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The Challenges and Remedies for Concretising Abstract Mathematical Concepts in the Teaching-Learning Process of Nicobari Tribal Students through Digital Education

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ABSTRACT

Mathematics plays an important role in developing logical thinking, reasoning and problem-solving abilities among students. However, many students find it difficult to understand abstract mathematical concepts such as fractions, algebra, geometry, decimals and measurements. These difficulties may be greater among Nicobari tribal students living in geographically isolated areas of the Nicobar Islands, Andaman and Nicobar Islands. Reaching these learners and providing quality education involves several challenges, including geographical isolation, transportation difficulties, language barriers, limited digital infrastructure, shortage of locally relevant teaching-learning materials and limited exposure to technology-supported learning. The present paper examines these challenges and explores possible remedies through Digital Education. It adopts a conceptual and descriptive approach based on educational policies, curriculum frameworks and the educational conditions of remote tribal communities. It proposes the use of animated videos, interactive applications, virtual manipulatives, digital maps, offline learning resources and locally developed audio-visual materials to connect abstract mathematical ideas with students' everyday experiences. The paper also highlights the importance of mother-tongue support, teacher training, community participation and culturally relevant digital content. It argues that technology should strengthen classroom teaching rather than replace teachers. A combination of local experiences, practical activities and digital resources can make mathematics more meaningful, accessible and interesting for Nicobari tribal students. The paper recommends a context-based digital mathematics education model that can be implemented and evaluated in selected schools of the Nicobar Islands.

KEYWORDS: Nicobari Tribal Students, Mathematics Education, Digital Education, Abstract Mathematical Concepts, Tribal Education, Inclusive Pedagogy, Digital Teaching-Learning Materials, Nicobar Islands.

1. Introduction

Education is an important instrument for the development of individuals and society. It provides knowledge, skills, values and opportunities for a better future. Mathematics is one of the important

subjects in school education because it develops logical thinking, reasoning, analytical ability and problem-solving skills.

Mathematics is not limited to numbers and calculations. It is closely connected with everyday activities such as counting, measuring, estimating, comparing, planning, constructing and making decisions.

However, mathematics is often considered a difficult subject by many school students. One major reason is the abstract nature of mathematical concepts. Students may memorise formulas, definitions and rules without understanding their actual meaning.

For example, a student may learn the formula for calculating the area of a rectangle but may not understand how the formula is connected with the actual measurement of a classroom floor or a school garden. Similarly, students may learn fractions, decimals, algebra, integers, angles and geometrical shapes without relating them to their daily experiences.

The teaching of mathematics becomes more effective when students are provided with opportunities to observe, touch, explore, experiment and understand mathematical ideas through concrete experiences before moving towards abstract symbols and formulas.

This issue requires special attention in the context of Nicobari tribal students living in the Nicobar Islands of the Andaman and Nicobar Islands. The Nicobar Islands have distinct geographical, social, cultural and linguistic conditions. Many communities live in island settlements separated by sea, and reaching these communities may require considerable travel and planning.

The educational needs of these students cannot always be addressed through conventional teaching methods alone. Geographical isolation, transportation difficulties, language differences, limited access to educational resources and variations in digital infrastructure may create additional challenges.

In this situation, Digital Education offers opportunities to improve the teaching-learning process. Animated videos, interactive applications, digital maps, virtual models, educational games and offline learning resources can help teachers explain mathematical concepts in simple and interesting ways.

However, digital education should not be understood merely as the use of computers, projectors or tablets. It should be considered a teaching approach that connects technology with local experiences, practical activities and the learning requirements of students.

The present paper therefore focuses on identifying the challenges in reaching Nicobari tribal students and making abstract mathematical concepts understandable through appropriate digital educational strategies.

2. Background of the Study: Educational Context of the Nicobar Islands

The Nicobar Islands form an important part of the Union Territory of Andaman and Nicobar Islands. They have a unique geographical environment, with communities living across different islands and settlements.

The educational situation in these areas is different from that of many mainland urban and semi-urban regions.

Geographical separation, sea transportation, weather conditions, communication facilities and the availability of educational infrastructure can influence the regular delivery of educational services.

Nicobari tribal students also grow up in a social and cultural environment that may differ from the examples commonly used in standard mathematics textbooks.

Therefore, teaching mathematics requires an understanding of the students' local surroundings, language, culture and daily activities.

For example, mathematics can be connected with:

- Counting coconuts and other locally available fruits.
- Measuring objects and spaces.
- Understanding directions and distances between places.
- Comparing quantities and sizes.
- Studying geometrical shapes in buildings and household objects.
- Collecting and representing information from everyday activities.
- Understanding time, measurement and estimation.

These local experiences can provide a meaningful foundation for mathematical learning.

Digital Education can strengthen this approach by converting local experiences into photographs, videos, animations, interactive presentations and digital learning activities.

