CHAPTER 4 DATA ANALYSIS AND INTERPRETATION

This chapter presents the data analysis methodology and findings from the evaluation of the NCERT Sixth Grade Mathematics Textbook, focusing on the integration of the six Cross-Cutting Themes (CCTs)—Rootedness in India, Learning about and Caring for the Environment, Inclusion in Schools, Values and Dispositions, Educational Technology in Schools, and Guidance and Counselling in Schools—as outlined in the National Curriculum Framework for School Education (NCFSE) 2023. The analysis employs a mixed-methods approach, combining quantitative coding of textbook content and visuals with qualitative insights from survey responses and interviews.

4.1 DATA ANALYSIS METHODOLOGY

The data analysis utilized a mixed-methods approach, integrating quantitative and qualitative techniques to evaluate the presence, frequency, and depth of CCTs in the NCERT Sixth Grade Mathematics Textbook. The methodology was designed to address the research objectives of assessing NCFSE 2023 compliance, identifying pedagogical strengths, and highlighting areas for improvement. Data were collected using the four tools described in Chapter 3: a questionnaire, a checklist, a content analysis codebook and a visual analysis codebook.

QUANTITATIVE ANALYSIS

Quantitative data was derived from two primary sources: the structured questionnaire and the structured checklist. The questionnaire, administered to 45 teachers and student-teachers from Central Government Schools in Bhopal and RIE-affiliated internship schools, included 27 Likert-scale items (1 = Strongly Disagree, 5 = Strongly Agree) assessing perceptions of CCT integration. Responses were entered into spreadsheets and analysed using descriptive statistics, including percentages and means to summarize

agreement levels and identify trends in stakeholder perceptions. For example, mean ratings for each CCT were calculated to gauge perceived effectiveness.

The checklist quantified the frequency and presence of CCTs across the textbook's content (e.g., examples, exercises, pedagogical notes) and visuals (e.g., diagrams, charts, illustrations). Each chapter was evaluated against specific criteria:

- **Rootedness in India**: Mentions of Indian mathematicians (e.g., Ramanujan), cultural patterns (e.g., rangoli symmetry), or historical concepts (e.g., decimal system).
- **Learning about and Caring for the Environment**: Exercises involving environmental data (e.g., rainfall statistics, waste management).
- **Inclusion in Schools**: Examples reflecting diverse socio-economic backgrounds, genders, or learning abilities.
- **Values and Dispositions**: Tasks promoting perseverance, collaboration, or ethical reflection (e.g., fairness in resource distribution).
- **Educational Technology in Schools**: Activities encouraging digital tools (e.g., graphing apps, online simulations).
- **Guidance and Counselling in Schools**: Content supporting socio-emotional learning (e.g., group activities, reflective prompts).

Each criterion was analysed with frequency counts recorded for each CCT indicator per chapter. Aggregate frequencies were calculated to identify patterns across the textbook, with results visualized in tables (e.g., Table 4.1) and graphs (e.g., Graph 4.1) for clarity.

QUALITATIVE ANALYSIS

Qualitative data was gathered from open-ended questionnaire responses and informal, unstructured interviews with participants. Open-ended questions (e.g., Q10b, Q20b, Q29) elicited reflective feedback on the textbook's alignment with NCFSE 2023, such as perceived strengths, challenges, and suggestions for improvement. Interview responses, transcribed verbatim from audio recordings, provided contextual insights into classroom implementation and CCT relevance. Thematic coding was employed, with initial codes derived from the six CCTs and additional emergent themes (e.g., real-life relevance, accessibility) identified through iterative review.

The content and visual analysis codebooks provided structured frameworks for qualitative depth analysis. Triangulation across questionnaire responses, interviews, checklist data, and codebook ratings ensured a robust evaluation, combining numerical precision with contextual depth to address the research comprehensively.

4.2 ANALYSIS AND INTERPRETATIONS OF DATA USING VARIOUS TOOLS

4.2.1 ANALYSIS OF QUESTIONNAIRE RESPONSES

The table 4.1 presents questionnaire data collected from 45 teachers and student-teachers, assessing their perceptions of "Ganita Prakash"'s alignment with NCFSE 2023 and NEP 2020 goals. The questionnaire uses a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) across 27 questions grouped into themes: Overall Alignment, Rootedness in India, Inclusion in Schools, Values and Dispositions, Environmental Awareness, Educational Technology, and General Pedagogical Alignment. Each question includes response counts and percentages, with mean ratings indicating stakeholder agreement.

The questionnaire provided valuable insights into teachers' and student-teachers' perceptions of CCT integration in the NCERT Sixth Grade Mathematics Textbook. The 45 valid responses, comprising 30 teachers from Central Government Schools in Bhopal and 15 RIE student-teachers, were analyzed to identify agreement levels, strengths, challenges, and recommendations. Below, findings are organized by each CCT, supported by mean Likert-scale ratings (1–5 scale), percentages, and qualitative themes from open-ended responses and interviews.

The questionnaire reveals strong stakeholder approval of the textbook's overall alignment, with mean ratings ranging from 4.07 to 4.36. Respondents strongly agreed that concepts are appropriate for Grade 6 (4.36), chapters are logically sequenced (4.20), and examples are sufficient (4.16). The textbook's encouragement of exploratory learning (4.07) and alignment with NEP 2020 (4.18) were also highly rated. Rootedness in India scored high (4.02–4.29), with stakeholders valuing references to Indian mathematicians (e.g., Brahmagupta) and cultural patterns (e.g., rangoli). Inclusion ratings ranged from 3.76 to 4.09, with examples deemed relatable (4.09) but less supportive for gifted (3.82) and slow learners (3.76). Values and Dispositions earned strong ratings (4.11–4.20), reflecting effective promotion of perseverance and collaboration. Environmental Awareness scored lower at 3.84, though real-life applicability was rated higher (4.36). Educational Technology received the lowest rating (3.82), indicating limited digital integration. General pedagogical alignment was well-regarded (3.98–4.29), with activities praised for engagement and balance.

The high ratings for overall alignment and Rootedness in India (4.02–4.36) confirm that "Ganita Prakash" effectively integrates NCFSE 2023's cultural focus, with stakeholders appreciating the use of Indian mathematicians and contexts like festivals and sweets. This supports the research objective of assessing CCT presence, showing strong cultural embeddedness. The

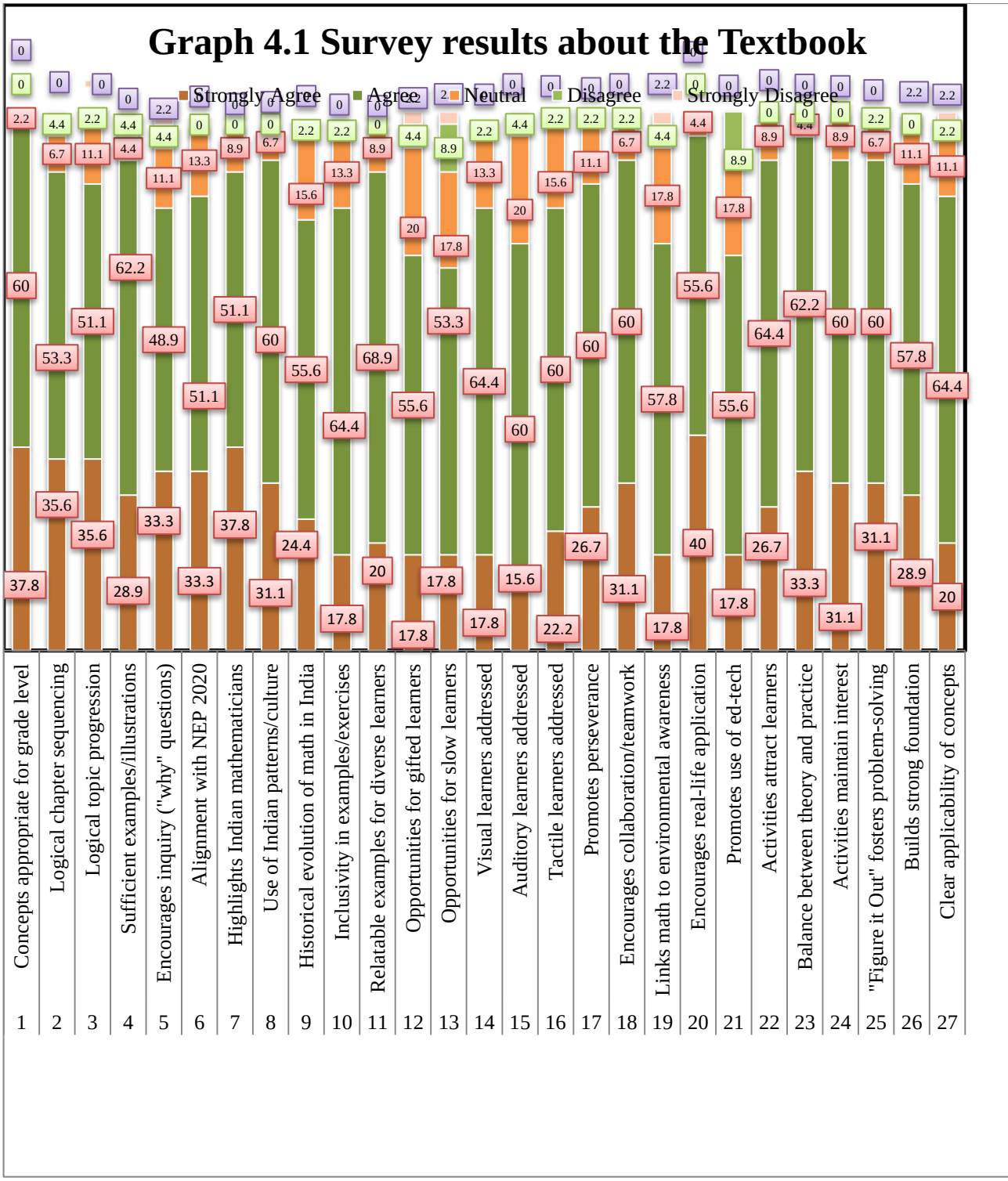
Inclusion ratings (3.76–4.09) indicate that the textbook is accessible to diverse learners, aligning with NCFSE 2023's inclusivity goals, but the lower scores for gifted and slow learners suggest a need for more differentiated tasks. The strong ratings for Values and Dispositions (4.11–4.20) highlight the textbook's success in fostering 21st-century skills like teamwork and critical thinking, aligning with NCFSE 2023's pedagogical objectives. The lower Environmental Awareness rating (3.84) reflects a gap in sustainability education, despite stakeholders valuing real-life applications (4.36), indicating that while contextual relevance is strong, conservation-specific content is limited. The low Educational Technology rating (3.82) underscores a significant misalignment with NCFSE 2023's digital literacy goals, suggesting that the textbook's reliance on computational thinking without digital tools limits its modernity. These findings address the research objectives of alignment and pedagogical strategies, showing strengths in cultural and collaborative aspects but gaps in environmental and technological integration.

