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SARVA SHIKSHA ABHIYAN AND MATHEMATICS LEARNING IN NAYAGARH DISTRICT (ODISHA): STATUS, CHALLENGES, AND PATHWAYS FOR IMPROVEMENT

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ABSTRACT

This paper examines the implementation of Sarva Shiksha Abhiyan (SSA) and its successor/integrated form Samagra Shiksha in Nayagarh District, Odisha, and the programme's relationship with mathematics learning at the elementary level. Combining published district-level studies, government programme material, and recent research on foundational numeracy in Nayagarh, the paper synthesizes evidence on learning outcomes, infrastructure, teacher capacity, and community factors that influence mathematics achievement. It proposes a practicable mixed-methods research design for a district-level study, presents interim findings from existing literature, and ends with evidence-based recommendations for policy and practice to strengthen mathematics learning under Samagra Shiksha in Nayagarh. Key sources include a 2024 NCERT study of foundational numeracy in Nayagarh, district education documentation, and state/district programme reports

KEYWORDS: ***Sarva Shiksha Abhiyan (SSA), Samagra Shiksha, foundational numeracy, mathematics learning, Nayagarh, elementary education, Odisha***

1. INTRODUCTION AND RATIONALE

Mathematics is universally recognized as a foundational discipline that supports logical reasoning, quantitative thinking, and problem-solving skills essential for academic success and everyday life. In the context of school education, early mathematical competence especially in areas such as number sense, counting, basic operations, and pattern recognition serves as the bedrock upon which higher-order mathematical concepts are built. Thus, strengthening mathematics learning in the early grades is crucial for ensuring long-term educational progression and future employability.

In India, the Government has long emphasized the improvement of elementary education through large-scale national programmes. **Sarva Shiksha Abhiyan (SSA),** launched in 2001–02, aimed at achieving universal enrollment, retention, and quality education for all children in the 6–14 age group. SSA played a transformative role in expanding school infrastructure, establishing new schools and classrooms, hiring teachers, and promoting inclusive education for socially disadvantaged and differently-abled learners. Over time, however, it became evident that while access improved substantially, **learning outcomes particularly in mathematics remained uneven across states and districts.**

Recognizing the need for integration across educational stages and for a stronger focus on learning quality, the Government of India introduced **Samagra Shiksha** in 2018. This comprehensive scheme brought together SSA (elementary level), Rashtriya Madhyamik Shiksha Abhiyan (RMSA) for secondary education, and teacher education under one umbrella. Samagra Shiksha expanded the scope of interventions to include pre-primary to higher secondary education. It emphasizes **Foundational Literacy and Numeracy (FLN)**, teacher professional development, competency-based learning, ICT-enabled education, inclusive schooling, and measurable improvements in learning outcomes.

Despite these systemic efforts, national surveys such as NAS and ASER highlight persistent learning gaps, especially in **foundational numeracy**, even among upper primary students. These gaps manifest in difficulties with basic operations, understanding place value, solving word problems, and engaging with mathematical reasoning. The issue is not merely one of academic weakness but of deeper pedagogical and systemic shortcomings ranging from limited teacher preparation and insufficient use of manipulatives, to inadequate assessment systems and minimal follow-up after teacher training.

This research places special emphasis on **Nayagarh District,** a district in Odisha that reflects many of the national patterns while also presenting unique local challenges. Nayagarh has seen steady implementation of SSA and Samagra Shiksha initiatives, with improvements in school infrastructure, enrolment, and teacher availability. However, several block-level and school-based studies including the recent NCERT (2024) study indicate that foundational numeracy among students continues to be a concern. Children often demonstrate procedural learning without conceptual understanding, struggle with multi-digit operations, and show limited comfort with problem-solving tasks.

Nayagarh's educational landscape is shaped by factors such as multi-grade teaching in rural schools, variation in teacher experience, linguistic diversity, socio-economic differences among communities, and inconsistent use of Teaching Learning Materials (TLMs). These contextual factors influence how national and state-level reforms translate into classroom practices. Therefore, it is essential to examine **how SSA and Samagra Shiksha initiatives have been operationalized in Nayagarh,** what support systems exist for teachers, how assessment data is used for planning, and what gaps remain in achieving mathematics learning goals.

The rationale for conducting this study rests on the urgent need to:

- Understand the connection between policy interventions and actual classroom practices in mathematics,
- Diagnose the specific learning barriers encountered by children in Nayagarh,
- Assess the and effectiveness of teacher training resource utilization**,**
- Identify the systemic gaps that prevent learning improvements, and
- Recommend research-based, context specific strategies to strengthen mathematics learning in the district.

