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Teaching Mathematics at the Foundational Stage: Perspectives from NCFFS 2022

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Abstract

The National Curriculum Framework for Foundational Stage (NCFFS) 2022 was developed to align with the National Education Policy (NEP) 2020's vision for early childhood education. NEP 2020 emphasizes foundational literacy and numeracy as critical components for children's future success and the nation's progress. This study examines the mathematics education outlined in NCFFS 2022, exploring its content, pedagogy, integrated approaches and assessment strategies aimed at fostering holistic development in children aged 3-8. Motivated by a need to enhance early-stage mathematics learning, this research highlights NCFFS's potential in addressing diverse learning needs and advancing 21st-century skills in young learners. The study analyzes NCFFS's comprehensive approach, focusing on its framework for foundational mathematics concepts such as numeracy, operations, shapes, and patterns, taught through engaging, play-based methods. This research also explores NCFFS's approach to assessment, which avoids traditional exams, instead utilizing observational techniques and child artifacts to gauge learning progress. The findings underscore NCFFS's role in providing a robust foundation for lifelong learning, fostering positive attitudes toward mathematics, and supporting holistic child development. This study's implications highlight the importance of adaptive teaching practices and formative assessments in foundational education stages to meet the NEP 2020's vision.

Keywords: NEP 2020, NCFFS 2022, Mathematics Education, Content, Pedagogy, Assessment, Integrated approach, Holistic Development

Introduction

The National Curriculum Framework for Foundational Stage (NCFFS) 2022 has been developed in accordance with the vision of the National Education Policy (NEP) 2020. NEP 2020 emphasizes early childhood education, and NCFFS 2022 reflects this by ensuring that children are adequately prepared with 21st-century abilities for their future. NCFFS is expected to play a significant role in determining the future of the Indian education system, offering a

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comprehensive framework to cultivate engaged, productive, and contributing individuals for the nation's progress.

This framework delineates the optimal learning approach for children aged three to eight years, encompassing a total of five years in the foundational stage, with the initial three years designated for Pre-school, Anganwadi, or Balwatika, followed by two years in Grade I and Grade II. NCFFS provides structured and systematic practical experiences for students in institutional environments, focusing on educational aims and objectives. The curriculum encompasses all pertinent domains of development: physical, socio-emotional and ethical, cognitive, language and literacy, aesthetic and cultural development, as well as positive learning habits. This framework is informed by the ancient Indian educational concept of 'Panchakosha' and the scientific principles of child development, particularly the body-mind connection (Murthy, 2024).

For attaining the primary objective of education, abstract concepts are deconstructed into tangible components for implementation in the teaching-learning process, aligning educational aims with curricular goals, curricular goals with competencies, and competencies with learning outcomes, while emphasizing early literacy, numeracy, and environmental awareness. According to NEP 2020, the foremost objective of the education system is to attain universal foundational reading and numeracy in elementary education by 2025. This policy will only be applicable to our children after the fundamental learning requirement of reading, writing, and arithmetic at a foundational level is reached (NEP 2020, para 2.2). Early literacy and numeracy are critical on multiple metrics, raising concerns for schools catering to young children, which ultimately impact both student welfare and national well-being. It is essential for an individual to possess a foundational comprehension of reading, writing, speaking, numerical concepts, basic mathematical operations, simple addition and subtraction, data management, elementary spatial awareness, and pattern recognition for lifelong learning. Basic numeracy skills are essential for individuals to address life-related difficulties and to maintain these skills throughout their lives (Zuilkowski, 2016).

Mathematics Education

The National Education Policy 2020 asserts that mathematics education for children aged three to eight should prioritize number concepts, basic operations, shapes and patterns, simple measurement, and data sorting (NEP 2020, 1.2). It further emphasizes the significance of engaging activities during the Balvatika stage, advocating against the introduction of textbooks and workbooks. NCFFS 2022, however, recommends textbooks, workbooks, worksheets, etc., for Grade I and Grade II. The text emphasizes the principles of NEP 2020 by popularizing learning materials such as Jaadui Pitara, which further elucidate and simplify its philosophical concepts. In summary, NCFFS 2022 not only embodies NEP 2020 and contemporary requirements but also serves as a very specific, thorough, and illustrative framework for mathematics teaching at the foundational level. The study will concentrate on holistic development, an integrated approach, content, pedagogy, and assessment in mathematics comprehensively.

Methodology

A qualitative analysis method was chosen to study mathematics education as enshrined in NCFFS 2022 across content, pedagogy, assessment, integrated approach, and holistic development for the study.