An important principle should be followed: Digital content for Nicobari tribal students should be developed around their learning needs and local environment rather than simply transferring urban-oriented digital lessons into island classrooms.

3. Statement of the Problem

The teaching of mathematics requires students to move gradually from concrete experiences to pictorial representations and finally to abstract mathematical thinking.

However, this learning process may not be effective when mathematics is taught mainly through textbooks, blackboards, verbal explanations and memorisation.

In the context of Nicobari tribal students, the following issues deserve particular attention:

1. The language used in textbooks may differ from the language spoken by students at home.
2. Geographical separation may make it difficult to provide regular academic support.
3. Schools may have different levels of access to electricity, internet and digital devices.
4. Locally developed mathematics teaching-learning materials may be limited.
5. Teachers may need additional training in digital mathematics pedagogy.
6. Mathematical examples may not always reflect the local environment and experiences of students.
7. Students may have different levels of prior mathematical understanding.
8. Digital learning materials may not be available in familiar languages or in offline formats.

The central problem is therefore how to reach these learners effectively and provide opportunities to understand mathematical concepts through meaningful, practical and technology-supported learning experiences.

4. Objectives of the Study

The paper has the following objectives:

1. To identify the major educational and geographical challenges in reaching Nicobari tribal students.
2. To examine the difficulties in understanding abstract mathematical concepts.
3. To study the possible role of Digital Education in improving mathematics teaching.
4. To suggest digital methods for connecting mathematical concepts with local experiences.
5. To examine the importance of local languages and culturally relevant learning materials.
6. To suggest measures for strengthening teachers' digital competencies.
7. To propose a practical digital mathematics learning framework for schools in the Nicobar Islands.

5. Research Questions

The paper attempts to address the following research questions:

1. What are the major challenges in reaching Nicobari tribal students with quality mathematics education?
2. How do geographical isolation, language and infrastructure affect mathematics teaching and learning?
3. Why do students experience difficulties in understanding abstract mathematical concepts?
4. How can Digital Education help overcome these difficulties?
5. What digital resources are suitable for the geographical and educational conditions of the Nicobar Islands?
6. How can teachers, educational institutions and local communities work together to improve mathematics learning?

6. Research Methodology

The present paper follows a conceptual and descriptive research approach.

It draws upon secondary sources such as:

- National Education Policy 2020.
- National Curriculum Framework for Foundational Stage 2022.
- National Curriculum Framework for School Education 2023.
- Published literature on mathematics education.
- Research on digital learning and inclusive education.
- Educational approaches for geographically isolated and tribal communities.

The paper also develops illustrative teaching-learning activities based on the local environment of the Nicobar Islands.

The study does not claim to have collected primary data from Nicobari students or teachers. It does not report any experimental findings or statistical results. The challenges identified are issues for consideration and verification through field-based research.

7. Review of Related Literature and Educational Frameworks

7.1 National Education Policy 2020

The National Education Policy 2020 recognises the importance of technology in improving teaching, learning, teacher training and educational access. It also highlights the need to reduce the digital divide.

The policy supports the use of technology to improve educational opportunities, especially for learners who face geographical and social barriers.

In the Nicobar context, this approach is important because digital learning resources can provide additional academic support to schools located far from major educational centres (Ministry of Education, 2020).

7.2 National Curriculum Framework for Foundational Stage 2022

The National Curriculum Framework for Foundational Stage emphasises play-based, activity-based and experience-based learning.

Children learn mathematical ideas more effectively when they interact with familiar objects, explore patterns, count materials and participate in practical activities.

This principle can be extended through digital activities that present mathematical concepts using pictu-

res, sounds, animations and interactive exercises (NCERT, 2022).

7.3 National Curriculum Framework for School Education 2023

The National Curriculum Framework for School Education 2023 emphasises conceptual understanding, competency-based learning, experiential learning and the development of mathematical thinking.

It supports the use of appropriate teaching-learning materials and technology to strengthen classroom learning (NCERT, 2023).

7.4 Concrete-Pictorial-Abstract Approach

The Concrete-Pictorial-Abstract approach is a useful way to teach mathematics.

- Concrete: Students use actual objects and materials.
- Pictorial: Students understand concepts through pictures and diagrams.
- Abstract: Students use numbers, mathematical symbols and formulas.

For example, while teaching multiplication, students can first group actual objects, then observe pictures of equal groups and finally learn the multiplication expression.

Digital Education can strengthen the pictorial stage through animations and virtual manipulatives.

7.5 Context-Based Mathematics Learning

Context-based learning connects mathematical ideas with the real-life experiences of students.

In the Nicobar Islands, familiar local objects, school activities, maps, measurements and environmental examples can provide useful situations for mathematical learning.

Digital photographs, recorded demonstrations and interactive activities can help teachers convert these situations into meaningful lessons.

These educational frameworks provide the foundation for the proposed digital mathematics learning approach.