In essence, this research aims to bridge the gap between policy design and ground-level implementation, focusing on how SSA/Samagra Shiksha can meaningfully enhance mathematical achievement. By analyzing Nayagarh as a case study, the findings can also contribute to broader insights for educational planning across Odisha and India, particularly in improving foundational numeracy and overall mathematics competence.

2. OBJECTIVES OF THE STUDY

The study seeks to explore the role of SSA and Samagra Shiksha in enhancing mathematics learning among elementary-level students, particularly within Nayagarh district. Grounded in the broader educational landscape of India and Odisha, the research aims to understand both systemic progress and the persistent barriers affecting mathematical achievement.

2.1 General Objective

To analyze the role, effectiveness, and impact of SSA/Samagra Shiksha on mathematics learning in Nayagarh district, while situating the findings within the larger national and state-level context of mathematics education in India and Odisha.

This overarching goal reflects the need to link national policy intentions with district-level implementation and classroom-level learning outcomes.

2.2 Specific Objectives

1. To trace the historical evolution of mathematics globally and in India highlighting India's significant contributions to mathematical knowledge and their relevance to contemporary school mathematics.
2. To examine national trends in mathematics learning, including performance patterns observed in NAS, ASER, NCERT studies, and other national assessments, with a focus on foundational numeracy and competency-based learning.
3. To analyze mathematics learning in Odisha, including state policies, the implementation of Samagra Shiksha initiatives, teacher training programmes, use of Teaching Learning Materials (TLMs), and district-level learning outcomes.
4. **To assess the implementation and effectiveness of SSA/Samagra Shiksha initiatives in Nayagarh district**, focusing on:
    - Foundational Literacy and Numeracy (FLN) interventions
    - Teaching practices and classroom processes
    - Teacher professional development
    - Assessment and remedial strategies
    - School infrastructure and learning resources
5. To propose and describe an appropriate research design for measuring mathematics learning in Nayagarh**,** including:
    - Sampling strategy
    - Tools for data collection
    - Assessment approaches
    - Data analysis techniques
6. To identify the major challenges affecting mathematics learning in Nayagarh district such as pedagogical gaps, resource limitations, teacher-related factors, socio-economic barriers, or administrative constraints.
7. strategies To recommend evidence-based, context-sensitive for improving mathematics learning outcomes in Nayagarh, aligning with national priorities such as NEP 2020 and the NIPUN Bharat Mission.

3. MATHEMATICS LEARNING IN INDIA AND ODISHA

Mathematics education in India has evolved through centuries of intellectual advancement, pedagogical innovations, and policy reforms. The present-day learning environment reflects both a rich historical mathematical heritage and ongoing systemic efforts to strengthen foundational numeracy and higher-order competencies. This chapter examines mathematics learning in India and Odisha, leading to a district-level focus on Nayagarh.

3.1 History of Mathematics

Mathematics originated from human attempts to understand, record, and manage the world around them. Counting livestock, measuring land, tracking seasons, and maintaining trade records were among the earliest mathematical practices. As societies grew more complex, mathematical concepts evolved from simple arithmetic to advanced theories, laying the foundation of modern mathematics.

3.1.1 Contributions of Ancient India

India is widely regarded as a global epicenter of early mathematical development. Ancient Indian scholars not only advanced theoretical mathematics but also created a number system that transformed global computation.

Major Contributions Include:

- **Invention of Zero (Śūnya):** Indian mathematicians conceptualized zero as both a symbol and a number with arithmetic properties a revolutionary idea that changed mathematics worldwide.
- **Decimal Place Value System:** The Hindu–Arabic numeral system, first developed in India, introduced positional notation that simplified computation and enabled the representation of large numbers.
- **Negative Numbers:** Indian scholars used negative numbers centuries before their widespread acceptance in Europe, mainly in contexts like debts and deficits.
- **Algebra and Trigonometry: Aryabhata (476 CE)** introduced sine tables, approximated π (pi), and formulated the place-value system.
- **Brahmagupta (598 CE)** provided arithmetic rules for zero and negative numbers and solved quadratic equations.
- **Bhaskara II (1114 CE)** pioneered early concepts of calculus, including derivatives and "instantaneous motion."
- **Pingala (circa 300 BCE)** introduced binary numbers and developed combinatorial methods fundamental to modern computer science.

India's innovations disseminated through Arab scholars to Europe, becoming the backbone of global mathematical development.

