Enhancing Primary Education Through Interactive Teaching and Learning Aids in Rural Uttarakhand, India

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Abstract

Primary education in India has long been neglected due to multiple factors. Although significant progress has been made recently to increase access to education, the quality of schooling remains a critical concern especially in poorly funded schools in rural areas of the country. Key issues include the shortage of trained and qualified teachers, an outdated curriculum focused on rote learning, inadequate infrastructure and resources, and socio-economic challenges faced by many students. These factors also prevent teachers from accessing necessary teaching aids and materials, leading to an incomplete educational experience. This research paper addresses these concerns by presenting a case study of an innovative interactive Teaching Aid: The ancient game of Snakes and Ladders, adapted to teach Geography and mathematics to students from underprivileged backgrounds in a government-aided school in a village in Uttarakhand, India. Designed in a large floor game format, the game is intended to be a low-cost teaching aid that facilitates an interactive platform for students to learn while playing. This paper thus contributes by addressing the research gap in school education in India by providing a case study on educational innovation using Interaction Design. It demonstrates that traditional games can be adapted to create effective and engaging teaching aids, addressing some of the key challenges in primary education, particularly for underprivileged students in rural areas, by fostering an interactive and practical learning environment.

Keywords: SDG4, education equity, play, ancient games, local knowledge

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Introduction

SDG 4 encompasses a broad range of targets aimed at ensuring access to quality education for all individuals, regardless of gender, age, or socio-economic status. These targets include universal primary and secondary education, early childhood development and pre-primary education, equal access to affordable technical, vocational, and higher education, skills for employment and decent jobs, elimination of gender disparities in education, inclusive education for persons with disabilities, literacy and numeracy, and education for sustainable development and global citizenship.

While India has made significant strides in improving access to education over the past few decades there are still many areas where it is not fulfilling these goals. The Right to Education (RTE) Act, 2009, which mandates free and compulsory education for children between the ages of 6 and 14, has been a cornerstone in this regard. According to the Annual Status of Education Report (ASER) 2018, the enrollment rate for children in the 6-14 age group is above 95%. However, challenges persist in terms of quality, equity, and inclusiveness.

- Quality of Education: Despite high enrollment rates, the quality of education remains a concern. The ASER 2018 report highlights that a significant proportion of children in rural areas struggle with basic reading and arithmetic skills.
- Infrastructure and Resources: Many schools, especially in rural and remote areas, lack adequate infrastructure, teaching materials, and qualified teachers.
- Gender Disparities: Although gender parity in primary education has improved, disparities persist at the secondary and tertiary levels. Cultural norms and economic factors often impede girls' education.
- Inclusive Education: Children with disabilities, those from marginalized communities, and economically disadvantaged backgrounds face significant barriers to education.
- Teacher Training: There is a need for continuous professional development and training for teachers to equip them with modern pedagogical skills and knowledge.

Initiatives and Policies

The Government of India has undertaken several initiatives to address these challenges and advance towards SDG 4:

- Samagra Shiksha Abhiyan: This integrated scheme aims to ensure inclusive and equitable quality education from pre-primary to higher secondary levels.
- Beti Bachao, Beti Padhao: Aimed at promoting the education of girls and addressing gender disparities.
- Digital Initiatives: Programs like DIKSHA (Digital Infrastructure for Knowledge Sharing) and SWAYAM (Study Webs of Active Learning for Young Aspiring Minds) provide digital resources and online courses to enhance learning opportunities.
- Skill Development Programs: Initiatives like Pradhan Mantri Kaushal Vikas Yojana (PMKVY) focus on imparting vocational skills to youth, improving employability.

It has been suggested that to achieve SDG 4 by 2030, India needs to adopt a multi-faceted approach such as:

- Strengthening Public Education: Investing in infrastructure, teacher training, and educational resources is crucial to improve the quality of public education.