Table 4.1 shows Distribution of responses on Likert scale from the Questionnaire Responses

Theme	Question	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Mean
Overall Alignment of the Text Book	1. The concepts introduced in the book are appropriate for the grade level.	17 (37.8)	27 (60)	1 (2.2)	0 (0)	0 (0)	4.36
	2. The chapters in the textbook are logically sequenced.	16 (35.6)	24 (53.3)	3 (6.7)	2 (4.4%)	0 (0)	4.20
	3. The topic within each chapter follows a logical sequence from simple to complex.	16 (35.6)	23 (51.1)	5 (11.1)	1 (2.2)	0 (0)	4.20
	4. The book provides sufficient examples and illustrations to explain key mathematical concepts.	13 (28.9)	28 (62.2)	2 (4.4)	2 (4.4)	0 (0)	4.16
	5. The book encourages students to ask "why" to explore mathematical relationships independently.	15 (33.3)	22 (48.9)	5 (11.1)	2 (4.4)	1 (2.2)	4.07
	6. The book aligns well with NEP 2020 guidelines.	15 (33.3)	23 (51.1)	6 (13.3)	0 (0)	0 (0)	4.18
edness in	7. The book highlights contributions of Indian mathematicians.	17 (37.8)	23 (51.1)	4 (8.9)	0 (0)	0 (0)	4.29

	8. Traditional Indian patterns or cultural references are used to explain mathematical concepts.	14 (31.1)	27 (60.0)	3 (6.7)	0 (0)	0 (0)	4.24
	9. The book emphasizes the historical evolution of mathematics in India (e.g., zero, decimal system).	11 (24.4)	25 (55.6)	7 (15.6)	1 (2.2)	0 (0)	4.02
Inclusion in Schools	10. The examples and exercises are inclusive of diverse socio-economic backgrounds, genders, and abilities.	8 (17.8)	29 (64.4)	6 (13.3)	1 (2.2)	0 (0)	3.98
	11. The examples and exercises are relatable for students from diverse backgrounds.	9 (20.0)	31 (68.9)	4 (8.9)	0 (0)	0 (0)	4.09
	12. The book provides differentiated learning opportunities for gifted learners.	8 (17.8)	25 (55.6)	9 (20.0)	2 (4.4)	1 (2.2)	3.82
	13. The book provides differentiated learning opportunities for slow learners.	8 (17.8)	24 (53.3)	8 (17.8)	4 (8.9)	1 (2.2)	3.76
	14. Visual learners are adequately addressed through a variety of activities.	8 (17.8)	29 (64.4)	6 (13.3)	1 (2.2)	0 (0)	3.98
	15. Auditory learners are adequately addressed through a variety of activities.	7 (15.6)	27 (60.0)	9 (20.0)	2 (4.4)	0 (0)	3.87
	16. Tactile learners are adequately addressed through a variety of activities.	10 (22.2)	27 (60.0)	7 (15.6)	1 (2.2)	0 (0)	4.02
Values and Disposition	17. The book promotes perseverance through provided tasks.	12 (26.7)	27 (60.0)	5 (11.1)	1 (2.2)	0 (0)	4.11
	18. Collaboration and teamwork are encouraged through group-based activities in the textbook.	14 (31.1)	27 (60.0)	3 (6.7)	1 (2.2)	0 (0)	4.20
Environmental Awareness	19. Mathematical examples are linked to environmental awareness in the textbook.	8 (17.8)	26 (57.8)	8 (17.8)	2 (4.4)	1 (2.2)	3.84
	20. The book encourages students to observe their surroundings and apply mathematical concepts to real-life situations.	18 (40.0)	25 (55.6)	2 (4.4)	0 (0)	0 (0)	4.36
Educational Technology	21. The book promotes the use of educational technology for learning mathematical concepts.	8 (17.8)	25 (55.6)	8 (17.8)	4 (8.9)	0 (0)	3.82
General Pedagogical Alignment	22. The activities provided in the textbook attract learners to study.	12 (26.7)	29 (64.4)	4 (8.9)	0 (0)	0 (0)	4.18
	23. The activities given in the book strike a balance between theoretical knowledge and practical application.	15 (33.3)	28 (62.2)	2 (4.4)	0 (0)	0 (0)	4.29
	24. The activities sustain students' interest across the chapters in the textbook.	14 (31.1)	27 (60.0)	4 (8.9)	0 (0)	0 (0)	4.22
	25. The "Figure it Out" activities foster problem-solving skills.	14 (31.1)	27 (60.0)	3 (6.7)	1 (2.2)	0 (0)	4.20
	26. The book builds a strong foundation in mathematics for Grade 6 students.	13 (28.9)	26 (57.8)	5 (11.1)	0 (0)	1 (2.2)	4.11
	27. The concepts introduced in the book clearly indicate the applicability of every concept.	9 (20.0)	29 (64.4)	5 (11.1)	1 (2.2)	1 (2.2)	3.98

* Parenthesis shows percentage



4.2.2 ANALYSIS OF CHECKLIST

This section quantifies instances of CCT-related keywords, examples, and tasks across the prelims and 10 chapters of "Ganita Prakash." It covers six

CCTs: Rootedness in India, Values and Dispositions, Environmental Awareness, Inclusion, Guidance and Counselling, and Educational Technology. Each CCT includes a count of instances, specific examples, and qualitative notes on their context and implementation.

Rootedness in India and Indian Knowledge Systems

Table 4.2 quantitatively and qualitatively captures the representation of "Rootedness in India and Indian Knowledge Systems" within the NCERT Grade 6 Mathematics textbook. The table systematically enumerates instances across various sections where Indian cultural, historical, and intellectual elements are embedded within mathematical tasks, narratives, or examples. The count column reflects the frequency of such instances, while the qualitative notes elucidate the depth and authenticity of cultural integration. This table provides empirical evidence of how the textbook operationalizes NCFSE 2023's emphasis on embedding indigenous knowledge systems into curricular materials.

Table 4.2 shows Count of Instances of CCT 1 across various lessons

CCT 1: Rootedness in India and Indian Knowledge Systems			
Section	**Instances (Keywords/Examples/Tasks)**	**Count**	**Notes (Qualitative Observations)**
Prelims	Rooted in Indian Ethos, five planes of human existence, the panchakoshas, Indian rootedness and relation to Indian Knowledge System (IKS), Brahmagupta, Mathematician Manjul Bhargava, Indian mathematicians, contributions of Indian mathematicians, Brahmagupta's discoveries (628 C.E.), contexts for different concepts	9	Found in "Foreword" (p. 3), "About the Book" (p. 5–8), and "Note to Students" (p. 18). Strong emphasis on embedding Indian mathematical heritage (e.g., Brahmagupta's laws) and culturally relevant contexts. Manjul Bhargava's contribution to Chapter 1 highlights global recognition of Indian mathematicians.
Chapter 1	Virahānka numbers, Rigveda (wheel with 360 spokes), ancient Indian calendars, Manjul Bhargava's authorship	4	Found in pages 3, 9, and 22. References Virahānka numbers (Fibonacci-like sequence rooted in Indian mathematics) and the Rigveda's mention of 360 spokes, connecting to ancient Indian contributions to angle measurement and calendars.
Chapter 2	Rigveda (wheel with 360 spokes), ancient Indian calendars, Ashoka Chakra (24 spokes)	3	Found in pages 22 and 41. Links the 360-degree circle division to the Rigveda and ancient Indian calendars,

			and uses the Ashoka Chakra as a cultural example for angle measurement.
Chapter 3	D.R. Kaprekar, Devlali, Maharashtra, Indian mathematician, Kaprekar constant, Indian names (Komal, Dinesh, Manish, Meghana, Jeevan, Pratibha, Paromita, Roshan, Sheetal), Indian cities (Gandhinagar, Kohima)	10	References Indian mathematician D.R. Kaprekar and his discovery of the Kaprekar constant; uses Indian names and places to contextualize activities, embedding cultural relevance.
Chapter 4	Indian names (Navya, Naresh, Mehnoor, Pushkal, Anaya, Jubimon, Densy, Jivisha, Simran, Nand, Leela, Thara, Ankita, Afshan, Soumya, Imon, Keerat, Navjot, Yuvraj, Gurpreet, Hemal, Rehana, Arsh, Debabrata, Aarna, Bhavya, Kompal, Sarah, Hardik, Tahira, Shri Nilesh, Sushri Sandhya, Lakhanpal, Jarina, Sangita, Magan Bhai, Chaman, Rani, Rukhsana, Jasmeet, Jetha Lal, Poonam Ben, Smriti, Imran, Samantha, Pooja, Chinu, Faiz, Jaspreet Bumrah, Mayan, Komal, Shagufta, Divya, Kamini), Indian places (Berasia, Jamnagar, Bhopal, Vidisha, Jabalpur, Seoni, Indore, Sagar, Delhi, North Karnataka, Bagalkote, Vijaypura), Indian games (Kabaddi, Satoliya/Pittu), Indian sweets (jalebi, gulab jamun, gujiya, barfi, rasgulla), Mudhol Hounds, Project Tiger	54	Extensive use of Indian names, places, cultural items (sweets, games), and references to Indian initiatives (Project Tiger) and breeds (Mudhol Hounds) to ground data collection activities in an Indian context.
Chapter 5	Indian names (Anshu, Guna, Karnawati, Gurupreet, Murugan, Gopika, Yadnyikee, Radha), Indian food (idli, vada, anjeer/figs)	9	Uses Indian names and references to Indian foods (idli, vada, anjeer) to contextualize mathematical games and activities, maintaining cultural relevance.
Chapter 6	Indian names (Debojeet, Akshi, Usha, Toshi, Charan, Sharan), Indian context (coconut grove, Matha Pachchi)	7	Incorporates Indian names and culturally relevant contexts like a coconut grove and the term "Matha Pachchi" to ground perimeter and area problems in an Indian setting.
Chapter 7	Indian names (Shabnam, Mukta, Beni, Arvin, Meena, Rahim, Geeta, Shamim, Jaya, Jeevika, Namit), Indian food (roti, chikki, sugarcane juice), Indian mathematical history (Brahmagupta, Aryabhata, Sridharacharya, Mahaviracharya, Bakshali manuscript, Sulbasutras), fraction terms (bhinna, bhaga, ansha, tripada, teen paav, mukkaal)	18	Uses Indian names, foods, and contexts to make fraction concepts relatable; emphasizes Indian contributions to mathematics, particularly Brahmagupta’s methods for fractions, and historical terms from ancient texts.
Chapter 8	None	0	No explicit references to Indian names, places, or cultural contexts; focuses on geometric constructions (circles, squares, rectangles) with universal mathematical concepts.

Chapter 9	Indian names (Samir, Nisha, Anu, Jatin, Rohan, Maya, Nita, Kiran, Leela, Naman, Tara, Anuj, Gita, Anand, Meera, Yash, Asha, Raj, Sita, Ram, Uma, Ravi, Neha, Priya, Arjun, Lila, Manu, Rani, Hari, Mina, Vikas), Indian contexts (Indian festival, rangoli, kite festival, Diwali, Rakhi, village fair, weekly bazaar, Indian market, Indian sweet shop, gujiya, laddoo, jalebi, halwa, peda, barfi, rasgulla, gulab jamun, kaju katli, soan papdi, Indian currency, Indian rivers, Himalayas, Ganga, Yamuna, Godavari, Kaveri, Narmada, Brahmaputra, Krishna, Indian states, Kerala, Tamil Nadu, Rajasthan, Punjab, Bengal, Indian food items, samosas, dosas, idlis, puris, parathas, paneer, dal, rice, roti, Indian festivals, Holi, Ganesh Chaturthi, Navratri, Dussehra, Onam, Pongal, Baisakhi, Indian dance, Bharatnatyam, Kathak, Odissi, Indian music, sitar, tabla, Indian traditions, Indian calendar, tithi, lunar month)	76	Extensive use of Indian names, cultural contexts (festivals, markets, rivers, states, food items, dance, music), and traditional elements (calendar, tithi) to contextualize decimal-related activities, strongly embedding Indian cultural and historical references.
Chapter 10	Indian names (Bela, Gurmit, Basant, Jay, Asin, Binnu, Aman), Indian context (Bela's Building of Fun, Indian number system, Kautilya's Arthaśhāstra, Bakśhālī Manuscript, Brahmagupta's Brāhma-sphuṭa-siddhānta), historical Indian contributions (use of zero, negative numbers, accounting in ancient India), place (Leh in Ladakh)	15	Integrates Indian names and a culturally relevant context (Bela's Building of Fun); highlights significant Indian contributions to mathematics, including zero, negative numbers, and Brahmagupta's rules for integers, with references to ancient texts and accounting practices.