3.1.2 Contributions from Ancient Greece

While India revolutionized number systems, Greece contributed significantly to logical and deductive structures:

- **Thales of Miletus (624–546 BCE):** Considered the first true mathematician, Thales introduced geometric reasoning and formulated Thales' Theorem on circles.

Greek mathematicians such as Euclid and Pythagoras later formalized axiomatic systems, creating structured proofs and geometric principles still taught today.

3.1.3 Global Mathematical Evolution

Mathematics developed across multiple civilizations, each making unique contributions:

Civilization	Key Contributions
Babylonians	Algebraic equations, base-60 numeral system
Egyptians	Geometry for land measurement, early fractions
Chinese	Arithmetic algorithms, magic squares, early algebra
Arabs (Islamic Golden Age)	Algebra (al jabr), algorithms, preservation of Indian numerals
India	Zero, decimal system, trigonometry, algebra, early calculus

The global evolution of mathematics demonstrates cumulative knowledge where each civilization built upon earlier foundations.

3.2 Mathematics Learning in India

India's current mathematics education landscape is shaped by national policies, curricular reforms, technological integration, and large-scale learning assessments.

3.2.1 Curriculum Context

Mathematics curriculum in India operates under the guidance of national frameworks such as:

- **NCF 2005 and NCF 2023** Emphasize activity-based learning, constructivism, problem-solving, and competency-based outcomes.
- **RTE Act 2009** Ensures free and compulsory education and mandates Continuous and Comprehensive Evaluation (CCE).
- **Samagra Shiksha** Integrates ECCE, elementary, secondary education, and teacher training.
- **NIPUN Bharat Mission (2021)** Focuses on Foundational Literacy and Numeracy (FLN) for Grades 1–3.
- **DIKSHA Platform** Provides digital content, e-textbooks, and teacher training modules.
- **NISHTHA** National teacher training for pedagogical strengthening and competency-based classroom practices.

Pedagogical Focus Areas in India

- Conceptual understanding rather than rote memorization
- Hands-on learning through manipulatives
- Real-life applications in daily mathematics
- Reasoning, pattern recognition, and problem-solving
- Competency-based assessments aligned to learning outcomes

3.2.2 National Learning Status

National studies like **NAS, ASER, U-DISE**, and **Pratham's Early Grade Learning Assessments** consistently show:

- Many Grade 3–5 students struggle with **place value, basic operations**, and **word problems.**
- A large proportion rely on memorization instead of conceptual understanding.
- Regular assessments are limited or mostly summative.
- Foundational numeracy deficits persist into upper primary levels.
- Learning loss during COVID-19 widened existing gaps.

Common Findings:

- Procedural understanding without reasoning
- Weak number sense
- Difficulty applying concepts in new situations

- Low exposure to mathematical discussions or inquiry-based learning

3.2.3 Major Challenges in India

Below is an expanded version of the challenge table:

Challenge	**Explanation**
Rote Learning Culture	Students often memorize rules without conceptual understanding, leading to fragile knowledge.
Teacher Preparation Gaps	Teachers receive limited training in activity-based and inquiry-driven pedagogy.
Inadequate Manipulatives	Many classrooms lack basic TLMs like number cards, blocks, abacus, etc.
Assessment Limitations	Assessments emphasize recall rather than reasoning or problem-solving.
Curriculum Overload	Heavy syllabi prevent deep learning of key competencies.
Regional Inequities	Differences across states and districts lead to inconsistent outcomes.
Language Barriers	Mathematics vocabulary becomes challenging for children learning in a non-mother-tongue medium.
Large Classrooms	Teachers often struggle to differentiate instruction for varied learning levels.

3.3 Mathematics Learning in Odisha

Odisha has made significant investments in strengthening school education through both national and state initiatives.

3.3.1 Policy Initiatives in Odisha

Odisha aligns with national reforms while introducing state-specific programmes, including:

- **OSEPA (Odisha School Education Programme Authority)** State implementation body for Samagra Shiksha.
- **Mo School Abhiyan** Mobilizes community participation and alumni support for school development.
- **Utthan Programme** Statewide FLN initiative focusing on foundational numeracy and language.
- **Odisha Adarsha Vidyalayas (OAVs)** Model schools offering quality education with emphasis on mathematics and science.
- **State Specific Teacher Training Modules** Designed to improve mathematics pedagogy and classroom practices.

3.3.2 Learning Outcomes in Odisha

Despite infrastructural progress, learning outcomes reveal persistent gaps:

- Students often struggle with place value, subtraction with regrouping, and problem-solving.
- Children from tribal and rural areas face language barriers due to differences between home language and school language.
- Classroom observations show limited use of manipulatives, though materials are available in schools.
- Regular assessments are conducted but often lack diagnostic depth.

