Research Article

Research Tales of Numbers: Enhancing Numeracy Skills through Digital Storytelling

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Abstract

The National Education Policy (NEP) 2020 emphasises the importance of foundational numeracy as a key component of early childhood education. The policy recognises that developing strong foundational numeracy skills is essential for building a strong foundation in mathematics and other disciplines and for preparing children for success in the 21st century. To achieve the goal of foundational numeracy we need that pedagogy, which is helpful in developing foundational skills among the learners in grade third. This paper focuses on such pedagogy which is helpful in teaching mathematics, i.e., digital storytelling. For this study, the methodology was a quasi-experimental design, which was conducted over 240 students in grade 3. The results of the control and experimental groups showed a significant difference at 0.5 level when the achievement of the two groups was compared. The results show that digital storytelling is effective in comparison to teaching mathematics in traditional ways.

Keywords: Digital Storytelling, Mathematics Competence, Foundational Numeracy

Introduction

Mathematics is a subject that often intimidates and confuses many students. It is abstract, complex, and, at times, difficult to grasp. However, with the advancement of technology, digital storytelling has emerged as an effective tool to enhance students' understanding of mathematical concepts. Digital storytelling refers to the use of multimedia tools, such as videos, animations, and images, to tell a story or convey information. It allows students to visualize and experience abstract mathematical concepts in a more concrete and engaging way, which leads to a better understanding and retention of the subject matter.

Competence-based learning (CBL) is an educational approach that focuses on developing students' skills and abilities through practical and hands-on experiences. It emphasizes the application of knowledge and the acquisition of competencies that are relevant to real-life situations. In this context, digital storytelling can play a crucial role in facilitating CBL by providing students with a dynamic and interactive learning experience. By using digital storytelling, educators can create a more immersive and personalized learning environment that encourages students to engage with mathematical concepts in a meaningful way.

Moreover, digital storytelling has been shown to be effective in promoting student engagement and motivation, which are critical factors in enhancing learning outcomes.

Fundamental Numeracy

The National Education Policy (NEP) 2020 emphasizes the importance of developing fundamental numeracy skills among students. The NEP 2020 recognizes the importance of fundamental numeracy skills for students and proposes a range of strategies to ensure that all students have the opportunity to develop these skills. By focusing on experiential and activity-based learning, integration of numeracy across different subjects, and the use of technology, the NEP 2020 aims to provide students with the tools and skills they need to succeed in the 21st century.

The NEP 2020 proposes the integration of numeracy across different subjects, including language, social sciences, and sciences. This approach can help students develop a deeper understanding of the relevance and application of mathematical concepts in different contexts. The NEP 2020 recognizes the potential of technology in education and proposes the use of technology to enhance the teaching and learning of numeracy skills. This can include the use of educational apps, games, and other digital tools that provide students with engaging and interactive ways to practice and develop their numeracy skills.

Digital Story

A digital story is a type of storytelling that combines various multimedia elements, such as images, video, audio, and text, to create a narrative. Digital Storytelling Association (2002) elaborates on digital storytelling as "the modern expression of the ancient art of storytelling using digital media to create media-rich stories to tell, to share, and to preserve. Digital stories derive their power through weaving images, music, narrative, and voice together, thereby giving deep dimension and vivid colour to characters, situations, and insights." It is a form of digital media that allows individuals or groups to share personal stories, experiences, and perspectives in a creative and engaging way. Digital stories can be used to communicate ideas, promote awareness, entertain, or educate audiences. They can be created using a wide range of digital tools and software, such as video editing software, animation software, and online platforms that offer templates for creating digital stories.

Digital stories can be shared on social media, websites, or other digital platforms, allowing them to reach a wider audience and potentially make a greater impact. They offer a unique way to tell stories and share experiences that can be more engaging and immersive than traditional forms of storytelling.

Digital Storytelling in Mathematics at Primary Stages

Digital storytelling can play a significant role in the development of mathematical competencies by creating engaging and interactive learning experiences that promote understanding, problem-solving, and critical thinking. Here are a few ways in which digital storytelling can support the development of mathematical competencies:

1. **Visual representation:** Digital storytelling allows for the use of images, animations, and videos to create visual representations of mathematical concepts. This can help learners to understand abstract concepts, visualize problems and solutions, and make connections between different mathematical concepts.
2. **Interactivity:** Digital storytelling can make learning more interactive by incorporating quizzes, games, and other activities that allow learners to apply their mathematical

knowledge and skills in a fun and engaging way. This can help to develop problem-solving skills and critical thinking.