8. Understanding Abstract Mathematical Concepts

Abstract mathematical concepts are ideas that are not always directly visible or physically available. They are represented through numbers, symbols, formulas, diagrams and relationships.

Students may find these concepts difficult when they are introduced without sufficient practical experiences.

Some examples are given below.

Mathematical concept	Possible learning difficulty	Suggested concrete approach
Fractions	Understanding parts of a whole	Dividing a coconut into equal parts
Decimals	Understanding place value	Digital money and measurement activities
Integers	Understanding positive and negative values	Animated number line
Geometry	Understanding shapes and angles	Interactive geometric models
Algebra	Understanding unknown quantities	Digital balance-scale activity
Area	Understanding the space covered	Measuring a school garden
Perimeter	Understanding boundary measurement	Measuring the boundary of a classroom
Volume	Understanding three-dimensional space	Rotatable 3D models

Ratio	Comparing quantities	Comparing groups of familiar objects
Data handling	Understanding information through graphs	Digital charts and bar graphs

The teacher should introduce a concept through familiar objects and activities before explaining the related mathematical symbols and formulas.

Digital resources can make this process more interesting by allowing students to observe changes, manipulate objects and repeat activities.

9. Major Challenges in Reaching Nicobari Tribal Students

This section is particularly important because the first requirement of effective teaching is to understand the conditions under which students learn.

9.1 Geographical Isolation and Sea Transportation

Andaman admin to protect Great Nicobar tribal interests, says Centre| India News hindustantimes.com

The Nicobar Islands are geographically separated by sea. Schools and settlements are spread across different islands, and transportation depends on available sea and other local transport facilities.

This geographical condition can create difficulties in:

- Reaching schools regularly for academic monitoring.
- Organising teacher training programmes.
- Supplying educational materials.
- Providing regular subject-specific support.
- Conducting workshops and demonstration classes.
- Maintaining communication between schools and educational institutions.

Suggested digital remedies:

1. Establish offline digital learning facilities in schools.
2. Prepare preloaded educational content for tablets and computers.
3. Provide recorded mathematics lessons prepared by subject experts.
4. Organise online academic support sessions whenever connectivity permits.
5. Develop a central digital repository for Nicobar schools.
6. Create digital teacher-support groups for sharing lesson plans and resources.

A school should be able to continue digital learning even when internet connectivity is unavailable.

9.2 Language and Communication Barriers

Language is an important factor in mathematics education. Students understand new ideas more easily when teachers use familiar words and expressions.

Nicobari students may speak local languages in their homes and communities, while the medium of instruction and textbooks may use Hindi or English.

This may create difficulties in understanding mathematical instructions, definitions and terminology.

For example, students may understand the practical meaning of sharing objects equally but may find it difficult to understand the term division when it is explained only through a formal definition.

Suggested digital remedies:

- Develop bilingual mathematics videos.
- Prepare audio explanations using familiar local languages with the support of competent local speakers.

- Use pictures and animations to explain mathematical terms.
- Create a digital glossary of basic mathematical vocabulary.
- Involve community members in preparing local language learning resources.
- Provide subtitles and simple voice explanations in digital lessons.

Digital content should support the gradual development of mathematical vocabulary in the language of instruction while respecting the students' home languages.

9.3 Limited Digital Infrastructure

Digital Education requires suitable equipment and basic facilities.

Depending on the school, students and teachers may face difficulties related to:

- Availability of computers and tablets.
- Internet connectivity.
- Electricity supply.
- Charging facilities.
- Projectors and digital boards.
- Maintenance and technical support.

Suggested digital remedies:

1. Provide suitable tablets and computers.
2. Develop offline digital mathematics libraries.
3. Use solar-supported charging facilities where feasible.
4. Install educational applications that work without continuous internet access.
5. Maintain shared digital learning facilities.
6. Provide technical maintenance and regular equipment checks.

Digital infrastructure should be planned according to the actual requirements of each school.

9.4 Difficulty in Understanding Abstract Concepts

Many mathematical concepts are introduced through symbols and formulas. Students may not understand the relationship between these representations and real-life situations.

For example, the formula for the area of a rectangle may be difficult to understand if students have never measured the area of an actual surface.

Suggested digital remedies:

- Use animated videos.
- Introduce interactive number lines.
- Use virtual geometrical models.
- Demonstrate fractions through digital pictures.
- Use digital measuring activities.
- Provide interactive exercises with immediate feedback.

The teacher should connect every digital demonstration with a practical classroom activity.

9.5 Limited Availability of Context-Based Teaching-Learning Materials

Mathematics learning becomes more effective when students can use concrete materials.

However, ready-made teaching-learning materials may not always be available in sufficient quantities or may not reflect the local environment.

Suggested digital remedies:

- Develop digital versions of mathematics teaching aids.
- Prepare virtual fraction models.

- Use digital geometrical instruments.
- Create local picture-based worksheets.
- Record videos demonstrating practical activities.
- Encourage teachers to create their own digital learning materials.

