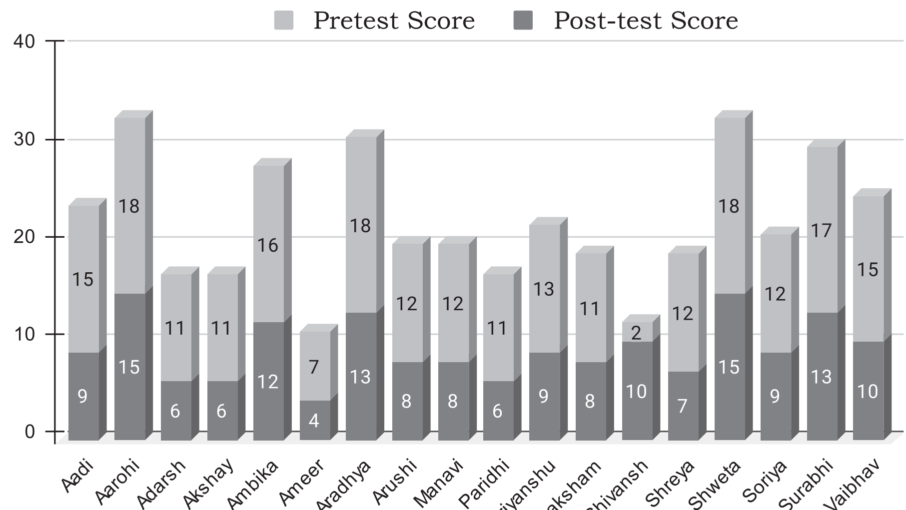

Figure 1: Performance of Experimental Group for Class 1

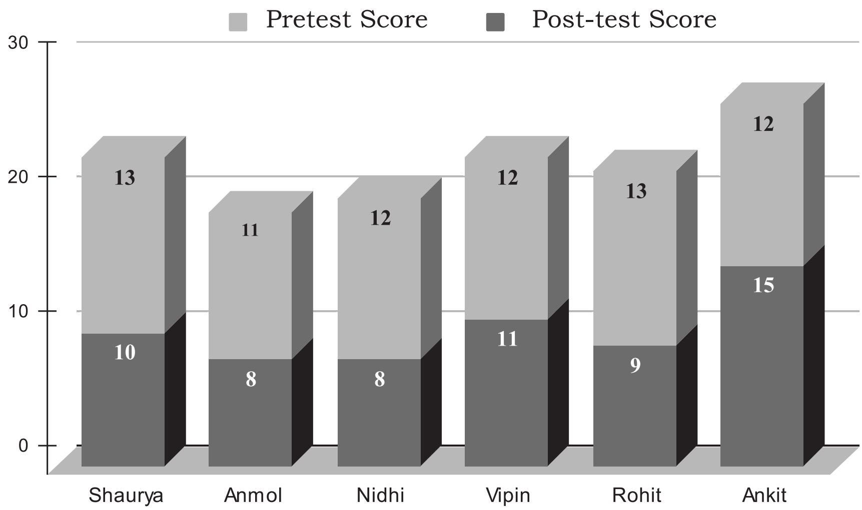

Figure 2: Performance of Control Group for Class 1

8. Collects, records (using pictures/ numerals) and interprets simple information by looking at visuals (LO 1.8)
9. Develops the concept of zero (LO 1.9)

In Class 1, 18 students (Experimental Group) have been exposed to indigenous games. After completion of project, it has been observed that the average performance of the group in mathematics has been increased by 51.6 per cent. The performance of the learners have been improved respectively by 67 per cent, 20 per cent, 83 per cent, 83 per cent, 33 per cent, 75 per cent, 38 per cent, 50 per cent, 50 per cent, 83 per cent, 44 per cent, 38 per cent, 60 per cent, 71 per cent, 20 per cent, 33 per cent, 31 per cent and 50 per cent. In contrast, six students of Class 1 made up of the control group from other school (who have not been exposed to indigenous games during the project time duration). After completion of the project, the post-test results have been compared and the average performance of the group increased by 32.5 per cent. The performance of the learners has been improved respectively by 30 per cent, 38 per cent, 50 per cent, 8 per cent, 44 per cent, and 25 per cent.