3.3.3 Use of FLN Initiatives

Under NIPUN Bharat, Odisha has strengthened FLN through:

- **Math workbooks and practice materials**
- **Bridge courses for learning recovery**
- **Activity-based math kits (TLMs)**
- **Teacher training through NISHTHA and state modules**
- **Peer-learning strategies in multi-grade settings**
- **ICT tools like DIKSHA and e-content**

However, implementation consistency varies across districts.

3.4 Mathematics Learning in Nayagarh District

Nayagarh serves as an important case study because it represents both the strengths and challenges typical of semi-rural districts in India.

3.4.1 District Profile

- Literacy rate is slightly above the state average.
- Most schools have basic infrastructure and adequate teacher availability.
- Despite these strengths, foundational numeracy remains a challenge.

3.4.2 Existing Studies

The **2024 NCERT district-level study** reported:

- **Wide variations in foundational numeracy levels** across schools.
- **Minimal gender gap**, indicating equitable access.
- **Major difficulties** in:
    - multi-digit addition/subtraction
    - understanding place value
    - solving simple word problems
    - applying reasoning to unfamiliar contexts

These findings align with state and national trends

3.4.3 SSA/Samagra Shiksha Implementation in Nayagarh

Key interventions include:

- Teacher training in foundational numeracy
- Distribution of TLMs and math kits
- Digital classrooms in selected schools
- Remedial learning (catch-up programmes)
- Strengthening School Management Committees (SMCs)
- Periodic assessments and learning reviews

However, on-the-ground effectiveness varies between blocks.

3.4.4 Key Local Challenges Identified

- Limited post-training support for teachers
- Multi-grade teaching environments in remote schools
- Insufficient and inconsistent use of manipulatives
- Irregular student attendance
- Lack of school-based continuous assessment
- Variation in teacher motivation and pedagogic skills

These challenges directly affect mathematics learning outcomes and demonstrate the need for targeted district-level research and interventions.

4. REVIEW OF LITERATURE

A review of literature provides the theoretical and empirical foundation necessary for understanding the role of SSA/Samagra Shiksha in mathematics learning. This chapter synthesizes global research, national studies, state-level analyses, and district-specific reports relevant to mathematics pedagogy, foundational numeracy, and educational interventions in India and Odisha.

4.1 Theoretical Foundations in Mathematics Learning

4.1.1 Constructivist Perspectives

Constructivism, as advanced by Piaget (1972) and Vygotsky (1978), forms the basis of modern mathematics pedagogy.

- **Piaget's Theory:**

  Children construct knowledge through active engagement and interaction with concrete materials. Early numeracy develops through stages sensorimotor, pre-operational, concrete operational, and formal operational. Implication: Early mathematics must emphasize hands-on learning and concrete experiences.

- **Vygotsky's Zone of Proximal Development (ZPD):**

  Learning is most effective when children receive guided support or scaffolding. Implication: Teachers must facilitate learning through questioning, modeling, and peer interactions.

These theories influence Indian reforms such as **NCF 2005**, **NCF 2023**, and FLN pedagogical approaches.

4.2 Global Research on Mathematics Learning

International literature highlights:

- Importance of manipulatives for early numeracy (Ginsburg & Amit, 2008).
- Role of conceptual understanding over rote learning (Hiebert & Carpenter, 1992).
- Effectiveness of competency-based learning (OECD, 2019).
- Need for continuous assessment for remedial support (Black & Wiliam, 1998).

UNESCO's Global Education Monitoring reports note that foundational numeracy gaps in low- and middle-income countries persist due to inadequate teacher training and resource inequity.

These findings provide comparative insights relevant to India's challenges.

4.3 National Literature on Mathematics Learning in India

4.3.1 National Achievement Surveys (NAS)

NAS (2017, 2021) identifies:

- Low proficiency in number operations, measurement, and geometry
- Higher achievement gaps in rural areas
- Limited problem-solving and reasoning skills
- Wide variations between states and districts

The findings emphasize the need for competency-based teaching**,** regular assessments**,** and teacher capacity-building**.**

4.3.2 ASER (Annual Status of Education Report)

ASER (2018–2023) consistently highlights:

- 50% of Grade 5 children cannot do basic division
- Many Grade 3 students struggle with two-digit subtraction
- Learning outcomes improve with teacher support and community engagement
- English-medium schools do not guarantee higher math proficiency

ASER underscores the importance of foundational numeracy before Grade 3.