Local objects should continue to be used alongside digital resources.

9.6 Teacher Preparedness and Digital Skills

The successful use of technology depends on the teacher's ability to select appropriate content and use it effectively.

Some teachers may require further training in digital teaching methods, particularly in the use of interactive mathematics applications.

Suggested digital remedies:

- Conduct regular digital pedagogy workshops.
- Provide hands-on training in GeoGebra and other educational applications.
- Develop short instructional videos for teachers.
- Organise online mentoring sessions.
- Establish teacher-sharing groups.
- Encourage teachers to prepare digital lesson plans based on local contexts.

Teacher training should focus on practical classroom application rather than only introducing software features.

9.7 Differences in Students' Learning Levels

Students in a classroom may have different levels of prior mathematical understanding.

Some students may be comfortable with number operations, while others may require additional support in counting, place value and basic calculations.

Suggested digital remedies:

- Conduct digital diagnostic assessments.
- Prepare activities at different difficulty levels.
- Use educational games for practice.
- Provide recorded explanations that can be viewed repeatedly.
- Give immediate feedback.
- Use digital learning records to identify areas requiring additional support.

Digital resources can help teachers provide more individual attention to learners.

9.8 Lack of Locally Relevant Digital Content

A major concern is that digital materials prepared for general use may not always reflect the experiences of Nicobari students.

If students cannot relate to the examples used in digital lessons, the learning process may become less meaningful.

Suggested digital remedies:

Develop local content using:

- Coconuts and other familiar fruits.
- Local houses and buildings.
- School gardens.
- Island maps.
- Local measurements and distances.

- Familiar household objects.
- Community activities.
- Environmental observations.

Teachers should involve local resource persons in selecting suitable examples and preparing digital content.

10. Digital Education as a Remedy for Mathematical Learning Difficulties

Digital Education can provide different ways of presenting mathematical concepts. It allows students to see, hear, observe, interact and practise mathematical ideas.

The National Curriculum Framework for Foundational Stage 2022 supports the use of concrete experiences, local surroundings, appropriate teaching-learning materials and digital resources in children's learning. It also recognises the value of different formats, including audio, video, pictures and interactive content.

NCERT+2

The following digital approaches may be useful in Nicobari schools.

10.1 Animated Mathematics Videos

Animated videos can explain mathematical concepts through movement, pictures, sounds and demonstrations.

For example:

- Addition and subtraction through animated objects.
- Fractions through pictures of divided fruits.
- Geometry through moving shapes.
- Multiplication through equal groups of objects.
- Measurement through practical demonstrations.
- Number patterns through visual sequences.

Students can watch these videos repeatedly according to their learning needs.

Practical suggestion: Teachers can prepare short mathematics videos of five to ten minutes using familiar local examples and simple language.

10.2 Interactive Digital Boards

Interactive digital boards can help teachers demonstrate mathematical concepts visually.

While teaching geometry, teachers can draw triangles, circles, rectangles and other shapes. Students can observe how shapes change when their sides or angles are modified.

For example, a teacher can demonstrate how the angles of a triangle change while its shape is adjusted.

This makes mathematics more interactive than simply copying diagrams from textbooks.

10.3 GeoGebra for Mathematics Learning

Bohatství výuky matematiky: modelování v programu Geogebra 1 | Noc vědy

GeoGebra

GeoGebra is useful for teaching geometry, algebra, graphs, angles, coordinate geometry and mathematical relationships through interactive demonstrations.

Official website

For example, students can change the length and breadth of a rectangle and observe how its area changes.

They can also construct circles, triangles and other geometrical figures and explore their properties.

Practical suggestion: Teachers should prepare demonstrations in advance and save them for offline use where possible.

10.4 PhET Interactive Simulations

Fractions: Mixed Numbers - Fractions | Equivalent Fractions | Mixed Numbers - PhET Interactive Simulations

PhET Interactive Simulations

PhET provides interactive simulations that can support mathematical learning through exploration and visual demonstrations.

Official website

Teachers can select suitable simulations for number operations, fractions and mathematical relationships. Students can change values and observe the results.

10.5 Digital Storytelling

Mathematics can be taught through short digital stories based on familiar surroundings.

For example, a story about collecting coconuts can introduce addition, multiplication and division.

A story about measuring a school garden can introduce length, area and perimeter.

A story about travelling between places can introduce distance, time and estimation.

Digital storytelling can connect mathematical concepts with students' everyday experiences.

10.6 Digital Maps and Geometrical Learning

Module 3 - OpenStreetMap and the High Resolution Settlement Layer | GIS-curriculum

OpenStreetMap

Digital maps can help students understand directions, distance, location, scale and spatial relationships.

Official website

Teachers can use maps of the Nicobar Islands to introduce distance, direction, estimation, scale and geographical relationships.

10.7 Offline Digital Learning Resources

Internet connectivity should not become a barrier to digital education.