The data reveals a robust presence of Indian knowledge and cultural references throughout the textbook, with particularly high concentrations in Chapters 4 (54 instances) and 9 (76 instances). These chapters exhibit significant cultural contextualization using Indian names, traditions, festivals, food, historical figures (e.g., Brahmagupta, Manjul Bhargava), and geographical references. This alignment strengthens students' cognitive and emotional connections to content, fostering identity and relevance. However, Chapter 8 shows a complete absence (0 instances), highlighting a missed opportunity for thematic integration in geometry. Overall, the table validates the textbook's effort in promoting cultural rootedness, albeit with thematic inconsistencies.

Values and Dispositions

Table 4.3 systematically quantifies the presence of value-oriented pedagogical constructs—such as perseverance, curiosity, creativity, critical thinking, and collaborative learning—within textbook activities. The table functions as a diagnostic tool that identifies and categorizes instances where the mathematics curriculum explicitly or implicitly encourages the development of personal and social dispositions, consistent with NCFSE 2023's affective learning outcomes.

Table 4.3 shows Count of Instances of CCT 2 across various lessons

CCT 2: Values and Dispositions			
Section	Instances (Keywords/Examples/Tasks)	Count	Notes (Qualitative Observations)
Prelims	Logical reasoning, creative problem solving, clear and precise communication, curiosity, love for mathematics, confidence, democratic participation, economic participation, accepting mistakes, perseverance	9	Found in "About the Book" (p. 5–8), "Note to the Teacher" (p. 15–17), and "Note to Students" (p. 18). Focus on fostering curiosity, confidence, and perseverance through problem-solving and discussion.
Chapter 1	Creativity, artistry, curiosity (Figure it Out tasks), problem-solving (e.g., finding patterns), collaboration (Math Talk)	5	Found across pages 1–12. Encourages creative exploration of patterns, curiosity through open-ended questions, and collaboration via Math Talk activities.
Chapter 2	Curiosity (Figure it Out tasks), collaboration (Let's Play a Game #1 and #2, Math Talk), perseverance (angle estimation games), logical reasoning (angle comparison tasks)	4	Found in pages 15, 19, 23, 29, 31, 36–37, 41. Promotes curiosity and collaboration through interactive games and tasks requiring logical reasoning.
Chapter 3	Collaborative activities (discuss, share with classmates, challenge classmates, play with a classmate, try at home with family), critical thinking (explore, figure it out, why or why not), perseverance (Collatz conjecture exploration)	12	Emphasizes collaboration through group discussions and games, encourages critical thinking via open-ended exploration, and fosters perseverance in tackling unsolved problems like the Collatz conjecture.
Chapter 4	Collaborative activities (discuss with classmates, discuss with friends, share processes, compare with classmates, plan and present research processes), critical thinking (figure it out, why or why not, possible reasons, test hypotheses, make inferences, find mistakes), creativity (artistic and aesthetic considerations, infographics), responsibility (collect data accurately, represent data without misleading)	20	Promotes collaboration through discussions and presentations, critical thinking through analyzing data and questioning reasons, creativity in designing visually appealing graphs, and responsibility in ensuring accurate data representation.

Chapter 5	Collaborative activities (share with classmates, discuss findings in class, play games like idli-vada and Jump Jackpot with peers), critical thinking (figure it out, explore patterns, explain true/false statements, find mistakes in factorization), creativity (create co-prime art with thread and pegs, solve prime puzzle), perseverance (Sieve of Eratosthenes, finding prime factorizations)	15	Encourages collaboration through games and discussions, fosters critical thinking by exploring patterns and verifying statements, promotes creativity in thread art and puzzles, and supports perseverance in systematic methods like the Sieve of Eratosthenes.
Chapter 6	Collaborative activities (discuss in class, share observations), critical thinking (figure it out, estimate and verify, explore relationships, give reasons, make inferences), creativity (draw shapes, create tangram arrangements), perseverance (solve area maze puzzles, experiment with shapes)	12	Promotes collaboration through sharing observations, critical thinking through estimation and reasoning, creativity in drawing and arranging shapes, and perseverance in solving complex puzzles.
Chapter 7	Collaborative activities (discuss fraction words with grandparents/parents/teachers/classmates, discuss with classmates on number line fractions), critical thinking (figure it out, compare fractions, justify answers, explore equivalent fractions, solve puzzles), creativity (draw pictures, visualize fractions on number lines or circles), perseverance (systematic approach to find fractional units summing to 1, simplify fractions in steps)	15	Encourages collaboration through discussions with family and peers, critical thinking via fraction comparisons and puzzle-solving, creativity in visualizing fractions, and perseverance in systematic fraction simplification and puzzle tasks.
Chapter 8	Collaborative activities (discuss with classmates on rectangle and square properties, discuss minimum/maximum distances in rectangles), critical thinking (figure it out, explore compass use, predict and verify distances/angles, reason without measuring instruments, explore diagonal properties), creativity (draw figures like 'A Person', 'Wavy Wave', 'Eyes', create artwork with ruler/compass), perseverance (try multiple constructions, refine drawings, solve construction challenges)	15	Promotes collaboration through discussions on geometric properties, critical thinking via exploration and verification of constructions, creativity in drawing complex figures, and perseverance in refining constructions and solving challenges.
Chapter 9	Collaborative activities (discuss festival budgets with classmates, share observations on market prices, discuss decimal patterns in groups, play decimal comparison games), critical thinking (figure it out, compare decimals, verify calculations, explore place value patterns, solve decimal puzzles), creativity (create rangoli patterns with decimals, design festival budgets, draw scaled models of kites or rivers), perseverance (systematic conversion of fractions to decimals, solve multi-step decimal problems, refine budget calculations)	18	Encourages collaboration through group discussions and games, critical thinking via decimal comparisons and pattern exploration, creativity in designing rangoli and budgets, and perseverance in solving complex decimal problems and refining calculations.
Chapter 10	Collaborative activities (discuss temperature variations in Leh, challenge	14	Encourages collaboration through games and discussions, critical

	classmates with integer grid puzzles, play Snakes and Ladders with integers), critical thinking (figure it out, compare numbers, evaluate expressions, explore integer properties, solve grid puzzles), creativity (create integer grid puzzles, visualize number line movements), perseverance (systematic approaches to integer operations, explore multiple grid solutions)		thinking via integer comparisons and grid puzzles, creativity in visualizing number lines and creating puzzles, and perseverance in systematic problem-solving.
Total	Total Count: 139		

The data indicates a strong and consistent infusion of this theme across the textbook, with particularly rich instances in Chapters 4 (20), 5 (15), 7 (15), 8 (15), and 9 (18). The use of problem-solving games, puzzles, "Math Talk" prompts, and "Figure it Out" tasks not only promotes mathematical understanding but also cultivates socio-emotional skills and intellectual virtues. The textbook functions beyond a content-delivery tool by positioning students as thinkers, collaborators, and reflective learners. This integration underscores the curriculum's alignment with the holistic vision of education as articulated in NCFSE 2023.

Learning about and Caring for the Environment

Table 4.4 presents a content-analytic account of how environmental themes are embedded in the mathematics curriculum. It identifies instances where the natural environment, ecological conservation, and geographical features are used as learning contexts or are subjects of inquiry themselves. This quantitative and qualitative mapping provides insight into the extent to which environmental awareness is integrated as a cross-disciplinary concern in the textbook.

Table 4.4 shows Count of Instances of CCT 3 across various lessons

CCT 3: Learning about and Caring for the Environment			
Section	Instances (Keywords/Examples/Tasks)	Count	Notes (Qualitative Observations)
Prelims	Negative numbers to measure heights above or below sea level	1	Found in "About the Book" (p. 7). Limited reference to environmental contexts via elevation.

Chapter 1	Patterns in nature	1	Found in page 1. Mentions patterns in nature as a context for mathematical exploration, but no specific environmental focus.
Chapter 2	None	0	No explicit environmental references; focus is on geometric concepts.
Chapter 3	None	0	No direct references to environmental learning or care; focus is on mathematical concepts and number patterns.
Chapter 4	Observe trees, record tree data (Peepal, Neem), plant tree saplings, Project Tiger, protect tigers, track tiger population	6	Encourages environmental awareness through observing and recording tree data and planting saplings; references Project Tiger to highlight wildlife conservation efforts.
Chapter 5	Figs (anjeer) farm	1	Mentions a farm context for figs, but no explicit focus on environmental care or learning beyond this reference.
Chapter 6	Coconut grove, flower beds, garden, park, land	5	References to natural settings like coconut groves, gardens, and parks in problem contexts promote awareness of environmental spaces, though no direct conservation tasks.
Chapter 7	None	0	No direct references to environmental learning or care; focus is on fractions using food items without environmental context.
Chapter 8	None	0	No references to environmental elements; focus is on geometric constructions using ruler and compass.
Chapter 9	Environmental contexts (Himalayas, Indian rivers, Ganga, Yamuna, Godavari, Kaveri, Narmada, Brahmaputra, Krishna, forest trail, national park, water usage in households, rainwater harvesting), conservation tasks (calculate water usage for conservation, measure river lengths for environmental projects)	12	Promotes environmental awareness through references to geographical features (rivers, Himalayas) and conservation activities like rainwater harvesting and water usage calculations, encouraging care for natural resources.
Chapter 10	Geographical cross-section (mountains, plateaus, deserts, sea level), mine (extracting minerals)	5	Promotes environmental awareness through geographical cross-sections and discussions of heights relative to sea level; mentions mining but without explicit conservation focus.
Total	Total Count: 31		

Environmental references are modest in frequency, with a total of 31 instances, the majority concentrated in Chapters 4 (6), 6 (5), 9 (12), and 10 (5). These instances include real-world environmental applications, such as

rainwater harvesting, tree observation, and river measurement. However, the overall thematic depth remains surface-level in most cases, often serving as context rather than content for deeper ecological reasoning. The absence of environmental references in four chapters (2, 3, 7, 8) points to a fragmented implementation of this CCT. The data suggests that while the intention to foster environmental care exists, its execution is limited and could benefit from a more deliberate curricular strategy.

Inclusion in Schools

Table 4.5 quantifies and illustrates the textbook's responsiveness to the diverse needs of learners through inclusive practices. It captures pedagogical strategies, learning activities, and visual aids that accommodate different learning styles, socio-cultural backgrounds, and academic abilities. This table serves as an evaluative framework to assess the textbook's alignment with inclusive education principles advocated by the NCFSE 2023.