3. **Personalization:** Digital storytelling can be personalized to the needs and interests of individual learners by incorporating real-world examples and scenarios that are relevant to their lives. This can help to increase engagement and motivation and promote deeper learning.
4. **Collaboration:** Digital storytelling can promote collaboration and communication among learners by allowing them to share their work, give and receive feedback, and work together on projects. This can help to develop communication and teamwork skills, as well as support social and emotional learning.

Digital Storytelling, thus, can be a powerful tool in the development of mathematical competencies by creating engaging and interactive learning experiences that promote understanding, problem-solving, and critical thinking.

Significance of storytelling in the teaching

Digital storytelling can be helpful in developing fundamental numeracy by providing an engaging and interactive way for students to learn and practice basic mathematical concepts. Here are some ways in which digital storytelling can help develop fundamental numeracy:

- **Making Mathematics Engaging:** Digital storytelling can make mathematics more engaging by incorporating visual elements, audio, and interactive elements that capture the attention and interest of students.
- **Contextualizing Mathematical Concepts:** Digital storytelling can contextualize mathematical concepts by presenting them in real-world situations, helping students understand how math is used in everyday life.
- **Developing Number Sense:** Digital storytelling can help students develop number sense by presenting numerical information in a variety of formats, such as graphs, charts, and tables, and allowing them to interact with the information.
- **Promoting Problem-Solving:** Digital storytelling can promote problem-solving skills by requiring students to solve math problems as part of the storytelling process or by presenting them with math-related challenges that they need to overcome to complete the story.
- **Enhancing Communication Skills:** Digital storytelling can enhance communication skills by requiring students to effectively communicate mathematical concepts in a clear and concise manner as part of the storytelling process.

Digital storytelling can be an effective tool for developing fundamental numeracy by making math more engaging, contextualized, and interactive and by promoting problem-solving and communication skills.

Literature Review

Digital storytelling in mathematics is an emerging area of research that aims to enhance students' engagement and learning outcomes by using digital tools to create and share stories related to mathematical concepts. Some recent research in this field includes "Digital Storytelling: A Meaningful Technology-integrated Approach for Engaged Student Learning " by Alaa Sadik (2008),

which found that digital storytelling can improve students' engagement and achievement in mathematics, particularly for students with lower prior achievement. According to Robin and Pierson (2005), the act of creating meaningful stories has improved the experience for both students and teachers. Digital storytelling has grabbed both students' and teachers' imaginations. According to Robin (2005), educators can utilise digital storytelling in a variety of ways to assist students' learning by encouraging them to organise and express their thoughts and knowledge in a unique and meaningful manner. "Digital Storytelling as a new meaningful teaching/learning strategy for mathematics and geometry. " By Corrado P. et. al. (2013), which explored the use of digital storytelling to promote students' understanding of geometric transformations found that students were more engaged and had a better conceptual understanding of the topic. "Digital storytelling to support mathematics learning in the Early Years" by Ulutas, I. et al. (2022). which investigated the use of digital storytelling to support young children's mathematical learning and found that it was effective in promoting their interest in mathematics and improving their mathematical skills. These studies suggest that digital storytelling can be an effective tool for enhancing students' engagement and understanding of mathematical concepts. Digital storytelling in mathematics is an emerging field of research in India, with a growing number of studies exploring its potential to enhance students' engagement and learning outcomes. Some recent research in this field includes: " The Effectiveness of Digital Storytelling in the lCassrooms: a comprehensive study" by Smeda et al. (2014), The results of this study indicate that digital storytelling is a potent tool for fusing instructional messages with educational activities to make learning environments more fascinating and engaging. It is an effective strategy for developing a constructivist learning environment based on cutting-edge teaching and learning ideas. As a result, this strategy could improve student engagement and give students better educational results. "Enhancing Teaching-Learning of Mathematics among Grade II Children Using Storytelling Strategy" Singh and Gandhi (2020), which investigated Storytelling proved to be an appropriate strategy for this involvement Storytelling helped the intern-teacher in solving the problem of low participation in the mathematics classroom. Bohara, P.S (2023), in his study "Incorporating Digital Storytelling in Secondary Mathematics for Engaged Learning; A Collaborative Action Research Study", which was conducted on secondary school students, found out that using digital storytelling in their pedagogy enhances the engagement of the learners in three aspects emotional, behavioural, and cognitive that the story, besides providing a meaningful context to the children, helped to break the teacher-student barrier. Digital storytelling and multimodal design were unfamiliar concepts to the group of preservice teachers, who saw them as novel approaches. They saw digital storytelling as a method and strategy for promoting "Student voice" and participatory knowledge creation.