Schools can maintain digital libraries containing:

- Recorded mathematics lessons.
- Interactive presentations.
- Educational animations.
- Digital worksheets.
- Audio explanations.
- Mathematics games.
- Digital assessment materials.
- Subject-wise video lessons.

These resources can be stored on computers, tablets, pen drives or local school servers.

This approach is particularly important for schools where internet connectivity may be irregular or unavailable.

10.8 Digital Assessment and Feedback

Digital assessment can help teachers identify students' learning difficulties.

Teachers can prepare simple quizzes, worksheets and interactive exercises.

For example, after teaching fractions, students can complete a digital activity in which they identify one-half, one-third and one-fourth.

The teacher can examine the responses and provide additional support to students who need it.
Digital assessment should be used as a supportive tool and should not replace classroom observation, oral questioning and practical assessment.

11. Context-Based Digital Mathematics Activities for Nicobari Students

The most effective digital learning materials are those that connect mathematical concepts with the environment in which students live.
The following examples are proposed for classroom use.

Table 1. Proposed Context-Based Digital Mathematics Activities

Local context	Mathematical concept	Suggested digital activity
Coconut collection	Addition and multiplication	Animated counting and grouping
Dividing fruits	Fractions	Interactive fraction models
Traditional houses	Geometry	Digital identification of shapes
School garden	Area and perimeter	Digital measurement and grids
Island maps	Distance and direction	Interactive mapping
Fishing-related activities	Data handling	Digital tables and bar graphs
Water containers	Volume and capacity	3D visual demonstrations
Community activities	Ratio and percentage	Digital comparison activities
Boat journeys	Time and distance	Digital time and distance problems
Local objects	Symmetry	Interactive reflection and rotation

Source: Examples developed by the author for this conceptual paper. These are suggested activities, not observed research findings.

11.1 Activity One: Teaching Fractions Through Coconut Division

Flat lay background of coconut, coconut shell and meat pieces on white wooden table
Learning objective: To understand fractions as equal parts of a whole.
Teaching process:

1. Show an actual coconut or a suitable picture.
2. Explain the meaning of a whole.
3. Divide its representation into two equal parts.
4. Explain one-half using the symbol 1/2.
5. Divide another representation into four equal parts.
6. Explain one-fourth using the symbol 1/4.
7. Show a digital animation of different fractions.
8. Ask students to complete an interactive exercise.

Expected learning: Students can connect the concept of fractions with a familiar object before learning mathematical symbols.

11.2 Activity Two: Teaching Area and Perimeter Through a School Garden

Lorne's Monarch Butterfly Sanctuary – Monarch Butterfly Sanctuary – Lorne Street Elementary lornestes.lausd.org
Learning objective: To understand the difference between area and perimeter.
Suppose a school garden is 8 metres long and 5 metres wide.
Perimeter:

\[2(8+5)=26\text{ metres} \]
Area:
\[8\times5=40\text{ square metres} \]
The teacher can first take students to the school garden and demonstrate actual measurement. The same dimensions can then be entered into a digital grid or interactive presentation.
Expected learning: Students understand that mathematical formulas represent the measurements of real spaces.

11.3 Activity Three: Teaching Data Handling Through Local Activities

Graphing Flip Chart | National School Products
nationalschoolproducts.com
Learning objective: To understand the collection, organisation and representation of data.
The teacher can collect simple information from students, such as the number of different fruits brought to school.
The information can be entered into a digital spreadsheet and presented as a bar graph.
Students can learn:

- Collection of data.
- Classification of information.
- Preparation of tables.
- Reading bar graphs.
- Comparison of quantities.
- Identification of the highest and lowest values.

This activity can also develop observation, communication and analytical skills.

11.4 Activity Four: Teaching Distance Through Island Maps

Learning objective: To understand distance, direction and scale.
The teacher can display a suitable digital map of the Nicobar Islands or a familiar local area.
Students can identify locations, observe directions and estimate distances.
The teacher can explain that the distance shown on a map is represented through a scale.
For example, if 1 cm on a simple classroom map represents 1 km in the actual area, then 4 cm represents 4 km.
Expected learning: Students develop spatial understanding and learn how mathematical measurements are used in geographical situations.

11.5 Activity Five: Teaching Volume Through Water Containers

Learning objective: To understand capacity and volume.
The teacher can show different containers used in everyday life.
Students can compare their capacities and estimate which container holds more water.
A digital 3D animation can demonstrate how the same quantity of water appears in containers of different shapes.
Expected learning: Students understand the relationship between capacity, measurement and three-dimensional space.

12. Proposed Digital Pedagogical Model for Nicobari Schools

This paper proposes a five-stage digital mathematics learning model.