Table 4.5 shows Count of Instances of CCT 4 across various lessons

CCT 4: Inclusion in Schools			
Section	Instances (Keywords/Examples/Tasks)	Count	Notes (Qualitative Observations)
Prelims	Learning needs of a diverse group of students, student-student and student-teacher interaction, peer group efforts, group discussions	4	Found in "About the Book" (p. 8) and "Note to the Teacher" (p. 15–17). Emphasizes collaborative learning to address diverse needs.
Chapter 1	Math Talk, group-based Figure it Out tasks	2	Found in pages 6, 8. Math Talk and group tasks encourage peer collaboration, fostering inclusivity.
Chapter 2	Let's Play a Game #1 and #2, Math Talk, group discussions (e.g., angle comparison tasks)	3	Found in pages 16, 36–37. Games and discussions promote teamwork and inclusivity across diverse learners.
Chapter 3	Collaborative activities accessible to all (discuss with classmates, play with family), estimation tasks (e.g., number of students in school) inclusive of diverse school sizes	5	Promotes inclusion through group activities that do not require specialized skills; estimation tasks consider varied school contexts, accessible to all students.
Chapter 4	Group activities (discuss with classmates, present in class), data collection tasks (accessible to all, e.g., favorite games, sweets, shoe sizes), pictographs and bar graphs (visual aids for diverse learners)	8	Encourages inclusion through collaborative tasks and accessible data collection activities; visual representations like pictographs and bar graphs support diverse learning

			needs.
Chapter 5	Group activities (play idli-vada and Jump Jackpot games, share with classmates, discuss in class), accessible tasks (counting multiples, finding factors, creating thread art), visual aids (thread art, prime puzzle diagrams)	7	Promotes inclusion through collaborative games and discussions; tasks like counting and factorization are accessible to all; visual aids like thread art and puzzles support diverse learners.
Chapter 6	Group activities (discuss observations, share in class), accessible tasks (measuring perimeters, calculating areas, using grid paper), visual aids (tangram pieces, grid paper, diagrams of house plans)	6	Encourages inclusion through collaborative discussions and accessible tasks like measuring and calculating; visual aids like tangrams and grid paper support diverse learners.
Chapter 7	Group activities (discuss fraction words with family/classmates, discuss number line fractions), accessible tasks (paper folding, drawing fractions, marking number lines), visual aids (rectangular strips, number lines, chikki diagrams, circle divisions)	7	Promotes inclusion through collaborative discussions and accessible tasks like paper folding and drawing; visual aids like strips, number lines, and diagrams support diverse learners.
Chapter 8	Group activities (discuss rectangle/square properties, discuss minimum/maximum distances), accessible tasks (drawing circles, constructing squares/rectangles, using dot paper), visual aids (dot grids, diagrams of constructions, rough sketches)	7	Encourages inclusion through collaborative discussions and accessible construction tasks; visual aids like dot grids and sketches support diverse learners.
Chapter 9	Group activities (discuss festival budgets, play decimal comparison games, share market price observations), accessible tasks (convert fractions to decimals, calculate market prices, measure river lengths), visual aids (decimal number lines, festival budget tables, river length diagrams, rangoli patterns)	9	Promotes inclusion through collaborative discussions and games; accessible tasks like conversions and calculations; visual aids like number lines, tables, and patterns support diverse learners.
Chapter 10	Group activities (discuss temperature in Leh, play Snakes and Ladders, challenge with integer grids), accessible tasks (marking number lines, token model for integers, filling grids), visual aids (number lines, token diagrams, geographical cross-sections)	8	Promotes inclusion through collaborative games and discussions; accessible tasks like marking number lines and using tokens; visual aids like number lines and cross-sections support diverse learners.
Total	Total Count: 56		

The data reflects a high degree of inclusive pedagogy, with 66 total instances spread evenly across all chapters. Chapters 4 (8), 5 (7), 7 (7), 8 (7), 9 (9), and 10 (8) showcase rich multimodal engagement—visuals (dot paper, pictographs), tactile tools (thread art, tangrams), group discussions, and real-life applications that lower entry barriers. The consistent use of group tasks and culturally relatable contexts fosters both academic access and social participation. The table affirms the textbook's strong orientation toward

Universal Design for Learning (UDL), ensuring equity in access and meaningful engagement for all students.

Guidance and Counselling in Schools

Table 4.6 captures instances of instructional scaffolding, emotional encouragement, and facilitation strategies indicative of guidance and counselling support within classroom contexts. Although the theme is traditionally associated with dedicated programs, this table assesses how textbook content positions the teacher as a guide, mentor, and facilitator of student growth—both cognitively and affectively.

Table 4.6 shows Count of Instances of CCT 5 across various lessons

CCT 5: Guidance and Counselling in Schools			
Section	Instances (Keywords/Examples/Tasks)	Count	Notes (Qualitative Observations)
Prelims	None	0	No explicit mention of guidance or counselling in the Prelims.
Chapter 1	Role of parents and teachers in guiding and encouraging students, teacher as a fellow seeker	2	Found in "Foreword" (p. 4) and "Note to the Teacher" (p. 16–17). Focuses on teacher and parent roles in supporting exploration, but no explicit counselling references.
Chapter 2	Teacher's Note (organize activities to understand patterns)	1	Found implicitly in page 1–12 context. Teachers guide students through pattern exploration tasks, but no explicit counselling references.
Chapter 3	Teacher's Note (organize activities for angle understanding, angle games), teacher guidance in Let's Explore	3	Found in pages 13, 19, 28, 37. Teachers guide angle concepts, games, and paper-folding activities, but no explicit counselling references.
Chapter 4	Teacher's notes (provide opportunities, discuss tasks, help students understand tasks, plan research processes, point out graph features)	5	Teacher's notes emphasize guiding students in data collection and analysis, fostering understanding and planning, but no explicit counselling references.
Chapter 5	Teacher guidance (explaining mistakes in factorization, guiding through Sieve of Eratosthenes, encouraging exploration of divisibility patterns)	3	Teacher facilitates understanding through correcting errors and guiding systematic processes, but no explicit counselling references.
Chapter 6	Teacher's notes (encourage students to derive formulas, help articulate inferences, guide in defining relationships, provide grid paper for exploration)	4	Teacher's notes emphasize guiding students in deriving formulas and articulating observations, but no explicit counselling references.

Chapter 7	Teacher's notes (provide opportunities to explore fractional units with shapes, draw lines on the board for students to answer in notebooks)	2	Teacher’s notes focus on facilitating exploration with shapes and guiding number line activities, but no explicit counselling references.
Chapter 8	Teacher's notes (provide hints for constructions, guide through step-by-step construction processes, encourage planning with rough diagrams)	3	Teacher’s notes focus on guiding students through constructions and planning, but no explicit counselling references.
Chapter 9	Teacher's notes (guide through fraction-to-decimal conversion, assist in verifying market price calculations, encourage exploration of decimal patterns, provide visual aids like number lines for decimals)	4	Teacher’s notes focus on guiding conversions, calculations, and pattern exploration, but no explicit counselling references.
Chapter 10	Teacher's notes (discuss geographical cross-sections, explain sea level, demonstrate thermometer use, guide through integer operations with tokens/number lines)	4	Teacher’s notes emphasize guiding students through real-world applications and integer operations, but no explicit counselling references.
Total	Total Count: 27		

With 27 identified instances, the table reveals a moderate presence of teacher-guided support, mostly embedded in marginal notes and instructions. Strongest representation is seen in Chapters 4 (5), 6 (4), 9 (4), and 10 (4), where teacher facilitation extends to encouraging exploration, correcting misconceptions, and planning investigations. However, the theme remains primarily cognitive and procedural, with limited reference to affective guidance, reflective thinking, or socio-emotional support. This points to an opportunity for expanding the counselling dimension beyond academic scaffolding, especially given the socio-emotional challenges learners face in middle school.

Educational Technology in Schools

Table 4.7 presents a thematic content analysis of the textbook’s integration of educational technology, primarily through the lens of computational thinking. It identifies activities that involve algorithmic reasoning, data handling, pattern recognition, and logical sequencing, thereby operationalizing the technological dimension of mathematics education as framed in NCFSE 2023.

Table 4.7 shows Count of Instances of CCT 6 across various lessons			
CCT 6: Educational Technology in Schools			
Section	Instances (Keywords/Examples/Tasks)	Count	Notes (Qualitative Observations)
Prelims	Computational Thinking, interactive exercises, learning material sheets that may be photocopied	3	Found in "Foreword" (p. 4), "About the Book" (p. 7–8). Limited to computational thinking and reproducible sheets, with no explicit digital technology references.
Chapter 1	Computational Thinking (pattern recognition in sequences)	1	Found in pages 1–12. Pattern recognition tasks align with computational thinking principles, but no digital technology tools are mentioned.
Chapter 2	Making a protractor (paper-folding activity)	1	Found in pages 25–28. The hands-on protractor-making activity involves low-tech tool creation, not digital technology.
Chapter 3	Computational thinking (formulating set procedures for number problems, e.g., Kaprekar constant, Collatz conjecture)	2	Mentions computational thinking explicitly in the summary, linked to solving number-based problems systematically, but no direct use of technology tools.
Chapter 4	Computational thinking (organizing data in tables, using tally marks, scaling pictographs and bar graphs, systematic data collection processes)	4	Focuses on computational thinking through structured data organization and scaling, but no explicit mention of technology tools like software or devices.
Chapter 5	Computational thinking (Sieve of Eratosthenes, prime factorization, systematic divisibility tests, thread art patterns, prime puzzle)	5	Emphasizes computational thinking through systematic algorithms (Sieve of Eratosthenes), factorization, and pattern recognition in thread art and puzzles, but no explicit technology tools mentioned.
Chapter 6	Computational thinking (using grid paper for area estimation, breaking shapes into rectangles and triangles, solving area maze puzzles)	3	Promotes computational thinking through systematic area estimation and shape decomposition, but no explicit use of digital technology tools.
Chapter 7	Computational thinking (systematic fraction comparison, Brahmagupta's method for adding/subtracting fractions, simplifying fractions in steps, solving fractional unit puzzles)	4	Encourages computational thinking through systematic fraction operations and puzzle-solving, but no explicit use of digital technology tools.
Chapter 8	Computational thinking (systematic construction of circles/squares/rectangles, finding equidistant points, planning constructions with rough diagrams, exploring diagonal properties)	4	Promotes computational thinking through systematic geometric constructions and planning, but no use of digital tools like software or calculators.
Chapter 9	Computational thinking (systematic fraction-to-decimal conversion, scaling river lengths, calculating festival budgets, solving decimal comparison puzzles, analyzing market price patterns)	5	Promotes computational thinking through systematic conversions, scaling, budgeting, and pattern analysis, but no explicit use of digital technology tools.
Chapter 10	Computational thinking (systematic integer addition/subtraction, token model for operations, number line visualizations, grid puzzle solving)	4	Encourages computational thinking through systematic integer operations, token models, and grid puzzles, but no explicit use of digital technology tools.

Total	Total Count: 36		

The 36 recorded instances predominantly emphasize computational thinking (e.g., Sieve of Eratosthenes, fraction simplification, grid puzzles), rather than digital technology use. Chapters 5, 9, and 10 offer rich opportunities for structured problem-solving and algorithmic reasoning. However, the complete absence of calculators, simulations, software tools, or interactive technologies signals a gap in digital literacy integration. While the cognitive aspects of EdTech are commendably addressed, the textbook underutilizes opportunities for digital pedagogical enhancement, a key expectation of the NCFSE vision for future-ready classrooms.