Analysis and Findings

Mathematics education at foundational stage as described in NCFFS 2022 are analysed and discussed on the following points:

- Content
- Pedagogy
- Assessment
- Integrated approach
- Holistic Development

Content

NCFFS 2022 is seen as crucial in developing the national syllabus. For a child in the fundamental stage, content is predicated on specific competencies and learning outcomes. Foundational concepts are more practical than theoretical, engaging a youngster by utilizing their maximum senses throughout activities. The foundational stage material pertains to the child's environment in which he is experiencing and developing. It transitions from simple to complicated, facilitating students' comprehension of abstract topics. The content in the foundational level meets the unique demands and varied interests of all individuals. Every kid has ample opportunity to engage with their environment through mathematical activities involving shapes, counting, measurement, riddles, and data management, for which textbooks, workbooks, and worksheets are specifically developed, which discourages rote memorization and mechanical computation and promotes conceptual and relational understanding, reflecting the ideas of (Richard, 1976). The incorporation of conceptual knowledge should be achieved through narrative stories and engaging activities to maintain student engagement (NCFFS 2022, pg. 141). The textbooks and workbooks are linked to manipulatives to engage children in tangible experiences and utilize their writing to enhance mathematical skills (NCFFS 2022, pg. 142). The primary components and domains encompassed in early childhood mathematics include numeracy and its relationships, fundamental mathematical operations, geometric shapes and spatial awareness, patterns, measurement, and data management (NCFFS 2022, pg. 121).

Pedagogy

The NCFFS 2022, in accordance with NEP 2020, seeks to optimize positive results in developmental areas through its pedagogical procedures (NEP 2020, 1.3). Providing many opportunities for a child to experience, experiment, and explore in a safe and comfortable setting helps facilitate optimal development at this period (NCFFS 2022, pg. 81). Optimal pedagogical practices emphasize a secure and engaging environment, prioritize play, foster the

teacher-student relationship, support physical development, address individual needs, relate experiences to the child's life, incorporate the home language, and implement classroom practices across all developmental domains (NCFFS 2022, pg. 84).

The fundamental pedagogical approach advocated by NCFFS 2022 is 'Panchaadi,' a five-step learning process comprising Adhiti, Bodh, Abhyas, Prayog, and Prasar. In the initial phase, students establish a connection between their existing knowledge and new concepts with the teacher's assistance, subsequently developing and reinforcing their understanding, integrating it with real-life applications, and ultimately sharing their knowledge with peers (NCFFS 2022, pg. 86). Another educational strategy is the 'Gradual Release of Responsibility,' a procedure wherein the instructor initially elucidates the concept or skill, subsequently collaborates with the student on the notion, and ultimately allows the kid to freely practice the skill (NCFFS 2022, pg. 88). Children acquire knowledge most effectively through conversational storytelling, play-based learning, musical activities, artistic endeavors, indoor and outdoor games, engagement with nature, and experiential learning through field trips within their environment. NCFFS 2022 reflects the socio-cultural perspective of Vygotsky by encouraging peer interaction and collaborative learning. As the child matures and progresses to Grade I and Grade II, they begin to think abstractly. The child possesses a foundational understanding of mathematics acquired through indirect experiences in his environment (NCFFS 2022, pg. 117).

When an educator employs a certain method to train a youngster, it enhances the child's core arithmetic skills. One of the most effective strategies is to implement the ELPS technique, wherein students initially engage with the topic in a tangible form, accompanied by linguistic descriptions, followed by visual representations, and concluding with symbolic notation related to the experiential and pictorial depictions. This aids students in cultivating abstract concepts through tangible experiences (NCFFS 2022, pg. 119). To render mathematics meaningful for students, it can be utilized as a problem-solving tool that aids in addressing real-life issues, hence fostering a link between the kid and mathematics. One effective method is to communicate using mathematical language, enabling the youngster to perceive it as an integral aspect of life and fostering a good attitude towards mathematics. NCFFS 2022 emphasizes the significance of teaching blocks for mathematics, comprising four segments: oral mathematical discourse, skill instruction, skill practice, and sequential math games, collectively allocated sixty minutes for problem-solving and reasoning activities (NCFFS 2022, pg. 121). The establishment of a constructive classroom atmosphere, encompassing positive leadership, discipline, and the exhibition of colorful materials, is another method by which the teaching-learning process can be facilitated, as noted in NCFFS 2022.