Five-stage digital mathematics learning model

1. Stage 1: Local Experience
   Introduce a mathematical idea through familiar objects, activities and surroundings.
2. Stage 2: Visual Representation
   Use photographs, drawings, pictures, charts and diagrams.
3. Stage 3: Digital Exploration
   Use animations, simulations, virtual manipulatives and interactive applications.
4. Stage 4: Mathematical Representation
   Introduce mathematical symbols, numbers, formulas and calculations.
5. Stage 5: Application and Assessment
   Ask students to solve real-life problems, complete digital exercises and explain their understanding.

Figure 1. Proposed five-stage digital mathematics learning model. Developed by the author.

This model follows the principle of moving from concrete experiences to visual representations and finally to abstract mathematical understanding.

It also reflects the educational approach described in NCF-FS 2022, which emphasises concrete experiences, representation and gradual development of abstract ideas.

NCERT+1

12.1 Classroom Implementation of the Model

Consider the teaching of multiplication.

Stage	Teacher's activity	Student's activity
Local experience	Shows groups of familiar objects	Counts objects in groups
Visual representation	Displays pictures of equal groups	Identifies repeated groups
Digital exploration	Shows an animated multiplication lesson	Interacts with the animation
Mathematical representation	Writes $4 \times 3 = 12$	Understands the mathematical expression
Application	Gives a practical problem	Solves and explains the answer

The same model can be adapted to fractions, geometry, measurement, algebra and data handling.

13. Proposed Implementation Plan for Nicobar Schools

Digital Education should not remain limited to the supply of computers and projectors. It should become part of regular classroom teaching and learning.

The following implementation plan is proposed.

Table 2. Suggested Implementation Plan

Phase	Major activity	Responsibility
Phase 1	Identify school-wise digital infrastructure and learning needs	School heads and education authorities
Phase 2	Prepare local-context mathematics content	Teachers and subject experts
Phase 3	Develop offline digital learning libraries	DIET/SCERT and technical teams
Phase 4	Conduct digital pedagogy training	Teacher education institutions
Phase 5	Pilot digital lessons in selected schools	Mathematics teachers

Phase 6	Assess student learning and teacher feedback	School and academic teams
Phase 7	Improve and expand the programme	Education administration

13.1 Establish Digital Mathematics Resource Centres

A digital mathematics resource centre may be developed at suitable schools or educational cluster levels. It should contain:

- Computers and tablets.
- Projectors.
- Offline educational applications.
- Digital mathematics libraries.
- Interactive learning materials.
- Digital assessment resources.

These centres can also serve as training and resource-sharing facilities for teachers.

13.2 Develop Nicobari Context-Based Digital Content

Educational authorities should encourage the development of digital materials based on the geographical, cultural and environmental context of the Nicobar Islands.

Local teachers, language experts, community representatives and subject specialists should work together in preparing these resources.

13.3 Provide Specialised Teacher Training

Teachers should receive practical training in:

- Digital mathematics pedagogy.
- GeoGebra and interactive geometry.
- Educational videos and animations.
- Digital assessment.
- Offline educational applications.
- Preparation of context-based digital teaching-learning materials.

Training should include classroom demonstrations and opportunities for teachers to prepare their own digital lessons.

13.4 Strengthen School-Level Digital Infrastructure

The education administration should consider providing:

- Tablets and laptops.
- Projectors and interactive displays.
- Reliable electricity and backup systems.
- Solar charging facilities where feasible.
- Offline educational content.
- Technical maintenance and support.

The facilities should be planned according to the requirements of individual schools.

13.5 Encourage Community Participation

Parents and community members can help teachers identify familiar objects, activities, local terms and examples for mathematics teaching.

Their participation can make learning materials more meaningful and culturally appropriate.

13.6 Develop a Digital Monitoring and Feedback System

Teachers may maintain simple digital records of:

- Student participation.

- Conceptual understanding.
- Completion of learning activities.
- Performance in digital assessments.
- Areas requiring additional support.

These records can help teachers identify learning gaps and plan remedial activities.

13.7 Promote Institutional Collaboration

SCERT, DIET, school education authorities, teacher training institutions and relevant technical organisations should collaborate to develop and share suitable educational resources.

A common digital platform can help teachers access quality learning materials and exchange successful classroom practices.

14. Educational Management and Administrative Support

The successful implementation of Digital Education in Nicobar schools requires proper institutional planning and management.

Providing digital equipment without planning for its use, maintenance and academic support may not produce the desired results.

The following management measures are suggested.

A. School-level planning

Each school should prepare a simple digital education action plan. It should identify available equipment, electricity facilities, internet connectivity, teacher competencies and students' learning requirements.

B. Resource management

Digital equipment should be used according to a planned timetable. Schools may maintain a record of equipment, usage, maintenance and technical problems.

C. Academic monitoring

School heads and academic authorities should monitor whether digital resources are actually being used to improve classroom teaching.

D. Teacher support

Teachers should have access to regular academic guidance and opportunities to share their classroom experiences.

E. Community coordination

Community representatives and parents may be involved in the preparation of locally relevant learning resources.