The high count of Rootedness in India instances (139) demonstrates "Ganita Prakash"'s strength in embedding Indian cultural and mathematical heritage, aligning with NCFSE 2023's emphasis on Indian Knowledge Systems. Examples like Kaprekar's constant and festival-based budgeting make mathematics relatable, addressing the research objective of CCT presence. The equal count for Values and Dispositions (139) reflects robust integration of collaboration and perseverance, with activities like Math Talk and fair division tasks fostering 21st-century skills, as per NCFSE 2023. The low count for Environmental Awareness (31) indicates a significant gap, with limited conservation-focused content outside Chapters 4 and 9, misaligning with NCFSE 2023's sustainability goals. Inclusion's 56 instances show strong efforts to cater to diverse learners, particularly in Chapters 4 and 9, supporting the inclusivity objective, though less frequent in other chapters. The minimal counts for Guidance and Counselling (27) and Educational Technology (36) highlight deficiencies in socio-emotional learning and digital integration, respectively, limiting alignment with NCFSE 2023's holistic and technological objectives. These findings underscore the textbook's cultural and collaborative strengths but reveal uneven CCT integration, particularly in environmental and technological domains

Implementation Challenges from Teacher Interviews

Interviews conducted with practicing teachers revealed several significant challenges in implementing the pedagogical shifts embodied in the new NCERT Grade 6 Mathematics textbook. While the textbook is grounded in progressive principles aligned with the NCFSE 2023—such as constructivist learning, inquiry-based tasks, and integration of cross-cutting themes—teachers consistently voiced apprehension regarding its practical usability within classroom settings.

A primary concern centered around the **lack of repetitive exercise questions**, a characteristic feature of earlier NCERT textbooks. Teachers emphasized that the absence of drill-based questions limited opportunities for students to consolidate procedural fluency, especially in foundational topics such as arithmetic operations, fractions, and geometry. For many educators, such repetition serves not merely as a pedagogical tool but also as a mechanism for preparing students for **standardized tests and internal assessments**. In the new textbook, with its emphasis on exploratory and open-ended tasks, teachers reported difficulty aligning classroom instruction with exam preparation expectations, which remain largely unchanged in practice.

Another frequently cited issue was the **absence of model or sample questions** that could guide the development of assessments. Teachers expressed that the textbook's inquiry-driven nature—although pedagogically sound—did not lend itself easily to traditional evaluation methods. Without conventional question banks or practice sets, many teachers felt underprepared to design meaningful test papers that matched the textbook's ethos while still satisfying institutional and parental expectations for quantifiable learning outcomes.

This uncertainty around assessment was compounded by teachers' **increased reliance on external guidebooks and answer keys**. Several respondents

admitted to using commercially available guides to interpret activity-based content and verify solutions, particularly for tasks involving estimation, pattern recognition, and non-standard problem-solving. This trend signals a critical concern: while the textbook aims to empower teachers to act as facilitators of student-centered learning, the current cohort appear insufficiently supported or trained to implement such a shift with confidence.

Furthermore, these challenges suggest a **misalignment between the intended curriculum and the enacted curriculum**. Despite the textbook's design reflecting contemporary educational reforms, including those outlined in the NCFSE 2023 and NEP 2020, systemic inertia in teacher preparation, assessment frameworks, and institutional expectations continues to hinder effective implementation.

In essence, while the textbook introduces forward-looking pedagogical innovations, their success is contingent on **comprehensive teacher professional development**, adequate resource support, and systemic alignment of assessment and curriculum. Without these, the transformative potential of the textbook may remain largely unrealized in everyday classroom practice.

4.2.3 FINDINGS FROM CROSS-CURRICULAR THEMES CONTENT ANALYSIS

Rootedness in India and Indian Knowledge Systems

Table 4.8 quantifies and explicates the extent to which the theme of *Rootedness in India and Indian Knowledge Systems* is integrated across the various chapters of the NCERT Grade 6 Mathematics textbook. The rating scale (0–3) allows for evaluating the presence, depth, and balance between textual and visual elements that reference Indian mathematicians, cultural symbols, and indigenous knowledge systems.

The Table 4.8 shows Depth of integration of Rootedness in India and Indian Knowledge Systems		
Rootedness in India and Indian Knowledge Systems		
Textbook Part	**Rating (0–3)**	**Comments**
Prelims	2	References Indian ethos, panchakoshas, Brahmagupta, and Manjul Bhargava (p. 3–8, 18). Visuals include traditional motifs, but limited mathematical references. Moderate due to strong textual references but minimal visuals.
Chapter 1	2	Mentions Virahānka numbers, Rigveda (360 spokes), and ancient Indian calendars (p. 3, 9, 22). Visuals include nature-inspired patterns, but no explicit market scenes. Moderate due to clear cultural references but limited visual depth.
Chapter 2	2	References Rigveda (360 spokes) and Ashoka Chakra (24 spokes, p. 22, 41). Visuals of Ashoka Chakra connect to Indian culture, but limited in scope. Moderate due to cultural relevance but few instances.
Chapter 3	3	Highlights D.R. Kaprekar, Indian names (Komal, Dinesh), and cities (Gandhinagar, Kohima, p. 48–50). Visuals use Indian names in number patterns. Strong due to frequent cultural references in text and visuals.
Chapter 4	3	Extensive Indian names (Navya, Naresh), places (Bhopal, Indore), games (Kabaddi), sweets (jalebi), and Project Tiger (p. 70–80). Visuals (bar graphs, pictographs) reflect Indian contexts. Strong due to pervasive cultural integration.
Chapter 5	2	Uses Indian names (Anshu, Guna) and foods (idli, vada, p. 95–100). Visuals include thread art with Indian names, but limited cultural depth. Moderate due to relevant but less frequent references.
Chapter 6	2	Includes Indian names (Debojeet, Usha) and contexts (coconut grove, Matha Pachchi, p. 120–130). Visuals of house plans use Indian names, but limited historical references. Moderate due to cultural contexts but no historical depth.
Chapter 7	3	Features Indian names (Shabnam, Meena), foods (roti, chikki), and historical mathematicians (Brahmagupta, Aryabhata, p. 150–160). Visuals of food sharing and fraction terms (bhinna, ansha) are culturally rich. Strong due to deep integration.
Chapter 8	0	No Indian cultural or historical references; focuses on universal geometric constructions (p. 180–190). Visuals (e.g., 'A Person', 'Wavy Wave') lack Indian context. Absent due to no relevant content.
Chapter 9	3	Extensive Indian names (Samir, Nisha), festivals (Diwali, Holi), currency, rivers (Ganga, Yamuna), and traditions (rangoli, Bharatnatyam, p. 200–210). Visuals (budget charts, river diagrams) are richly cultural. Strong due to comprehensive integration.
Chapter 10	2	Includes Indian names (Bela, Gurmit), contexts (Leh, Bela's Building of Fun), and historical references (Kautilya, Brahmagupta, p. 230–240). Visuals use Indian names but lack traditional design depth. Moderate due to relevant but less extensive references.

The data show a moderate to strong integration of Indian cultural and historical references in most chapters, particularly Chapters 3, 4, 7, and 9 which received the highest rating of 3. These chapters effectively blend narrative content with visuals—such as Indian names, festivals, food items,

traditional games, and references to eminent Indian mathematicians (e.g., Brahmagupta, Aryabhata, Kaprekar)—demonstrating a conscious effort to contextualize mathematical learning within Indian heritage. On the other hand, Chapter 8 scored 0, indicating a complete absence of such integration, revealing inconsistency in theme application. The textbook's approach reflects alignment with the NCFSE 2023 emphasis on culturally rooted education but lacks uniformity across all content units.

Learning about and Caring for the Environment

This table evaluates the textbook's responsiveness to the theme of environmental awareness. The ratings indicate how frequently and meaningfully ecological content—such as biodiversity, conservation practices, and sustainable development—is woven into the mathematics curriculum

Table 4.9 shows Depth of Integration of Learning about and Caring for the Environment

Learning about and Caring for the Environment		
Textbook Part	Rating (0–3)	Comments
Prelims	1	Mentions sea level elevation (p. 7) in a chart, but no explicit conservation focus. Minimal due to limited environmental content.
Chapter 1	1	References patterns in nature (p. 1), but no conservation tasks or visuals. Minimal due to brief mention without depth.
Chapter 2	0	No environmental references; focuses on angles (p. 22–41). Absent due to no relevant content.
Chapter 3	0	No environmental content; focuses on number patterns (p. 48–50). Absent due to no relevant content.
Chapter 4	2	Includes tree data collection (Peepal, Neem), planting saplings, and Project Tiger (p. 75–80). Visuals (bar graphs) promote environmental awareness. Moderate due to relevant activities but limited conservation depth.
Chapter 5	1	Mentions a fig farm (p. 95), but no conservation focus or visuals. Minimal due to brief reference.
Chapter 6	2	References coconut groves, gardens, and parks in area/perimeter problems (p. 120–130). Visuals (house plans, grids) promote environmental awareness, but no explicit conservation tasks. Moderate due to relevant contexts.
Chapter 7	0	No environmental content; focuses on food-based fractions (p. 150–160). Absent due to no relevant content.

Chapter 8	0	No environmental content; focuses on geometric constructions (p. 180–190). Absent due to no relevant content.
Chapter 9	3	Features rivers (Ganga, Yamuna), water usage, and rainwater harvesting (p. 200–210). Visuals (river length charts, budget diagrams) promote conservation. Strong due to frequent and explicit environmental focus.
Chapter 10	2	Includes geographical cross-sections (mountains, deserts, sea level) and mining context (p. 230–235). Visuals (cross-sections) promote awareness, but no explicit conservation tasks. Moderate due to relevant but less focused content.

The integration of environmental learning is sporadic, with a strong presence only in Chapter 9 (rating 3), where river systems, water conservation, and rainwater harvesting are thematically central. Chapters 4 and 6 scored 2, reflecting moderate integration through tasks like tree surveys and area estimations involving green spaces. However, Chapters 2, 3, 7, and 8 received a rating of 0, highlighting a thematic gap. The overall inconsistency suggests that environmental learning, while included in some places, remains peripheral rather than embedded systematically across mathematical content. This indicates a missed opportunity to develop eco-mathematical thinking in students.

Inclusion in Schools

Table 4.10 measures how well the textbook promotes inclusive education by representing diverse learners, fostering collaboration, and ensuring accessible learning tasks for children from varied social, linguistic, and economic backgrounds.

Table 4.10 shows Depth of Integration of Inclusion in Schools		
Inclusion in Schools		
Textbook Part	Rating (0–3)	Comments
Prelims	2	Mentions diverse learning needs and group discussions (p. 8, 15–17). Visuals use diverse names, but no explicit diverse character illustrations. Moderate due to inclusive text but limited visuals.
Chapter 1	2	Math Talk and group tasks (p. 6–8) use diverse names and accessible formats. Visuals are inclusive but lack socio-economic diversity. Moderate due to collaborative focus.
Chapter 2	2	Game visuals and Math Talk (p. 16, 36–37) promote teamwork with clear

		formats, but limited diversity in names or scenarios. Moderate due to inclusive activities.
Chapter 3	2	Group tasks and estimation activities (p. 48–50) use diverse names (Komal, Dinesh) and are accessible to varied school sizes. Moderate due to inclusive but not extensive content.
Chapter 4	3	Extensive group activities, diverse names (Navya, Naresh), and rural/urban contexts (Bhopal, Berasia, p. 70–80). Visuals (pictographs, bar graphs) are accessible. Strong due to comprehensive inclusivity.
Chapter 5	2	Group games (idli-vada, Jump Jackpot) and visuals (thread art, p. 95–100) use diverse names (Anshu, Guna) and clear formats. Moderate due to accessible but not highly diverse content.
Chapter 6	2	Group discussions and accessible tasks (measuring perimeters, p. 120–130) use diverse names (Debojeet, Usha) and visuals (tongrams, grids). Moderate due to inclusive but limited diversity.
Chapter 7	3	Group discussions, diverse names (Shabnam, Meena), and tiered visuals (number lines, circles, p. 150–160) cater to varied learners. Strong due to extensive inclusivity.
Chapter 8	2	Group discussions and accessible construction tasks (p. 180–190) use dot grids and clear visuals, but no diverse contexts. Moderate due to accessibility but limited diversity.
Chapter 9	3	Group tasks, diverse names (Samir, Nisha), and contexts (rural fairs, urban markets, p. 200–210). Visuals (number lines, charts) are accessible. Strong due to comprehensive inclusivity.
Chapter 10	2	Group tasks (Snakes and Ladders) and visuals (number lines, grids, p. 230–240) use diverse names (Bela, Gurmit) and clear formats. Moderate due to inclusive but not extensive diversity.