4.3.3 Early Grade Mathematics Assessments (EGMA)

USAID and RTI's EGMA research in India shows:

- Severe gaps in number sense
- Limited understanding of mathematical reasoning
- Procedural learning without conceptual clarity
- Weak connection between classroom teaching and assessment

These findings validate the need for interventions like NIPUN Bharat**.**

4.3.4 Studies on Mathematics Pedagogy in India

Indian scholars identify:

- Overemphasis on algorithmic processes (Rampal, 2003)
- Limited use of concrete materials in classrooms (NCERT, 2019)
- Teacher beliefs influencing mathematics achievement (Subramaniam, 2019)
- Need for contextualized mathematics in multilingual settings (Mohanty, 2020)

These studies stress enabling teachers with pedagogical knowledge, not just content knowledge.

4.4 Literature on SSA and Samagra Shiksha

4.4.1 SSA-Era Studies

Research during the SSA period (2001–2018) noted:

- Substantial improvement in access, infrastructure, and enrollment.
- Mixed outcomes in learning achievement due to limited focus on classroom pedagogy.
- Need for teacher mentoring instead of one-time training (Clarke, 2014).

4.4.2 Samagra Shiksha Period

Studies after 2018 highlight:

- Improved integration of ECCE, primary, and secondary schooling
- Stronger emphasis on learning outcomes and FLN
- Greater role of technology (DIKSHA, QR-coded textbooks)
- Improved teacher training through NISHTHA

However, implementation gaps vary by district, especially in mathematics classrooms.

4.5 State-Level Literature on Mathematics Learning in Odisha

4.5.1 Odisha-Specific Achievement Reports

Odisha's performance in NAS and ASER shows:

- Moderate achievement in numeracy but significant rural–urban variation
- Students face challenges in place value, operations, and word problems
- Tribal districts show language-related learning gaps
- Strengths in enrollment, mid-day meal services, and teaching posts filled

4.5.2 FLN Initiatives in Odisha

Research on Utthan, Mo School, and OAVs highlights:

- Positive impact of community participation

- Activity-based learning materials improve engagement
- Teachers require continuous mentoring
- FLN gains vary widely by district

4.5.3 Odisha Teacher Training Studies

Odisha-focused studies (Sahoo, 2021; Panda, 2022) find:

- Teacher training needs continuous follow-up
- Classroom observation improves teacher performance
- Multi-grade teaching complicates mathematics instruction
- Mathematical vocabulary confuses learners in tribal areas

These findings are relevant to Nayagarh's context.

4.6 District-Level Literature on Nayagarh

4.6.1 NCERT and OSEPA Studies

Recent studies (NCERT 2024; OSEPA 2023) report:

- Wide variations in foundational numeracy across blocks
- Weak conceptual understanding of place value
- Limited use of TLMs despite availability
- No significant gender gap
- Students show difficulty in problem-solving tasks

4.6.2 Local Research Findings

District reports and block-level data from Nayagarh indicate:

- Multi-grade classrooms affect learning consistency
- Teachers often revert to rote teaching during syllabus pressure
- Math kits are used inconsistently
- Attendance issues affect continuity of learning
- Assessment is mostly summative, not diagnostic

These studies highlight areas requiring targeted improvement through SSA/Samagra Shiksha.

4.7 Summary of Literature Gaps

Despite rich literature, gaps exist:

1. Limited district-level research on mathematics-specific impacts of Samagra Shiksha.
2. Few studies analyze the connection between teacher training and classroom practices in small districts like Nayagarh.
3. Lack of research combining foundational numeracy**,** policy implementation**,** and local socio-cultural contexts**.**
4. Minimal focus on school based assessment practices in rural Odisha.
5. Absence of longitudinal studies tracking student progression in mathematics over time.These gaps justify the need for the present study.

5. RESEARCH METHODOLOGY

This chapter outlines the proposed methodological framework for studying the impact of SSA/Samagra Shiksha on mathematics learning in Nayagarh district. Given the multidimensional nature of the problem spanning learning outcomes, pedagogy, school functioning, and community involvement a mixed-methods research design is recommended. Mixed-method designs enable triangulation of data, enhance validity, and provide a comprehensive understanding of both quantitative achievement levels and qualitative classroom processes.

5.1 Research Design

A mixed-method design combining **quantitative and qualitative approaches** will be adopted:

- **Quantitative Component**

  To measure mathematics learning levels among students and identify statistical relationships between variables such as school facilities, teacher qualifications, classroom practices, and student achievement.

- **Qualitative Component**

  To explore contextual factors—teacher perceptions, pedagogical practices, school management, community involvement, and challenges that influence mathematics learning.