F. Financial planning

Adequate provision should be made for equipment, maintenance, electricity backup, digital content development and teacher training.

These management measures can help ensure that digital learning becomes a regular educational practice rather than an occasional classroom activity.

15. Policy Implications

The National Education Policy 2020 recognises the importance of technology in improving teaching-learning processes, teacher development and educational access.

The National Curriculum Framework for Foundational Stage 2022 also supports the use of contextual, age-appropriate and multilingual digital resources.
NCERT+1
In the context of Nicobar, the following policy-level measures deserve attention:

1. A special digital education plan for geographically isolated island schools.
2. Provision of offline-first digital learning facilities.
3. Development of multilingual and context-based educational content.
4. Regular capacity-building programmes for teachers.
5. Academic support through digital resource centres.
6. Monitoring of digital infrastructure and student learning outcomes.
7. Allocation of funds for equipment, maintenance and educational content development.
8. Collaboration between local communities and educational institutions.

These measures should be planned according to the actual requirements of individual schools rather than following a uniform model for all locations.

16. Expected Educational Outcomes

If the proposed strategies are implemented properly, they may contribute to the following improvements:

- Better understanding of abstract mathematical concepts.
- Increased student interest and participation.
- Greater confidence in solving mathematical problems.
- Improved visualisation and reasoning skills.
- Better connection between mathematics and daily life.
- Increased availability of learning resources.
- Greater opportunities for self-paced learning.
- Improved teacher preparedness for digital pedagogy.
- More inclusive educational opportunities for geographically isolated learners.

These are expected outcomes and should not be treated as established research findings. Their effectiveness needs to be assessed through classroom observation, student assessments and systematic field research.

17. Discussion

The challenges discussed in this paper show that the teaching of mathematics in tribal and geographically isolated communities requires an approach that considers the actual learning conditions of students.
The problem should not automatically be understood as a lack of mathematical ability among tribal students. Difficulties may arise from the methods used to introduce mathematical ideas, the language of instruction, the availability of learning materials and the opportunities provided to connect mathematics with everyday experiences.
Digital Education can provide useful support, but the introduction of technology alone cannot solve all educational problems.
For example, providing a tablet to a student does not automatically ensure mathematical understanding. The teacher must select appropriate content, explain the concept, encourage interaction and provide opportunities for practical application.

Similarly, a digital lesson prepared for students in an urban setting may not always be suitable for Nicobari tribal students. The content should consider their language, environment, culture and educational requirements.

Therefore, the most appropriate approach is a combination of three important elements:

1. Local experiences: Learning mathematics through familiar objects, activities and surroundings.
2. Digital resources: Using animations, simulations, videos and interactive applications to explain difficult concepts.
3. Teacher guidance: Encouraging students to ask questions, participate in activities, discuss ideas and solve problems.

This approach can help create a more inclusive and meaningful mathematics classroom.

The study also suggests that educational authorities should consider the geographical realities of the Nicobar Islands while planning digital infrastructure and teacher training.

Offline digital learning facilities, locally developed content and continuous academic support should receive particular attention.

An important consideration is that the digital learning process should respect the culture and identity of Nicobari communities. Local people should not be treated only as beneficiaries of educational programmes. They should also be invited to contribute their knowledge, language and experiences to the development of learning materials.

18. Limitations of the Paper

The present paper is conceptual and descriptive in nature. It does not include primary data collected directly from Nicobari tribal students or teachers.

The challenges discussed are potential educational and geographical barriers that require verification through field-based research. The availability of digital infrastructure, internet connectivity, language resources and teacher competencies may differ between individual schools and islands.

The proposed digital pedagogical model has not yet been experimentally tested. Therefore, the expected educational benefits cannot be considered proven outcomes.

Further studies involving classroom observations, teacher interviews, student assessments and community participation are necessary to establish the effectiveness of the suggested strategies.

19. Scope for Future Research

Future researchers may undertake empirical studies in selected schools of the Nicobar Islands to examine the effectiveness of Digital Education in mathematics teaching.

The following areas may be explored:

1. A comparative study of mathematics achievement before and after introducing digital learning materials.
2. A study of the impact of mother-tongue-supported digital mathematics lessons.
3. An investigation into teachers' preparedness for using digital mathematics resources.
4. A study of the effectiveness of GeoGebra and virtual manipulatives in teaching geometry.
5. An assessment of offline digital learning facilities in remote island schools.
6. A study of the relationship between context-based digital activities and student participation.
7. Development and evaluation of a Nicobari-context-based digital mathematics resource package.

8. A study of the role of school leadership and institutional management in implementing Digital Education in remote tribal schools.

A pilot intervention in selected schools could provide valuable evidence for planning a larger digital education programme across the Nicobar Islands.

20. Conclusion

Making abstract mathematical concepts concrete is one of the important responsibilities of mathematics teachers. Students should not learn mathematics only by memorising formulas, rules and procedures. They should understand mathematical ideas through observation, exploration, activities and practical experiences.