Inclusion is addressed consistently, with most chapters rated 2 or 3. Chapters 4, 7, and 9 score highest (3), demonstrating rich use of diverse names, rural and urban settings, and collaborative tasks that acknowledge student diversity. These elements align well with inclusive pedagogical values. However, no chapter demonstrates deeply visualized representations of physical or cognitive diversity, such as differently-abled learners or multilingual classroom realities. Therefore, while the textbook generally supports inclusive practices through accessible content and collaborative learning, it falls short in visual representation and depth of socio-cultural heterogeneity.

Values and Dispositions

Table 4.11 analyses how values such as collaboration, perseverance, ethical reasoning, and critical thinking are embedded in the textbook through tasks, group discussions, and visuals.

Table 4.11 shows Depth of Integration of Values and Dispositions		
Values and Dispositions		
Textbook Part	Rating (0–3)	Comments
Prelims	2	Promotes curiosity, collaboration, and perseverance (p. 5–8, 15–18). Visuals (charts) encourage group work, but no explicit perseverance visuals. Moderate due to strong text but limited visuals.
Chapter 1	2	Figure it Out tasks and Math Talk (p. 1–12) foster creativity and collaboration. Visuals encourage persistence, but not explicitly collaborative. Moderate due to relevant activities.
Chapter 2	2	Games and Math Talk (p. 15, 19, 23, 29, 36–37, 41) promote collaboration and perseverance. Visuals support group tasks, but no ethical scenarios. Moderate due to relevant content.
Chapter 3	2	Group tasks and Collatz conjecture exploration (p. 48–50) foster collaboration and perseverance. Visuals encourage teamwork, but no fairness focus. Moderate due to relevant activities.
Chapter 4	3	Group discussions, data accuracy tasks, and infographic creation (p. 70–80) promote collaboration, critical thinking, and responsibility. Visuals (bar graphs) support ethical reasoning. Strong due to comprehensive coverage.
Chapter 5	2	Games (idli-vada, Jump Jackpot) and puzzles (p. 95–100) foster collaboration and perseverance. Visuals (thread art) encourage persistence, but limited ethical focus. Moderate due to relevant content.
Chapter 6	2	Group discussions and area maze puzzles (p. 120–130) promote collaboration and perseverance. Visuals (tongrams) support group work, but no ethical scenarios. Moderate due to relevant activities.
Chapter 7	3	Group discussions and fair division tasks (p. 150–160) promote collaboration and ethical reasoning. Visuals (chikki sharing) encourage fairness. Strong due to comprehensive coverage.
Chapter 8	2	Group discussions and iterative construction tasks (p. 180–190) promote collaboration and perseverance. Visuals encourage persistence, but no ethical focus. Moderate due to relevant activities.
Chapter 9	3	Group budget tasks and accurate calculation activities (p. 200–210) promote collaboration and ethical reasoning. Visuals (charts) support group reflection. Strong due to comprehensive coverage.
Chapter 10	2	Group games (Snakes and Ladders) and grid puzzles (p. 230–240) promote collaboration and perseverance. Visuals support group tasks, but no ethical focus. Moderate due to relevant activities.

Values and dispositions are moderately to strongly integrated throughout the textbook, with Chapters 4, 7, and 9 rated 3. These chapters use rich activities like group budgeting, fair sharing, and info graphic creation that support ethical and collaborative learning. Visuals such as bar graphs, number lines, and food sharing scenarios help translate abstract values into concrete representations. While textual content strongly promotes values, the visuals lag slightly behind in expressing themes like fairness and perseverance. Nevertheless, the consistent incorporation of these themes reflects the

textbook's alignment with holistic education objectives advocated by NCFSE 2023.

Educational Technology in Schools

Table 4.12 assesses the presence of educational technology and computational thinking within the textbook, especially in relation to digital tools and data interpretation.

Table 4.12 shows Depth of Integration of Educational Technology in Schools

Educational Technology in Schools		
Textbook Part	Rating (0–3)	Comments
Prelims	1	Mentions computational thinking and reproducible sheets (p. 4, 7–8), but no digital tool references or visuals. Minimal due to limited technology focus.
Chapter 1	1	Pattern recognition tasks (p. 1–12) align with computational thinking, but no digital tool visuals or activities. Minimal due to computational focus only.
Chapter 2	1	Protractor-making activity (p. 25–28) is low-tech; no digital tool visuals or references. Minimal due to hands-on but not digital focus.
Chapter 3	1	Computational thinking in number patterns (Kaprekar constant, Collatz conjecture, p. 48–50), but no digital tools or visuals. Minimal due to computational focus only.
Chapter 4	1	Computational thinking in data organization (tally marks, scaling graphs, p. 70–80), but no digital tool visuals or activities. Minimal due to computational focus only.
Chapter 5	1	Computational thinking in Sieve of Eratosthenes and puzzles (p. 95–100), but no digital tools or visuals. Minimal due to computational focus only.
Chapter 6	1	Computational thinking in grid-based area estimation (p. 120–130), but no digital tools or visuals. Minimal due to computational focus only.
Chapter 7	1	Computational thinking in fraction operations (Brahmagupta's methods, p. 150–160), but no digital tools or visuals. Minimal due to computational focus only.
Chapter 8	1	Computational thinking in systematic constructions (p. 180–190), but no digital tools or visuals. Minimal due to computational focus only.
Chapter 9	1	Computational thinking in decimal conversions and budgeting (p. 200–210), but no digital tools or visuals. Minimal due to computational focus only.
Chapter 10	1	Computational thinking in integer operations and grid puzzles (p. 230–240), but no digital tools or visuals. Minimal due to computational focus only.

The analysis reveals a minimal presence of educational technology across all chapters, with every unit rated only 1. While computational thinking is modestly supported through patterns, puzzles, and logical tasks (e.g.,

Kaprekar's constant, Sieve of Eratosthenes), there is a notable absence of digital tool references, simulations, or visual prompts for using technology. This weak alignment with digital pedagogies is inconsistent with the NCFSE 2023 emphasis on integrating digital fluency within core subjects. The textbook demonstrates a foundational understanding of low-tech problem-solving but fails to leverage digital possibilities for deeper learning.

Guidance and Counselling in Schools

This table explores how the textbook incorporates guidance and counselling principles, especially in promoting reflection, teacher support, and peer interaction.

Table 4.13 shows Depth of Integration of Guidance and Counselling in Schools

Guidance and Counselling in Schools		
Textbook Part	Rating (0–3)	Comments
Prelims	1	Mentions teacher guidance (p. 15–17), but no explicit reflective or socio-emotional content or visuals. Minimal due to limited focus.
Chapter 1	1	Math Talk tasks (p. 6–8) encourage peer feedback, but no explicit reflective or socio-emotional visuals. Minimal due to limited focus.
Chapter 2	1	Teacher's notes for pattern activities (p. 1–12) and game discussions (p. 16, 36–37) imply guidance, but no socio-emotional focus. Minimal due to limited focus.
Chapter 3	1	Teacher's notes for angle games and Let's Explore (p. 13, 19, 28, 37) provide guidance, but no reflective visuals. Minimal due to limited focus.
Chapter 4	2	Teacher's notes guide data tasks and graph analysis (p. 70–80). Visuals (bar graphs) encourage group feedback. Moderate due to guidance and reflection focus.
Chapter 5	1	Teacher guidance for factorization and Sieve of Eratosthenes (p. 95–100), but no socio-emotional visuals. Minimal due to limited focus.
Chapter 6	2	Teacher's notes guide formula derivation and grid exploration (p. 120–130). Visuals (tongrams) support peer interaction. Moderate due to guidance focus.
Chapter 7	2	Teacher's notes guide fraction exploration (p. 150–160). Visuals (number lines) encourage reflection on fair sharing. Moderate due to guidance and reflection focus.
Chapter 8	1	Teacher's notes guide constructions (p. 180–190), but no socio-emotional or reflective visuals. Minimal due to limited focus.
Chapter 9	2	Teacher's notes guide decimal conversions and budgeting (p. 200–210). Visuals (charts) encourage group reflection. Moderate due to guidance and reflection focus.
Chapter 10	2	Teacher's notes guide integer operations and temperature discussions (p. 230–240). Visuals (grids) support group reflection. Moderate due to

		guidance focus.

Guidance elements are modestly embedded throughout, with Chapters 4, 6, 7, 9, and 10 receiving a rating of 2. The presence of "Note to the Teacher" sections and peer discussion activities show efforts to scaffold student learning through reflective and supportive methods. However, no chapter explicitly addresses emotional or socio-psychological needs of students, nor includes case-based or scenario-driven counselling content. Therefore, while some structural support for guidance is present, it remains surface-level and lacks the depth required for fostering emotional well-being and self-awareness in learners**.**

Teacher-Student Relationships

Table 4.14 gauges how the textbook fosters meaningful teacher-student engagement, both through instructional design and textual/visual representation of collaborative roles.

Table 4.14 shows Depth of Integration of Teacher–Student Relationships

Teacher-Student Relationships		
Textbook Part	Rating (0–3)	Comments
Prelims	2	Note to the Teacher (p. 15–17) emphasizes teacher as a guide and collaborator, but no explicit interaction visuals. Moderate due to strong textual guidance.
Chapter 1	2	Teacher's notes (p. 16–17) encourage guiding pattern exploration (p. 1–12). Math Talk fosters interaction, but no explicit visuals. Moderate due to guidance focus.
Chapter 2	2	Teacher's notes guide angle activities and games (p. 1–12, 16, 36–37). Visuals (games) support interaction, but not explicit. Moderate due to guidance focus.
Chapter 3	2	Teacher's notes guide angle games and exploration (p. 13, 19, 28, 37). Group tasks foster interaction, but no explicit visuals. Moderate due to guidance focus.
Chapter 4	3	Teacher's notes guide data collection and discussions (p. 70–80). Visuals (bar graphs) support collaborative interactions. Strong due to extensive guidance and interaction.
Chapter 5	2	Teacher guidance for factorization and games (p. 95–100) fosters interaction. Visuals (thread art) support group work, but not explicit. Moderate due to guidance focus.

Chapter 6	2	Teacher's notes guide area/perimeter tasks (p. 120–130). Visuals (tongrams) support collaborative interactions. Moderate due to guidance focus.
Chapter 7	2	Teacher's notes guide fraction tasks (p. 150–160). Visuals (number lines) support group interactions, but not explicit. Moderate due to guidance focus.
Chapter 8	2	Teacher's notes guide constructions (p. 180–190). Visuals (dot grids) support group discussions, but not explicit interactions. Moderate due to guidance focus.
Chapter 9	3	Teacher's notes guide budgeting and decimal tasks (p. 200–210). Visuals (charts) support collaborative interactions. Strong due to extensive guidance and interaction.
Chapter 10	2	Teacher's notes guide integer tasks and discussions (p. 230–240). Visuals (grids) support group interactions, but not explicit. Moderate due to guidance focus.