This design allows for integration of numerical achievement data with rich narrative explanations**,** providing a holistic picture of mathematics learning in Nayagarh.

5.2 Population and Sample

5.2.1 Population

The entire population includes:

- All government and government-aided schools in Nayagarh district
- All students enrolled in Grades 2–5
- Mathematics teachers and multi-grade teachers
- Head teachers, CRCCs/BEOs, and SMC members
- Parents and guardians

5.2.2 Sample Size and Sampling Strategy

A stratified, multi-stage sampling strategy is recommended to ensure representation across blocks, rural/urban areas, and school types.

Proposed Sample:

- **Schools:**
  60–80 schools across all blocks of Nayagarh
  - 10–12 schools per block (proportional representation)
- **Students:**
  1,200–2,000 students (Grades 2–5)
  - 20–30 students per school selected randomly
  - Representation from all four primary grades

- **Teachers:**
  120–160 mathematics/primary teachers
  - Including regular, contract, and multi-grade teachers
- **Head Teachers / Administrators:**
  60–80 head teachers
- **SMC Members & Parents:**
  100–150 individuals for qualitative components

Sampling Methods:

- **Stratified Random Sampling** for schools
- **Simple Random Sampling** for students
- **Purposive Sampling** for teachers, SMC members, and parents involved in FGDs

This ensures diversity and representativeness in the dataset.

5.3 Tools and Instruments

Multiple tools will be used to collect quantitative and qualitative data.

5.3.1 Mathematics Achievement Test

A grade-appropriate, competency-based test designed using:

- NIPUN Bharat FLN Learning Outcomes
- NCERT Learning Outcomes
- NAS Framework
- Odisha Utthan FLN competencies

Test components:

- Number sense
- Place value
- Basic operations
- Word problems
- Measurement

- Patterns and reasoning

Format: MCQs short response items Estimated duration: 60–90 minutes

5.3.2 School Infrastructure and Resource Checklist

Assesses the school environment including:

- Classrooms, furniture, electricity
- Mathematics TLM availability and usage
- Digital resources (smart class, DIKSHA access)
- Library and laboratory facilities
- Attendance records
- Multigrade settings
- Availability of math kits, manipulatives

Checklist based on OSEPA & Samagra Shiksha guidelines.

5.3.3 Teacher Questionnaire

Designed to collect information on:

- Teacher profile (qualification, experience, training history)
- Use of math pedagogy (activity-based, constructivist approaches)
- Use of TLMs and manipulatives
- Assessment practices
- Perceived challenges in teaching mathematics
- Views on SSA/Samagra initiatives
- Attitudes toward FLN

Mostly Likert-scale items & open ended questions.

5.3.4 Classroom Observation Schedule

Used to systematically document:

- Teacher–student interaction
- Use of teaching-learning materials
- Engagement in mathematical reasoning
- Instructional strategies
- Differentiated teaching in multi-level classrooms
- Classroom climate and inclusivity
- Time spent on different activities

Based on NCF, NIPUN Bharat Pedagogical Guidelines, and NCERT observation tools.

5.3.5 Focus Group Discussion (FGD) Guide

FGDs will be conducted with:

- Parents
- SMC members
- Teachers (as separate groups)

Discussion areas:

- Parental involvement in mathematics learning
- Perceptions of learning difficulties
- Home learning environment
- Effectiveness of SSA/Samagra support
- Community mobilization
- Attendance and motivation issues

Approx. 8–10 participants per FGD.

5.4 Data Collection Procedure

Data will be collected in three phases**:**

Phase 1: Quantitative Data Collection

- Administer achievement tests to students

- Administer teacher questionnaires
- School infrastructure checklist completion

Phase 2: Qualitative Data Collection

- Conduct classroom observations
- Organize FGDs with parents, teachers, and SMCs
- Conduct interviews with head teachers

Phase 3: Triangulation and Verification

- Cross-verify findings from different tools
- Conduct follow-up visits if required
- Validate results with district education authorities

5.5 Data Analysis Methods

5.5.1 Quantitative Data Analysis

Statistical analysis will include:

- Descriptive statistics:
  Mean, median, standard deviation, frequency distribution
- Inferential statistics**:**
- t-tests *(*gender and class comparison)
- ANOVA (block-level differences)
- Correlation analysis *(*teacher training ↔ student performance)
- Regression analysis *(*predictors of math achievement)
- Multilevel modelling (MLM) for school-level effects

Software recommended:

SPSS, R, or Excel

5.5.2 Qualitative Data Analysis

Adopting thematic analysis following Braun & Clarke (2006):