These studies suggest that digital storytelling has the potential to be an effective tool for enhancing mathematics education in India, and further research is needed to explore its potential in different educational settings and contexts.

Rationale of the Study

Our educational system is struggling with a number of ways to measure the advancement of technology in education to its standard level. We are in the age of digitalization, so our students are able to gather information from a

variety of sources. So that they are able to assess it, analyse it and collaborate with others.

Integrating ICT in education has opened a number of doors for the teachers as well as for the learners. At primary stages ICT has evolved around child-centred pedagogies. Teaching through using ICT has made learning more interesting and innovative. By using ICT tools, teachers are able to develop mathematics competence among the learners. Teachers' determination to succeed is the result of their mastery of mathematics subject, pedagogy, and technological integration, as well as their awareness of research findings.

Digital storytelling is one of the ways of teaching mathematics, which is helpful for teaching mathematics concepts till the primary stages. Through digital storytelling, the learners learn pre-number concepts, mathematics operations, shapes and measurements quickly. The researcher identified very few studies relating to the use of digital storytelling as a competence-based methodology in mathematics. There is a need for more explanation about this field. The Present study sought to determine how digital storytelling affects mathematics competence among primary-stage learners.

Title of the study:

Tales of Numbers: Enhancing Numeracy Skills through Digital Storytelling

Objectives of the Study

1. To find out the impact of digital stories telling in teaching on the student's achievement in mathematics
2. To compare the achievement of experimental groups and control groups in mathematics.

Hypothesis of the Study

1. There exists no significant impact of digital storytelling on the student's achievement in mathematics.
2. There exists no significant difference between digital storytelling and traditional teaching methods on students' achievement in mathematics

Operational Definition

Digital storytelling: It is a modern and multimedia-based form of storytelling that combines traditional storytelling techniques with various digital media elements. involving the creation and presentation of narratives using digital tools and technologies such as text, images, audio, video, animations, and interactive elements**.**

Mathematical competence: This refers to a learner's ability to understand, use, and apply mathematical concepts and skills effectively in various real-world contexts

Methodology

Description of digital storytelling

This is a case study of primary schools of Jamia Millia Islamia New Delhi. This was based on the basic mathematics learning in grade three students for this experiment some stories were developed, which were narrated to students. These stories were presented to control groups and experimental groups as well. To the experimental group, the same story was shown digitally using videos or showing slides. These stories were based on mathematics operations (addition, subtraction, multiplication and division) of two/three digits.

Some Ideas for Digital Stories in Mathematics for Primary Students:

Counting Adventures: A digital story

that takes students on a journey of counting adventures, where they count different objects such as animals, fruits, and shapes. The story can incorporate interactive elements that allow students to count along with the story and practice their counting skills.

Time-Telling Tales: A digital story that teaches students how they can tell time. The story can feature characters who have different activities throughout the day, and students can help them tell time by adjusting their hands on a clock.

Geometry Quest: A digital story that explores geometric shapes and their properties. The story can feature a character who is on a quest to find different shapes in their environment, such as circles, squares, and triangles.

Measurement Mayhem: A digital story that introduces students to the concept of measurement. The story can feature a character who needs to measure different objects to complete a task, such as baking a cake or building a treehouse.

Problem-Solving Stories: Digital stories that present students with math-related problems to solve, such as figuring out how many apples are left after some have been eaten or how to divide up a set of objects among a group of people. The stories can incorporate interactive elements that allow students to work through the problems and find solutions

Sample

The study was piloted on a sample of 240 students studying Jamia Schools. These students were divided into two groups; one group was kept as a control group, and the other group was treated as an experimental group.