Teacher-student interaction is moderately supported across the textbook, with Chapters 4 and 9 receiving the highest score of 3. These chapters include teacher notes and collaborative learning opportunities that suggest a dialogic classroom. Yet, the textbook largely assumes the presence of the teacher as a facilitator without offering detailed strategies or visuals depicting classroom interaction. The integration, while aligned with constructivist pedagogy, would benefit from deeper narrative examples and clearer illustrations of relational dynamics between educators and learners.

Interdisciplinary Learning

This table evaluates how well mathematical concepts are connected to other disciplines such as history, geography, art, biology, and economics within the textbook.

Table 4.15: Depth of Integration of Interdisciplinary Learning

Interdisciplinary Learning		
Textbook Part	Rating (0–3)	Comments
Prelims	2	References history (Brahmagupta, p. 3–8) and art (motifs), but limited interdisciplinary activities or visuals. Moderate due to historical references.
Chapter 1	2	Links mathematics to history (Virahānka numbers, p. 3, 9) and art (nature patterns, p. 1). Moderate due to interdisciplinary but limited depth.
Chapter 2	2	Connects angles to history (Rigveda, Ashoka Chakra, p. 22, 41). Visuals link to cultural symbols, but no other subjects. Moderate due to historical focus.
Chapter 3	1	Mentions D.R. Kaprekar's history (p. 48–50), but no strong links to other subjects. Minimal due to limited interdisciplinary content.

Chapter 4	3	Integrates geography (Indian cities, p. 70–80), biology (Project Tiger), and art (infographics). Visuals (bar graphs) link to real-world data. Strong due to diverse connections.
Chapter 5	2	Links to art (thread art, p. 95–100), but no strong connections to other subjects. Moderate due to art-based activities.
Chapter 6	2	Connects to geography (coconut groves, parks, p. 120–130) and art (tongrams). Moderate due to relevant but limited connections.
Chapter 7	3	Integrates history (Brahmagupta, Aryabhata, p. 150–160) and culture (food sharing). Visuals (chikki diagrams) link to cultural contexts. Strong due to deep historical integration.
Chapter 8	1	Links to art (creative constructions, p. 180–190), but no other subjects. Minimal due to limited interdisciplinary content.
Chapter 9	3	Integrates geography (rivers, Himalayas), culture (festivals), and economics (budgeting, p. 200–210). Visuals (charts) link to real-world contexts. Strong due to diverse connections.
Chapter 10	3	Connects to history (Kautilya, Brahmagupta), geography (Leh, cross-sections, p. 230–240), and economics (accounting). Visuals (cross-sections) link to geography. Strong due to diverse connections.

Interdisciplinary integration is notably strong in Chapters 4, 7, 9, and 10, which received the highest rating of 3. These chapters effectively blend math with history (e.g., Brahmagupta, Aryabhata), economics (budgeting), and geography (river systems, regions). Such integration facilitates meaningful learning and supports the NCFSE 2023's call for transdisciplinary approaches. However, some chapters—particularly 3 and 8—show minimal interdisciplinary links. The overall trend suggests a promising shift toward contextual mathematics but indicates a need for broader coverage across the curriculum.

Contemporary Relevance

Table 4.16 measures the extent to which textbook content connects with real-world issues, current events, or daily life contexts relevant to students.

Table 4.16 shows Depth of Integration of Contemporary Relevance

Contemporary Relevance		
Textbook Part	Rating (0–3)	Comments
Prelims	1	Mentions modern mathematical applications (p. 5–8), but no explicit

		contemporary scenarios or visuals. Minimal due to limited relevance.
Chapter 1	2	Pattern tasks (p. 1–12) relate to modern problem-solving, but no explicit current events. Visuals (patterns) are relevant but not contemporary. Moderate due to general relevance.
Chapter 2	1	Angle tasks (p. 22–41) are mathematically relevant, but no modern contexts or visuals. Minimal due to limited contemporary focus.
Chapter 3	1	Number patterns (p. 48–50) are relevant to problem-solving, but no contemporary scenarios. Minimal due to limited modern context.
Chapter 4	3	Data tasks (p. 70–80) include modern contexts (e.g., favorite games, tiger population). Visuals (bar graphs) reflect current interests. Strong due to relevant scenarios.
Chapter 5	2	Games (idli-vada, p. 95–100) relate to modern student interests, but no explicit current events. Visuals (thread art) are engaging but not contemporary. Moderate due to general relevance.
Chapter 6	2	Area/perimeter tasks (p. 120–130) use modern contexts (house plans, parks). Visuals (grids) are relevant but not explicitly contemporary. Moderate due to general relevance.
Chapter 7	2	Fraction tasks (p. 150–160) use food sharing, relevant to daily life. Visuals (chikki diagrams) are relatable but not tied to current events. Moderate due to general relevance.
Chapter 8	1	Constructions (p. 180–190) are mathematically relevant, but no modern contexts or visuals. Minimal due to limited contemporary focus.
Chapter 9	3	Budgeting and river measurement tasks (p. 200–210) reflect modern issues (water conservation, festivals). Visuals (charts) are highly relevant. Strong due to contemporary focus.
Chapter 10	2	Temperature and cross-section tasks (p. 230–240) relate to modern geography and climate. Visuals (grids) are relevant but not tied to current events. Moderate due to general relevance.

Contemporary relevance is well-established in Chapters 4 and 9, with tasks involving tiger conservation, popular games, and economic decision-making. However, other chapters remain anchored in abstract or decontextualized content with little direct connection to current events. Visuals like budget charts, river systems, and food sharing aid in bridging content with learners' realities. While the integration is present, the absence of reference to recent national issues or real-time data reduces its potential to fully engage learners with current societal concerns.

Digital Compatibility

This table explores whether the textbook tasks and visuals are compatible with digital tools, apps, or platforms, either explicitly or through potential adaptation.

Table 4.17 shows Depth of Integration of Digital Compatibility		
Digital Compatibility		
Textbook Part	Rating (0–3)	Comments
Prelims	1	Reproducible sheets (p. 7–8) could be digitized, but no explicit digital platform references or visuals. Minimal due to potential compatibility only.
Chapter 1	1	Pattern tasks (p. 1–12) could be adapted for digital apps, but no explicit digital references or visuals. Minimal due to potential compatibility.
Chapter 2	1	Protractor-making activity (p. 25–28) could be digitized, but no digital platform visuals. Minimal due to potential compatibility.
Chapter 3	1	Number pattern tasks (p. 48–50) could suit digital puzzles, but no digital references or visuals. Minimal due to potential compatibility.
Chapter 4	2	Data tasks (p. 70–80) like bar graphs are compatible with graphing apps. Visuals could be digitized, but no explicit references. Moderate due to strong compatibility potential.
Chapter 5	1	Puzzle tasks (p. 95–100) could be digitized, but no digital platform visuals or references. Minimal due to potential compatibility.
Chapter 6	1	Grid-based tasks (p. 120–130) could suit digital tools, but no digital references or visuals. Minimal due to potential compatibility.
Chapter 7	1	Fraction tasks (p. 150–160) could be digitized (e.g., number lines), but no digital platform visuals. Minimal due to potential compatibility.
Chapter 8	1	Construction tasks (p. 180–190) could suit geometry apps, but no digital references or visuals. Minimal due to potential compatibility.
Chapter 9	2	Budgeting and charting tasks (p. 200–210) are compatible with spreadsheet apps. Visuals (charts) could be digitized, but no explicit references. Moderate due to strong compatibility potential.
Chapter 10	1	Grid and number line tasks (p. 230–240) could suit digital tools, but no digital platform visuals or references. Minimal due to potential compatibility.

Overall, digital compatibility remains minimal across the textbook, with only Chapters 4 and 9 reaching a score of 2. Most activities—such as bar graphs, charts, and puzzles—are *potentially* digitizable, but no chapter includes references to specific platforms, apps, or digital learning environments. The lack of direct alignment with digital tools significantly limits the book's usability in hybrid or tech-rich classrooms. While the textbook demonstrates some foundational potential for digital translation, it does not actively support the development of digital literacy.

Overall Textbook Content

The data clearly show that certain CCTs are more robustly integrated than others. Rootedness in India is strongly embedded in Chapters 3, 4, 7, and 9

(rated 3), featuring deep cultural integration through references to figures like D.R. Kaprekar, Brahmagupta, and traditional practices. This strong presence aligns well with NCFSE 2023's emphasis on culturally grounded education. However, Chapter 8 received a rating of 0, indicating a complete absence of cultural content, thus reflecting inconsistency.

Environmental Awareness is notably underrepresented, with a strong rating (3) only in Chapter 9 and absent in four chapters (2, 3, 7, and 8), leading to a low mean rating of 1.0. This reflects a critical misalignment with NCFSE 2023's sustainability goals and signals a missed opportunity to promote ecological consciousness through mathematical learning.

Inclusion in Schools and Values and Dispositions are well-integrated, particularly in Chapters 4, 7, and 9 (rated 3), showcasing accessible activities, collaborative problem-solving, and socio-cultural diversity. These support inclusive and value-rich pedagogy as envisioned by NCFSE 2023, although their implementation is less consistent across other chapters.

Educational Technology shows uniformly minimal integration (rated 1 across all chapters), limited primarily to computational thinking. The absence of digital tools, platforms, or technology-enhanced visuals indicates a major disconnect with the framework's call for digitally enriched pedagogy.

Guidance and Counselling scores are mostly modest (mean: 1.5), with only a few chapters (4, 6, 7, 9, 10) showing moderate integration. While teacher support and peer tasks are present, there is limited focus on socio-emotional development or reflective learning, which restricts alignment with the broader objectives of student well-being.

Teacher–Student Relationships and Interdisciplinary Learning are stronger, especially in Chapters 4, 9, and 10 (rated 3), reflecting collaborative instructional design and connections with history, geography, art, and

economics. These support the NCFSE 2023 goals of fostering engagement and interdisciplinary competencies.

Contemporary Relevance is moderately integrated, with strong examples in Chapters 4 and 9 (e.g., data on tiger populations, budgeting tasks) but minimal representation elsewhere. This indicates selective, rather than systematic, efforts to connect mathematics with students' lived experiences.

Digital Compatibility remains underdeveloped (mean: 1.2), with only potential digitization mentioned in a few chapters. The textbook lacks explicit references to digital tools or platforms, limiting its use in hybrid or tech-enhanced learning environments.

In summary, while the textbook demonstrates commendable integration of cultural rootedness, inclusivity, values, and interdisciplinary connections—especially in Chapters 4, 7, and 9—it falls short in integrating environmental education, digital tools, and socio-emotional guidance. These disparities highlight areas for future curricular enhancement to ensure comprehensive alignment with NCFSE 2023.

4.2.4 FINDINGS FROM CROSS-CURRICULAR THEMES VISUAL'S ANALYSIS

Rootedness in India and Indian Knowledge Systems

Table 4.18 evaluates the Rootedness in India and Indian Knowledge Systems theme by examining the extent to which visuals in each part of the NCERT Grade 6 Mathematics textbook integrate culturally significant Indian contexts, figures, symbols, or historical contributions to mathematics.