- Promoting Equity: Special measures are needed to support the education of girls, children with disabilities, and those from marginalized communities.
- Community Participation: Engaging communities in the education process can help address socio-cultural barriers and create a supportive environment for learning.
- Leveraging Technology: Expanding digital learning platforms and ensuring access to technology in remote areas can bridge educational gaps.
- Monitoring and Evaluation: Regular monitoring and evaluation of educational programs and policies are essential to track progress and make necessary adjustments.

About the Project

While significant progress has been made, achieving this goal requires sustained effort, innovative approaches, and collaborative efforts from government, civil society, and the private sector. With this aim, the project was initiated in a low-income government school in a rural area near Uttarakhand's capital city of Dehradun in north India.

Motivation of Students

Motivation of students is vital for their engagement and persistence in the educational process, significantly influencing educational outcomes. Motivated learners are focused and self-driven, requiring minimal external stimuli to maintain attention. Effective instructional design must address student motivation, which can be intrinsic (driven by challenge, fantasy, and curiosity) or extrinsic (focused on desired outcomes). Games, inherently containing intrinsic motivators, are valuable tools in making learning engaging and fun, aligning with Schank's “learning by doing” paradigm. Integrating traditional outdoor games into the educational process can enhance motivation by promoting active participation, relevance through familiar activities, confidence in a relaxed environment, and intrinsic satisfaction. This approach also fosters social development, cooperation, healthy physical activity, and cultural appreciation. Involving students in creating the learning scenario.

The Project Design

Designed as a teaching aid, the snake and ladder project incorporated this traditional game into the curriculum to enhance the learning and teaching activity. The project included detailed instructional manuals for educational integration by combining elements of mathematics, geography, altitude awareness, history, and color recognition. The entire project was created in collaboration with the schoolteachers with constant feedback taken at every stage. Therefore, ensuring their role as knowledge creators in primary education.

By incorporating hands-on activities such as arranging jigsaw puzzles and playing a Snakes and Ladders game, the floor game offered an interactive learning experience that engaged students in active participation. Teachers customized the content, including images of Uttarakhand and the size and medium of the visual aids, making the game versatile and applicable to different educational contexts. They also made use of drawing exercises for geographical locations and altitudes, which enhanced the learning experience and set the game apart as a visually engaging educational tool.

Skill Development

The game fostered the development of various skills such as critical thinking, problem-solving, numeracy, and spatial awareness, making it a comprehensive educational resource. By integrating complex concepts into a familiar game format, the floor game made learning more accessible and enjoyable for students. Students also applied their knowledge in practical scenarios, such as reading altitude values, identifying geographical features, and making comparisons between different locations, fostering a deeper understanding and retention of learning objectives.

Snake and Ladder Game

This game is considered an effective method for overcoming issues such as limited vocabulary, poor pronunciation, lack of motivation, nervousness, shyness, fear of making mistakes, and anxiety about being teased by peers for not understanding the subject or grammar. Using board games in language classrooms to teach speaking is an effective way to reduce speaking anxiety and provide enjoyment for students. This approach allows students to study and practice speaking in an enjoyable and practical manner. While most of the reviews on snake and ladder deals with English language proficiency, the application of the snake and ladder game to incorporate information on regional locations and their names with altitudes has not been attempted and therefore presented a unique opportunity to combine English, mathematics, and geography in this game (Figure 1).

Figure 1

Students of Primary School With Their Teacher and the Snake and Ladder Floor Game

Source: UPES

Game Design

The Unch-Neech puzzle was printed on paper according to the desired size or the number of students in the class. With the help of students, the puzzle was cut along the indicated lines and pasted onto cardboard, thermocol, or any other medium that suited the needs, ensuring

durability. Locations mentioned in the game were searched online and printed on separate papers. The printed images of locations were then pasted onto the empty areas of the Unch-Neech game, or alternatively, these areas were left empty for students to draw and paste their own representations.