Tool used: Various Tools chosen and used by the investigators are given below:

- Mathematics Achievement Test developed by Researcher
- Digital story adapted from various sources

Execution of the Experiment & Data Collection

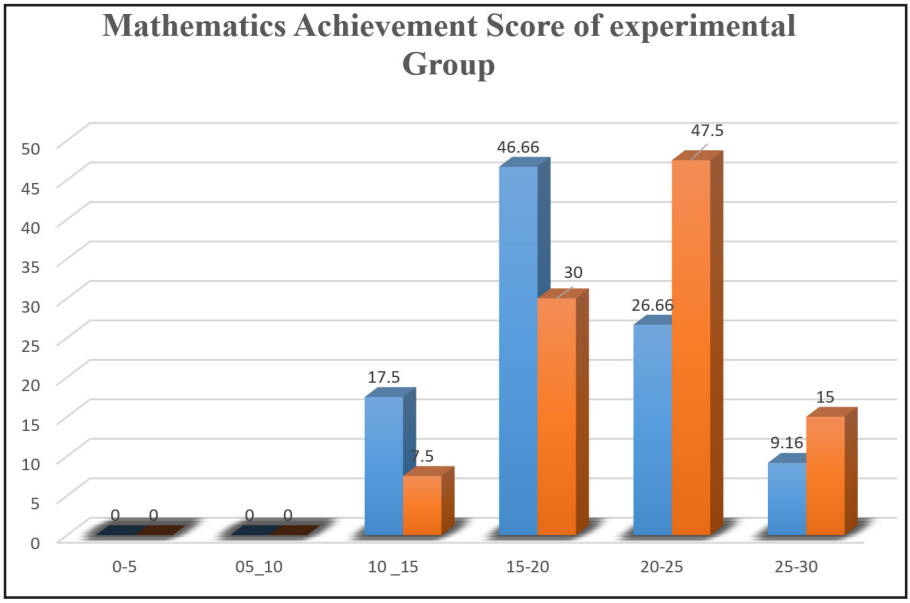
Execution of the experiment and data collection for this study took three weeks. Before the experiment, a pre-test was administered to check the previous concepts of students related to basic mathematics operations (addition, subtraction, multiplication and division) and also to know the use of mathematics in their daily life. Achievement tests were prepared to keep the mathematics competence needed at grade 3. The experiment was conducted by the investigator himself and some D.El.Ed. trainee doing their teaching practices.

Table-1: Mathematics Achievement Score of Control and Experimental Group

Class interval Pre-test		Mathematics achievement of control group		Mathematics achievement of experimental group	
		Post-test	Pre-test	Post-test	
1.	0-5	0	0	0	0
2.	5-10	1	0	0	0
3.	10-15	35	21	26	9
4.	15-20	53	55	56	36
5.	20-25	19	29	27	57
6.	25-30	12	15	11	18

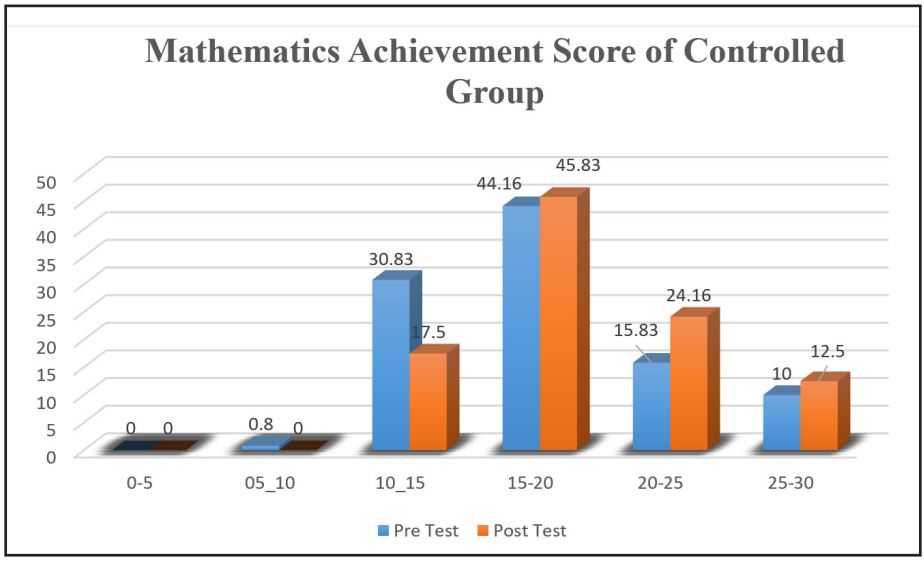
On the basis of the test score(Pre and Post) of controlled and experimental groups, we can say digital storytelling is useful. These results predict that if teachers use digital storytelling in their classrooms, then it is more effective than other traditional ways of storytelling.