1. Transcription of observations and FGDs
2. Coding of responses
3. Identification of emerging themes
4. Triangulation with quantitative findings
5. Interpretation within district context

Themes may include:

- Pedagogical practices
- Use of TLMs
- Challenges faced by teachers
- Parental support
- Perceptions of mathematics

5.6 Ethical Considerations

- Informed consent from parents and teachers
- Confidentiality of student performance
- Voluntary participation
- No harm or disruption to school routines

5.7 Expected Outcomes

The methodology will provide:

- Clear understanding of mathematics achievement levels
- Insight into classroom teaching practices
- Evidence of SSA/Samagra Shiksha implementation effectiveness
- Identification of systemic barriers
- Recommendations for district-level improvement

6. FINDINGS

This chapter synthesizes major findings from national, state, and district levels, integrating insights from literature, policy review, and proposed field data trends. The findings reflect how SSA/Samagra Shiksha has influenced mathematics learning, with specific reference to Nayagarh district. The synthesis is organized into strengths, weaknesses, and emerging concerns, helping contextualize the current state of mathematics learning.

6.1 Strengths

6.1.1 Strong and Coherent Policy Structure

India's educational reforms including SSA, RTE Act 2009, RMSA, and Samagra Shiksha have created a robust policy ecosystem focused on:

- universal access and retention
- inclusive education
- teacher development
- foundational literacy and numeracy
- competency-based learning

This policy continuity provides a stable foundation for improving mathematics learning nationwide.

6.1.2 Rich Historical and Cultural Foundation in Mathematics

India has a long tradition of mathematical thinking (Aryabhata, Brahmagupta, Kerala School). The National Curriculum Framework emphasizes:

- reasoning
- problem-solving
- conceptual clarity

Odisha's curriculum aligns closely with NCERT frameworks, offering a solid conceptual base for mathematics instruction in districts like Nayagarh.

6.1.3 Improved Access, Infrastructure, and Enrolment

Under SSA and Samagra Shiksha, Nayagarh district has benefited from:

- increased school availability within 1 km
- improved classroom infrastructure

- higher enrolment and attendance (especially among girls)
- access to textbooks, math kits, and uniforms

These improvements ensure that more children are physically present and equipped to learn mathematics.

6.1.4 Teacher Professional Development and Academic Support

Teacher training initiatives such as:

- in-service training
- FLN (Utthan) orientation
- activity-based pedagogy workshops
- DIKSHA online courses
- CRCC/BRC academic supervision

have improved teacher awareness of modern instructional strategies. Many teachers in Nayagarh demonstrate familiarity with:

- joyful math learning
- use of TLMs
- competency-based assessments

This indicates progress in pedagogical practices

6.2 Weaknesses

6.2.1 Persistent Foundational Gaps in Early Grades

Despite policy and training efforts, foundational gaps remain:

- difficulty in number sense and place value
- limited understanding of operations
- challenges with word problems and reasoning
- reliance on rote procedures rather than conceptual thinking

These gaps appear early (Grades 2–3) and widen without timely intervention.

6.2.2 Lack of Deep Conceptual Understanding

Qualitative findings highlight:

- mechanical learning
- memorization of steps
- limited opportunities for exploration
- teacher-dominated instruction
- insufficient student discourse

Many students can perform operations but cannot explain the underlying logic, reflecting shallow conceptual understanding.

6.2.3 Insufficient Use of Manipulatives and TLMs

Although math kits and TLMs exist in most schools, challenges remain:

- irregular use in classrooms
- teachers lack confidence or training to use them effectively
- inadequate storage or maintenance
- preference for chalk-and-talk teaching

This limits hands-on, experiential learning essential for early mathematics.

6.2.4 Need for Continuous and Formative Assessment

Assessment practices often rely on:

- summative exams
- correction-based feedback
- whole-class instruction

Teachers need more support in using:

- diagnostic assessments
- error analysis

- individualized remediation
- competency-based tracking

This leads to delayed identification of learning gaps.

6.2.5 Disparities Across Blocks and School Types

Block-wise differences within Nayagarh appear in:

- infrastructure quality
- teacher deployment
- student–teacher ratio
- community support
- access to training and digital resources

Remote and tribal pockets show lower achievement trends compared to semi-urban clusters.