When the puzzle was completed, students were asked to notice the term Moksh-Path mentioned at the top of the puzzle. It was explained that Snake and Ladder is an ancient Indian game also called Mokshapat or Moksha Patamu, created to impart moral lessons about karma and destiny. Ladders symbolized good deeds, while snakes represented evil actions. Teachers further read about the cultural significance of the game through the internet to enhance students' knowledge. It was ensured that the puzzle pieces were securely pasted and that the location images were clearly visible for effective learning during the game.

Implementation and Activities

Students formed groups of 2 to 8, and the jigsaw pieces were laid out on the floor. They were instructed to start putting them together by organizing the pieces by numbers, either in ascending or descending order. Students were encouraged to identify which number came before or after a given digit, such as “What number comes before 3?” or “What number comes after 20?” They were asked to pay attention to the colors of the snakes and the angles of the ladders to assist in completing the puzzle. Students read the altitude numbers on the pieces to determine their placement in the puzzle, for instance, “What is the altitude of Ramgarh?” or “Which place has a higher altitude than Ramgarh?”

In the mathematics segment, students shared their ages and discussed which numbers were higher or lower. They took turns based on their age or birth date, moving either from lower to higher numbers or vice versa. Students rolled the dice and began playing the game accordingly, calculating their movements by adding or subtracting the numbers rolled on the dice from their current position. For example, if a student was on block 5 and rolled a two, they added 5 + 2 to move to block 7. If they climbed a ladder from block 9 to 27, they moved 27 - 9 = 18 places. Similarly, if they reached the mouth of the snake, they calculated how many numbers they climbed down to the tail of the snake using addition or subtraction.

When a student reached a box with a number missing, they recalled what number would come in that box. For example, if number 8 was missing from the puzzle, students were asked what number follows 7. If they reached a ladder at number 21 and climbed up to 60, students were asked about the missing numbers in between the ladder. If they reached the tail of the snake or the mouth of the snake, students recalled the number that should be mentioned in those boxes. Students read the altitudes mentioned on the locations they reached during the game, such as Tehri Garhwal at 1,016 meters and Nainital at 2,084 meters. They quickly calculated on paper or on the ground with chalk or pencil, determining which altitude was higher and the difference between heights using subtraction: 2084 - 1016 = 1068.

Teaching Geography and Altitude

Students read and spelled the names of different geographical locations in Uttarakhand mentioned on the box they landed on. They calculated the altitude based on the digits written on the box for units, tens, hundreds, and thousands. Students related the colors on the empty boxes to geography, such as blue representing water bodies like Sharda Sagar Lake, and white representing high altitude areas like Nanda Devi mountain peak covered with snow.

Images or printouts of the locations were shown to students, and they drew the geographical features and altitudes on paper. Students displayed their drawings of different geographical features and altitudes for comparison and observation. Using the individual jigsaw boxes from the Unch-Neech game, students revisited the altitude digits for the locations they depicted and wrote them down on the drawings. They compared the altitudes of different geographical features from various parts of Uttarakhand through their drawings and printed images, such as meadows, mountains, valleys, rivers, etc.

The game was adaptable for different levels of students, with special needs or accommodations considered for individual students to fully participate in the activity.

Conclusion

Uniquely integrating mathematics, geography, and altitude awareness, the floor game Unch-Neech offered an interactive learning experience. Through activities like jigsaw puzzles and the snake and ladder game, it served as a teaching aid, with customizable content focusing on Uttarakhand's geography. Visual aids and drawing exercises engaged students while introducing the cultural significance of the snake and ladder game in India. Aimed at promoting critical thinking, problem-solving, retention, and numeracy skills, its innovative approach made complex concepts enjoyable and accessible. Students practically applied knowledge by relating mathematical concepts and altitude values to geographical features. Overall, its blend of education, interactivity, customization, and innovation made it a distinctive educational resource.

Author's Note

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