Learning Outcomes for Class 2

1. Works with two digit numbers (LO 2.1)
2. Describes basic 3D and 2D shapes with their observable characteristics (LO 2.2)
3. Estimates and measures length/ distances and capacities of containers, using uniform non-standard units, like a rod/ pencil, cup/spoon/bucket, etc. (LO 2.3)

4. Compares objects as heavier/ lighter than using simple balance (LO 2.4)
5. Identifies the days of the week and months of the year (LO 2.5)
6. Sequences the events occurring according to their duration in terms of hours/days (LO 2.6)
7. Draws inference based on the data collected (LO 2.7)

Table 3
Performance of Experimental Group for Class 2

Name of the Student (Class 2)	Score (Experimental Group)	LO 1.1	LO 1.2	LO 1.3	LO 1.4	LO 1.5	LO 1.6	LO 1.7	LO 1.8	LO 1.9	TOTAL	%
Shivani	Pretest Score	2	2	1	1	2	1	1	1	1	12	33
	Post-test Score	2	2	2	2	2	1	2	2	1	16	
Aarav	Pretest Score	1	2	1	1	2	2	1	0	0	10	60
	Post-test Score	2	2	2	2	2	2	2	1	1	16	
Ishika	Pretest Score	2	2	2	1	1	1	1	2	1	13	38
	Post-test Score	2	2	2	2	2	2	2	2	2	18	
Nazma	Pretest Score	1	1	1	0	0	1	1	0	1	6	83
	Post-test Score	1	1	1	1	1	2	2	1	1	11	
Siddarth	Pretest Score	1	1	0	1	0	0	0	1	0	4	75
	Post-test Score	2	2	1	1	0	0	0	1	0	7	
Average (Increase in Performance)												57.8

Table 4
Performance of Control Group for Class 2

Name of the Student (Class 2)	Score (Control Group)	LO 1.1	LO 1.2	LO 1.3	LO 1.4	LO 1.5	LO 1.6	LO 1.7	LO 1.8	LO 1.9	TOTAL	%
Abhay	Pretest Score	2	2	2	1	1	1	2	1	1	13	8
	Post-test Score	2	2	2	1	1	2	2	1	1	14	
Pankaj	Pretest Score	1	1	2	1	1	1	1	0	0	8	25
	Post-test Score	2	1	2	1	1	1	1	1	0	10	
Aradhana	Pretest Score	1	1	2	1	1	2	1	0	0	9	22
	Post-test Score	1	2	1	2	1	2	1	1	0	11	

Shivam	Pretest Score	2	2	1	1	2	1	0	0	0	9	33
	Post-test Score	2	2	2	1	2	2	0	0	1	12	
Amrita	Pretest Score	1	1	1	0	0	1	1	0	0	5	40
	Post-test Score	1	1	1	1	1	1	1	0	0	7	
Ananya	Pretest Score	2	2	1	2	1	1	1	1	0	11	27
	Post-test Score	2	2	1	2	2	1	2	1	1	14	
Average (Increase in Performance)												25.83