Nicobari tribal students deserve equal opportunities to access quality mathematics education, irrespective of geographical distance, language differences or limitations in educational infrastructure.

Digital Education can become an effective means of reducing these barriers when it is planned according to the actual needs of students and teachers.

Animated videos, interactive applications, virtual manipulatives, digital maps and offline learning materials can help explain mathematical concepts in simple and interesting ways.

However, technology should not replace the teacher or practical classroom experiences. It should strengthen the teacher's ability to connect abstract mathematical ideas with concrete learning situations.

The use of local examples, familiar languages, community participation and culturally relevant digital resources can make mathematics more meaningful for Nicobari tribal students.

The success of this approach depends on proper planning, teacher training, infrastructure, continuous monitoring and institutional support.

Ultimately, the aim should not be merely to introduce digital devices into tribal schools, but to use Digital Education as a bridge between the mathematical world of numbers and symbols and the real-life experiences of children.

Mathematics becomes meaningful when students can see it, experience it, discuss it and apply it in their everyday lives.

21. References

The following references are relevant to the conceptual framework and recommendations of this paper. They are presented in APA 7th edition style.

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22. Declarations

Conflict of Interest: The author declares no conflict of interest, subject to confirmation.

Funding: No external funding has been reported for the preparation of this conceptual manuscript. This statement should be confirmed by the author.

Ethical Approval: This paper does not report primary research involving human participants. Ethical approval and informed consent will be necessary if future field-based research involves students, teachers or community members.

Data Availability Statement: No primary dataset was generated or analysed for this conceptual paper.

Author Contribution: The author should review and confirm responsibility for the research design, academic content, accuracy and final approval of the manuscript.

AI Assistance Disclosure: Generative AI (ChatGPT, GPT-6) was used to assist with the initial drafting, organisation and language improvement of the manuscript. The author should critically review, verify, revise and approve the final content in accordance with the journal's AI-use policy.

23. Compliance with JMLR Submission Guidelines

I checked the journal's current official submission and author guidelines.

Required manuscript format

Particular	Requirement
Total length	5,000–7,000 words
Abstract	150–250 words
Keywords	4–8
Font	Times New Roman
Font size	12 pt
Line spacing	1.5
Margins	2.5 cm
Alignment	Left
Title	Bold, 16 pt
Main headings	Bold, 14 pt
Referencing	APA 7th edition
File	Microsoft Word preferred

Source: Official JMLR submission guidelines.

Journal of Management and Legal Research

Important academic considerations:

1. The manuscript above is a conceptual research draft. It should be expanded and checked against the 5,000–7,000-word requirement before submission.
2. JMLR describes its scope as multidisciplinary, with a particular focus on management and legal studies. It would be wise to obtain editorial confirmation that a mathematics education paper with an educational management focus is suitable.

Journal of Management and Legal Research

3. The journal requires authors to disclose the use of AI tools and does not permit AI systems to be listed as authors.
   Journal of Management and Legal Research
4. The final manuscript should be submitted without author-identifying information in the main review copy; author details should be provided separately.
   Journal of Management and Legal Research

Official submission resources:

- JMLR Submission Guidelines
- JMLR Author Guidelines
- JMLR Aims and Scope

My recommendation

The strongest contribution of this paper should be the proposed Nicobar Digital Mathematics Learning Model, particularly its use of local experiences, local-language support, offline digital resources and teacher-led interactive learning.

I recommend keeping the paper focused on the actual educational conditions of Car Nicobar and Nancowry, while avoiding unsupported claims about individual tribal communities.

Original wording does not guarantee a zero similarity score. Before submission, verify all references, check the similarity report and personally validate the manuscript's academic claims.

CONCLUSION

Mathematics education becomes meaningful when students understand concepts through real experiences rather than memorising rules and formulas. This paper has discussed the challenges that may affect the teaching of abstract mathematical concepts to Nicobari tribal students in the Nicobar Islands, including geographical isolation, transportation difficulties, language differences, limited digital infrastructure, shortage of locally relevant learning materials and the need for teacher support. It has proposed Digital Education as a way to address these challenges through animated lessons, interactive applications, virtual models, digital maps and offline learning resources.

However, technology alone cannot ensure learning. Digital materials must reflect students' languages, culture, surroundings and learning needs. Teachers should connect digital demonstrations with practical activities using familiar objects and local examples. Training, equipment, technical support and community participation are also necessary for implementation.

The proposed approach should be introduced gradually in selected schools and reviewed through classroom observations, student assessments and feedback from teachers, students and families. Such evaluation will help identify effective practices and areas requiring improvement. Ultimately, Digital Education should act as a bridge between abstract mathematical ideas and children's everyday experiences. With planning and institutional support, it can help make mathematics more accessible, engaging and inclusive for Nicobari tribal learners.