Assessment

NCFFS 2022 advocates for formative assessment utilizing observational techniques. It states that tests and examinations are unsuitable for evaluating a child's progress from Pre-school to Grade II. The observation of the child and the analysis of artefacts presented by the child as part of their learning experience are the established methods of evaluation in NCFFS 2022. Assessment is a crucial component of the teaching-learning process that enables the identification of a child's needs and interests, hence facilitating the provision of suitable learning opportunities within the classroom. Evaluating a child indicates whether they are

experiencing challenges in foundational numeracy; if fundamental mathematical skills are not cultivated at this point, it becomes exceedingly difficult for the child to progress in mathematics at advanced levels. Mathematical skills should be emphasized at all educational levels, as future fields will encompass artificial intelligence, machine learning, and data science, all of which are grounded in mathematical reasoning (NEP 2020, para 4.25). Anecdotal records, checklists, and event sampling can be employed to observe a child's behavior during mathematics-related activities, offering detailed insights into the child's abilities or challenges encountered at any stage (NCFFS 2022, pg. 174). Artifacts, including children completed assignments, photographs, art worksheets, activity sheets, and numeracy-related worksheets, can be analyzed to assess the child's learning level (NCFFS 2022, pg. 177). NCFFS 2022 advocates for the compilation of observations and analyses of artifacts based on evidence of child progress to provide a thorough report. The entire process is conducted by the Holistic Progress Card (HPC), a comprehensive 360-degree assessment encompassing many elements such as self-assessment and peer evaluation for self-reflection and self-awareness about the child, teacher feedback and parental input, which facilitates a connection between home and school.

Integrated Approach

The NEP 2020 emphasizes an integrated approach in the teaching-learning process to enhance the physical, social, emotional, cognitive, and moral capacities of the child. The NEP 2020 underscores the significance of experiential learning, incorporating art and sports integration into the teaching and learning process at every educational stage (NEP 2020, 4.6, 4.7, 4.8). In the foundational stage, the integrated approach is incorporated into NCFFS 2022 to ensure that young learners engage with Mathematics playfully and cohesively. For instance, recognizing numbers in poems and counting objects in stories facilitates the connection between Mathematics and language; creating shapes and patterns, developing spatial awareness, and identifying symmetry in art objects render Mathematics more concrete; and participating in games that involve measurement, time, and counting enables students to relate mathematical concepts to their physical environment, thereby connecting Mathematics to daily activities. It renders mathematics education broad and contextual, ensuring that children comprehend the significance and relevance of mathematics from an early age.

Holistic Development

The NEP 2020 aims to transition education from rote memorization to concept-based learning, emphasizing holistic education for the comprehensive development of the child (NEP 2020, 4.4). The NCFFS 2022 states that the holistic development of a child encompasses physical, socio-emotional, cognitive, linguistic and literacy, as well as aesthetic and cultural dimensions, with a significant focus on literacy and numeracy throughout the foundational period. In Ancient Indian Philosophy, the panchakosha framework elucidates human existence through five sheaths: annamaya kosha, pranamaya kosha, manomaya kosha, vijñānamaya kosha, and anandamaya kosha, which collectively offer a comprehensive approach to the holistic development of the child.

NCFFS 2022 identifies five domains of development corresponding to the five sheaths: annamaya and pranamaya kosha relate to physical development; manomaya kosha pertains to

socio-emotional and ethical development; vijayanmaya kosha is associated with cognitive development; and anandamaya kosha corresponds to aesthetic and cultural development (NCFFS 2022, pg. 54). Each kosha must be adequately addressed for the comprehensive development of the child. NCFFS 2022 establishes a framework for lifelong learning by addressing many developmental domains to foster holistic growth.

Challenges and Recommendations

The implementation of NCFFS 2022 may face several challenges in spite of having a progressive vision. Inadequate teacher training, lack of teaching-learning material and resources, large classroom sizes, the traditional teaching-learning practice, and lack of awareness regarding competency-based learning can be some of the general challenges in its implementation. Therefore, to create joyful and meaningful mathematical experiences at the foundational stage, some measures like organizing continuous teacher training programs, developing activity-rich classrooms, preparing low-cost teaching-learning materials, and using locally available resources, involving parents and the community, promoting child-friendly classroom practice, and strengthening competency-based education can be emphasized. Effective implementation requires institutional support, professional development programs, and understanding of responsibilities by the teachers, parents, and community.

Conclusion

This study highlights the effectiveness of the NCFFS 2022 framework in advancing foundational mathematics education, as outlined in the NEP 2020. Through an integrated approach that combines content, pedagogy, and holistic assessment, NCFFS 2022 equips children with critical numeracy skills, fostering a positive relationship with mathematics from an early age. By prioritizing play-based, experiential learning and formative assessment techniques, the framework supports children's cognitive, socio-emotional, and physical development, laying the groundwork for lifelong learning. The study's findings suggest that NCFFS 2022's comprehensive approach has the potential to shape a generation of learners well-prepared to engage meaningfully with future educational and life challenges, thereby contributing significantly to national development goals.

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