Figure-1: Mathematics Achievement Score of Controlled Group



Achievement scores of the controlled group show that when teachers taught traditional ways or by storytelling verbally then the achievement of the students did not rise significantly. But some changes were seen in group 20-25 and other groups remained almost the same.

Figure 2: Mathematics Achievement Score of experimental Group



By the graph, when we compare students' scores of pre and post-tests then we observe decrease in groups 10-15 and 15-20, and the scores rise

in groups 20-25 and 25-30. Most of the students who were in groups 15-20 shifted to the group. The maximum distribution, i.e. 47.5 per cent was observed in group 20-25.

Table-2: t-Value of Pre- Mathematics scores of controlled and experimental groups

	M	N	Std. Deviation	Std. Error Mean	t-value
CONTROL	18.57	120	4.883	.446	.991 Insignificant at (0.5 and 0.1)
EXPERIMENTAL	18.28	120	4.777	.436	

Comparing Mean, Standard Deviation

The two groups (control group and experimental group) selected for the experiment and control are approximately equivalent. The mean of achievement tests of the control group and experiment group are nearly same.

Table-3: t-Value of Post- Mathematics scores of controlled and experimental groups

	M	N	Std. Deviation	Std. Error Mean	t-value
CONTROL	18.67	120	4.882	.445	3.252* Significant at (0.5 and 0.1)
EXPERIMENTAL	21.29	120	4.399	.401	

Comparing Mean, Standard Deviation

Table-4: Comparing Means of Experimental and Control Group

Summary of ANCOVA				
	Sum of Squares	df	Mean Square	F-ratio
Between Groups	1725.256	21	82.155	13.941
Within Groups	577.536	98	5.893	

Students of the experiment group showed significant improvement in post-score (after treatment) the t-value calculated comparing two groups was 3.252, which is significant at 0.5. This shows the difference between the means of control and the experimental group. and ANCOVA is a statistical technique used to compare means of two or more groups while controlling for the influence of one or more continuous covariates. This is a test statistic that measures the ratio of the variability between groups to the variability within groups. It's used to determine if there are significant differences between the group means. The F-statistic is 13.941, which is significant at 0.05. This result shows that the experimental group achieved higher scores than the control group. Thus, H01 rejected the idea that teaching mathematics by using

digital storytelling is more effective than teaching by traditional ways or telling stories orally at grade 3. In this method, the audio-visual senses of students Participate in learning and so they see and listen to the situation so the learning is effective. These results are supported by McLaren, Adams, Mayer, and Forlizzi (2017), who found a favourable correlation between ICT use and math achievement. ICT improved kids' learning, critical thinking, and math proficiency, according to the study's findings Istenic Starčič, A., Cotic, M., Solomonides, I., & Volk, M. (2016). Albano, G., & Pierri, A. (2017) "perceived digital storytelling as a strategy meant for empowering the student's voice and active construction of knowledge". Thus, we can say digital storytelling in mathematics in primary classes is an effective way of teaching mathematics and developing competence, which is required in the 21st century.

Conclusion

Early numeracy skills are crucial for learning because this not only provides the groundwork for future academic success but also for a person's quality of life, well-being, and economic prosperity. Children who have strong numeracy skills are better able to learn, explore, reason, and create, as well as participate in society on a social, cultural, and economic level. So, the goal of teaching children fundamental numeracy is to help them develop into independent, enthusiastic readers and writers who can move from "learning to read" to "reading to learn" and from "learning to write" to "writing for academic achievement and pleasure." Youngsters show an awareness of numbers and mathematical concepts, establish connections between ideas, and gradually apply what they have learned. This is only possible as per the demand of the 21st century, i.e., using technology and the interest of the learners together.

In this study, digital storytelling was found to be significantly different from traditional storytelling in a t-test; it suggests that the two methods of storytelling are not equivalent in terms of their impact or effectiveness. So, meeting the demand for digital storytelling should be used as a methodology to achieve the target of foundational numeracy.

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