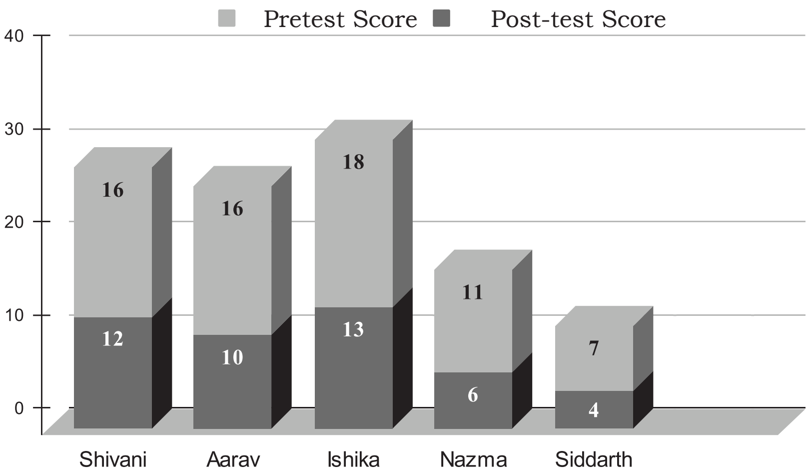

Figure 3: Performance of Experimental Group for Class 2

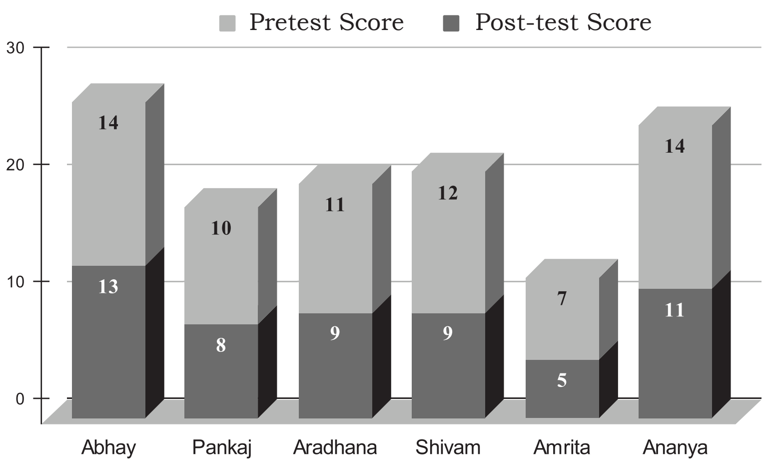

Figure 4: Performance of Control Group for Class 2

In Class 2, five students (Experimental Group) have been exposed to indigenous games. After completion of the project, it has been observed that the average performance of the group in mathematics has been increased by 57.8 per cent. The performance of the learners has been improved, respectively, by 33 per cent, 60 per cent, 38 per cent and 75 per cent.

In contrast, six students of Class 2 made up the control group from other school (who have not been exposed to indigenous games during the project time duration). After completion of the project, the post-test results have been compared and the average performance of the group increased by 25.8 per cent. The performance of the learners has been improved, respectively, by 8 per cent, 25 per cent, 22 per cent, 33 per cent, 40 per cent and 27 per cent.

Conclusions and Implications

In recent years, there has been a growing interest in the integration of games into educational settings, especially for Primary students. Games offer a dynamic and engaging platform for learning, providing opportunities for students to develop a range of skills, while having fun. Indigenous games have long been a part of human culture, passed down through generations and played in communities around the world. Beyond their recreational value, these games offer rich opportunities for learning, especially in the context of mathematical development at foundational stage.

Indigenous games often involve elements of counting, sequencing and spatial reasoning, which are foundational numeracy concepts. For example, in hopscotch, players must accurately count squares and calculate distances to progress through the game. Similarly, *pitthu* involves estimating trajectories and angles to aim accurately, reinforcing concepts of geometry and measurement. By engaging in these activities, Primary students develop an intuitive understanding of numeracy concepts, making abstract ideas more concrete and tangible. Indigenous games present players with a variety of challenges and obstacles that require problem-solving skills and strategic thinking. Players must analyse situations, make decisions and adapt their strategies accordingly. Through repeated gameplay, students learn to anticipate consequences, evaluate alternatives and apply mathematical principles to solve problems effectively.

Indigenous games provide opportunities for mathematical discourse and collaboration among learners at the foundational level, fostering communication and peer learning. Whether playing cooperatively or competitively, students engage in discussions, share strategies and explain their reasoning to peers. This exchange of ideas promotes mathematical communication and vocabulary, enabling students to articulate their thoughts and express mathematical concepts fluently. Moreover, games create a supportive environment, where students feel comfortable taking risks, asking questions, and seeking help from peers and teachers. This collaborative learning experience enhances mathematical understanding and confidence, empowering students to engage actively in mathematical discourse, both inside and outside the classroom.

Games have a unique ability to capture students' interest and motivation, making learning more enjoyable and meaningful. Unlike traditional teaching methods, which may feel monotonous or passive, games offer an interactive and immersive learning experience that captivates students' attention and curiosity. The elements of challenge and reward inherent in games motivate students to persist in their efforts and overcome obstacles, fostering a growth mindset and resilience. Moreover, games provide immediate feedback and assessment, allowing students to monitor their progress and identify areas for improvement in real time. This feedback loop promotes self-directed learning and empowers students to take ownership of their education, leading to deeper engagement and long-term retention of knowledge. Games offer a safe space for the foundational level students to explore and regulate their emotions, promoting emotional intelligence and well-being. Many games incorporate storytelling and character development, allowing players to empathise with virtual characters and understand different perspectives. By engaging with emotionally rich narratives, students develop empathy, compassion and interpersonal skills, which are essential for building positive relationships and navigating social interactions. Additionally, games provide opportunities for students to experience and cope with failure in a supportive environment, teaching them resilience, perseverance and self-confidence. Through these experiences, students develop a healthy attitude towards challenges and setbacks, fostering a positive mindset and mental resilience.

By embracing challenges and learning from mistakes, students develop a growth mindset, believing in their ability to improve, and succeed through effort and practice. Moreover, the sense of achievement and satisfaction gained from mastering a game reinforces positive attitudes towards mathematics, motivating students to continue exploring and learning.

Indigenous games have a significant impact on the foundational numeracy skills of students, providing opportunities to cultivate mathematical concepts, problem-solving skills and mathematical discourse. By integrating these games into educational practices, teachers can create engaging and interactive learning environments that foster numeracy skills. Moreover, indigenous games offer a valuable supplement to formal instruction, promoting mathematical persistence and confidence in young learners. As we continue to explore the potential of indigenous games in mathematics education, it is essential to leverage their strengths effectively to empower students and nurture their numeracy aptitude.

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