6.3 Additional Emerging Concerns

6.3.1 Multi-Grade Teaching Challenges

Many small or rural schools operate with:

- one teacher managing multiple classes
- limited time for individual attention
- difficulty implementing activity-based mathematics teaching

6.3.2 Limited Home Support in Mathematics

Parents in rural areas often report:

- low confidence in helping children with mathematics
- lack of learning materials at home
- dependency on schools for all academic learning

6.3.3 Gaps in Monitoring and Academic Supervision

CRCC/BRC visits sometimes focus on administrative tasks rather than:

- observing classrooms
- mentoring teachers
- supporting math pedagogy

6.4 Summary of Findings

Overall synthesis suggests:

- SSA/Samagra Shiksha has significantly improved access**,** infrastructure**,** and**.** teacher training
- However, learning outcomes in mathematics remain below expected levels**,** particularly in foundational competencies.
- Classroom practices and assessment strategies need strengthening.
- Block-wise disparities and contextual challenges continue to influence learning outcomes in Nayagarh.

7. RECOMMENDATIONS (PRACTICAL, EVIDENCE-BASED, IMPLEMENTABLE THROUGH SAMAGRA/SSA MECHANISMS)

7.1 Strengthen FLN-focused teacher coaching cascade

- Establish a block-level FLN coaching team (BEO-led) trained centrally and scheduled to visit schools monthly to model numeracy lessons, demonstrate manipulatives use, and provide classroom-specific feedback. Use Samagra funds for honoraria and travel.
- Make post-training classroom visit logs mandatory and review them in monthly cluster meetings.

7.2 Deploy a short, standardized district numeracy diagnostic and remedial package

- Create a 30–minute grade-wise numeracy diagnostic (Grades 1–5) aligned to Odisha FLN frameworks. Test every quarter. Provide pre-written remedial lesson sequences and low-cost manipulatives kits to schools; Samagra funds can purchase kits centrally.
- Train teachers on interpreting diagnostic profiles and forming three-tier remedial groups (basic, bridging, enrichment).

7.3 Use data dashboards and micro-planning

- Samagra/Nayagarh district team to develop a simple dashboard that displays block/school-level diagnostic results, attendance, and resource allocation; review in monthly district review meetings to allocate targeted support.

7.4 Strengthen community & SMC engagement for numeracy

- Train SMCs to run “numeracy corners” and short home-based activity packs so parents can support practice. Use existing SSA community mobilization structures.
- Pilot volunteer-led after-school numeracy camps using local youth/SHG members

7.5 Focused investment in teacher learning resources

- Prioritize procurement of grade-wise manipulatives (number lines, place value cards, counters) and teacher guides focused on active learning rather than additional high-cost digital solutions unless accompanied by strong pedagogy. Samagra allocations for TLMs should be tracked and matched to school-level needs.

7.6 Monitoring & evaluation

- Commission a district baseline (using the methodology above) and a midline after 12–18 months of intervention; use mixed methods to evaluate both fidelity and impact. The district Samagra office should collate results and disseminate good practices across blocks.

8. SUGGESTED TIMELINE & BUDGET SKETCH (HIGH-LEVEL)

- **Months 0–3:** District baseline survey & diagnostics, TLM procurement list, coach selection and training.
- **Months 4–15:** Coaching visits, remedial camps, quarterly diagnostics, SMC mobilization.
- **Months 16–18:** Midline assessment, summative evaluation, policy briefing.

Budget elements (indicative): training & coach stipends, low-cost manipulatives for schools, diagnostic printing, modest monitoring dashboard development (spreadsheet visualization), travel and coordination. Samagra/SSA district funds and routine AWP&B can cover much of this with targeted reallocation.

9. LIMITATIONS OF CURRENT EVIDENCE & RESEARCH GAPS

- Existing district studies (including the NCERT 2024 study) provide valuable snapshots but are limited in geographic coverage or sample size; a comprehensive district-representative baseline is necessary to generalize and design scaled interventions.
- There is limited published rigorous causal evidence at the district level on which specific Samagra-financed interventions produce the largest gains in mathematics learning in Nayagarh; the proposed mixed-methods study would help fill this gap.

10. CONCLUSION

Nayagarh District shows the institutional presence of SSA/Samagra mechanisms and has active interest in improving foundational learning. However, foundational numeracy gaps and variability in how SSA/Samagra inputs are converted into classroom practice persist. A focused, district-led programme that strengthens FLN-aligned teacher coaching, uses short diagnostics to guide remedial teaching, equips classrooms with low-cost manipulatives, and mobilizes SMCs can accelerate mathematics learning. The district Samagra office is well-placed to coordinate such efforts, provided that monitoring systems are made actionable and capacity-building receives sustained follow-up beyond standalone workshops. Key recent local studies and district documents should be used as the evidence base to design and evaluate interventions moving forward

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