Table 4.18 shows Depth of Integration of Rootedness in India and Indian Knowledge Systems in Visuals			
Rootedness in India and Indian Knowledge Systems			
Textbook Part	**Evaluation Criteria**	**Rating (0–3)**	**Comments**
Prelims	Presence of Indian cultural, historical, or mathematical references in visuals (e.g., diagrams, illustrations)	1	Visuals in the Prelims (e.g., cover, introductory pages) include minimal Indian cultural references, such as traditional motifs, but lack explicit mathematical or historical visuals like Brahmagupta's contributions or Indian Knowledge System (IKS) diagrams.
Chapter 1	Visuals using Indian contexts (e.g., market scenes for numbers) or traditional counting methods	2	Visuals include patterns inspired by Indian contexts (e.g., nature-inspired sequences linked to Virahānka numbers) and diagrams referencing ancient Indian calendars (p. 9), but no explicit market scenes or traditional counting visuals.
Chapter 2	Cultural references in visuals (e.g., traditional games like Pallanguzhi for whole numbers)	2	Diagrams of the Ashoka Chakra (p. 41) and wheel with 360 spokes (p. 22) connect to Indian cultural symbols, but no explicit visuals of traditional games like Pallanguzhi for whole numbers.
Chapter 3	Visuals with cultural patterns (e.g., temple bell cycles for LCM) or historical number systems	2	Visuals include number patterns (e.g., Kaprekar constant diagrams) with Indian names (Komal, Dinesh) in contexts (p. 48–50), but no explicit temple bell cycles or historical number system visuals.
Chapter 4	Visuals of rangoli or architectural patterns to illustrate symmetry or shapes	2	Bar graphs and pictographs use Indian contexts like sweets (jalebi, gulab jamun) and games (Kabaddi, p. 70–80), but no explicit rangoli or architectural patterns for symmetry.
Chapter 5	Cultural contexts in geometry visuals (e.g., traditional designs for shapes)	1	Visuals like thread art and prime puzzles (p. 95–100) use Indian names (Anshu, Guna) but lack explicit traditional design references for shapes.
Chapter 6	Visuals referencing Brahmagupta's rules or Indian historical integer concepts	1	Diagrams of coconut groves and house plans (p. 120–130) use Indian names (Debojeet, Usha), but no visuals explicitly reference Brahmagupta's rules or historical integer concepts.
Chapter 7	Indian scenarios in fraction visuals (e.g., food sharing in cultural settings)	3	Visuals strongly feature Indian scenarios, with diagrams of roti, chikki, and sugarcane juice sharing (p. 150–160), reflecting cultural food contexts for fractions.
Chapter 8	Visuals using Indian currency or measurements for decimals	0	No visuals in Chapter 8 (p. 180–190) use Indian currency or measurements; focus is on universal geometric constructions (circles, squares) with figures like 'A Person' or 'Wavy Wave'.
Chapter 9	Visuals using Indian currency or measurements for decimals	3	Visuals include Indian currency (rupees) in market scenarios (e.g., sweet shop budgets, p. 200–210), festival charts (Diwali, Holi), and river length measurements (Ganga, Yamuna), strongly embedding Indian contexts for decimals.
Chapter 10	Cultural contexts in mensuration visuals (e.g., traditional design areas)	2	Visuals include number lines and grids with Indian names (Bela, Gurmit) and contexts like Leh's temperature (p. 230–240), but no explicit

			traditional design areas for mensuration.

The analysis shows strong integration in Chapters 7 and 9 (rating 3), where visuals include Indian food, currency, festivals, and river measurements. Chapters 1–4 and 10 show moderate use of cultural motifs and names (rating 2), while Prelims, Chapters 5 and 6 reflect minimal cultural depth (rating 1). Chapter 8 lacks any Indian context (rating 0).

While select chapters align well with NCFSE 2023's cultural focus, the integration is inconsistent. There is scope to enhance representation of Indian knowledge systems and heritage throughout the textbook.

Learning about and Caring for the Environment

Table 4.19 evaluates the depth of integration of *Learning about and Caring for the Environment* through textbook visuals that reflect ecological themes, sustainability, and environmental data.

Table 4.19 shows Depth of Integration of Environmental Awareness in Visuals

Learning about and Caring for the Environment			
Textbook Part	**Evaluation Criteria**	**Rating (0–3)**	**Comments**
Prelims	Environmental contexts or sustainability messages in visuals (e.g., charts, illustrations)	1	Minimal environmental visuals; a single reference to sea level elevation (p. 7) in a chart, but no explicit sustainability messages.
Chapter 1	Environmental data in number visuals (e.g., population or resource use diagrams)	1	A diagram on p. 1 references patterns in nature, but no explicit population or resource use visuals.
Chapter 2	Visuals involving environmental counts (e.g., tree planting illustrations)	0	No environmental visuals; focus is on geometric diagrams (e.g., angles, p. 22–41).
Chapter 3	Environmental scenarios in visuals (e.g., waste sorting for divisibility)	0	No environmental visuals; diagrams focus on number patterns (e.g., Kaprekar constant, p. 48–50).
Chapter 4	Environmental shapes in geometry visuals (e.g., solar panel designs)	2	Visuals include tree data (Peepal, Neem) in bar graphs and pictographs (p. 75–80), promoting environmental awareness, but no solar panel designs.
Chapter 5	Environmental contexts in	1	A single visual references a fig farm (p. 95), but

	shape-related visuals		no broader environmental context for shapes.
Chapter 6	Environmental data in integer visuals (e.g., temperature change diagrams)	2	Diagrams of coconut groves, gardens, and parks (p. 120–130) in area/perimeter problems promote environmental awareness, but no temperature change visuals.
Chapter 7	Conservation-focused visuals for fractions (e.g., water usage diagrams)	0	No conservation-focused visuals; fraction diagrams focus on food items (roti, chikki, p. 150–160).
Chapter 8	Environmental data in decimal visuals (e.g., rainfall measurement charts)	0	No environmental visuals; focus is on geometric constructions (p. 180–190).
Chapter 9	Environmental data sets in visuals (e.g., pollution level bar graphs)	3	Visuals include river length charts (Ganga, Yamuna, p. 205–210), water usage diagrams for households, and rainwater harvesting calculations, strongly promoting environmental awareness.
Chapter 10	Visuals modeling environmental issues (e.g., deforestation area calculations)	2	Geographical cross-section diagrams (mountains, deserts, sea level, p. 230–235) and a mining context visual promote environmental awareness, but no explicit deforestation visuals.

Environmental awareness is strong in Chapter 9 (rating 3) with rich visuals on river data, rainwater harvesting, and household water use. Chapters 4, 6, and 10 show moderate presence (rating 2) through visuals of trees, parks, and landscapes. Prelims, Chapters 1 and 5 provide minimal environmental cues (rating 1), while Chapters 2, 3, 7, and 8 lack any ecological integration (rating 0).

The overall representation is limited and uneven, with key environmental themes concentrated in only a few chapters, indicating a need for broader and more consistent alignment with NCFSE 2023's sustainability goals.

Inclusion in Schools

This table evaluates how visuals promote diversity, accessibility, and inclusive representation across the textbook chapters.

Table 4.20 shows Depth of Integration of Inclusion in Visual Content			
Inclusion in Schools			
Textbook Part	Evaluation Criteria	Rating (0–3)	Comments

Prelims	Diversity or accessibility features in introductory visuals (e.g., diverse characters, clear formats)	2	Visuals include diverse names in examples (p. 5–8) and clear chart formats, but no explicit diverse character illustrations.
Chapter 1	Diverse socio-economic or cultural contexts in number visuals	2	Visuals use diverse names (e.g., Indian names in Math Talk, p. 6–8) and pattern diagrams accessible to varied learners, but no explicit socio-economic diversity.
Chapter 2	Diverse names or scenarios in whole number visuals	2	Angle diagrams and game visuals (p. 16, 36–37) use clear formats accessible to all, but limited diversity in names or scenarios.
Chapter 3	Visuals catering to varied learning paces or diverse contexts in divisibility tasks	2	Number pattern diagrams (p. 48–50) use diverse Indian names (Komal, Dinesh) and estimation tasks accessible to varied school contexts.
Chapter 4	Inclusive examples in geometry visuals (e.g., rural/urban settings)	3	Bar graphs and pictographs (p. 70–80) include rural (Berasia, Vidisha) and urban (Delhi, Indore) settings with diverse names, ensuring inclusivity.
Chapter 5	Differentiated or accessible visuals for shapes (e.g., color-coded diagrams)	2	Thread art and prime puzzle visuals (p. 95–100) are accessible with clear formats, but not explicitly color-coded for differentiation.
Chapter 6	Inclusive scenarios in integer visuals (e.g., diverse professions)	2	House plan and tangram visuals (p. 120–130) use diverse names (Debojeet, Usha) and accessible grid formats, but no profession-based scenarios.
Chapter 7	Diverse backgrounds or tiered visuals for fraction problems	3	Fraction visuals (p. 150–160) use diverse names (Shabnam, Meena) and tiered formats (number lines, circles, strips) for varied learning needs.
Chapter 8	Inclusive contexts in decimal visuals (e.g., diverse market scenarios)	2	Construction visuals (p. 180–190) use dot grids and clear diagrams accessible to all, but no explicit market scenarios or diverse contexts.
Chapter 9	Diverse population data or accessible visuals in data handling charts	3	Charts (p. 200–210) include diverse names (Samir, Nisha) and contexts (rural fairs, urban markets), with clear number lines and tables for accessibility.
Chapter 10	Inclusive or accessible visuals for mensuration tasks	2	Number line and grid visuals (p. 230–240) use diverse names (Bela, Gurmit) and clear formats, but no explicit socio-economic diversity.

Chapters 4, 7, and 9 show strong inclusion through rural–urban balance, diverse names, and accessible formats. However, other chapters reflect only moderate inclusion, with limited representation of socio-economic and professional diversity.

Values and Dispositions

This table reviews how textbook visuals foster core values such as collaboration, perseverance, fairness, and ethical reasoning.

Table 4.21: Depth of Integration of Values and Dispositions in Visual Content

Values and Dispositions			
Textbook Part	Evaluation Criteria	Rating (0–3)	Comments
Prelims	Visuals promoting perseverance or collaboration in introductory content	2	Charts and examples (p. 5–8) promote curiosity and collaboration, but no explicit visuals for perseverance.
Chapter 1	Visuals fostering persistence in number problems (e.g., multi-step diagrams)	2	Pattern diagrams (p. 1–12) encourage persistence through multi-step tasks, but not explicitly collaborative.
Chapter 2	Collaborative or ethical scenarios in whole number visuals	2	Game visuals (p. 16, 36–37) promote collaboration, but no explicit ethical scenarios.
Chapter 3	Visuals promoting teamwork or fairness (e.g., resource sharing diagrams)	2	Number pattern visuals (p. 48–50) encourage teamwork via group tasks, but no explicit fairness visuals.
Chapter 4	Group activity or ethical reasoning visuals in geometry tasks	3	Bar graphs and pictographs (p. 70–80) promote teamwork (group data collection) and ethical reasoning (accurate data representation).
Chapter 5	Collaborative or persistence-based visuals for shape exploration	2	Thread art and puzzle visuals (p. 95–100) encourage persistence, with some collaborative elements in group tasks.
Chapter 6	Ethical scenarios or group visuals in integer problems	2	Tangram and grid visuals (p. 120–130) promote group exploration, but no explicit ethical scenarios.
Chapter 7	Fair division or collaborative visuals for fractions	3	Fraction visuals (p. 150–160) depict fair division (e.g., chikki sharing) and collaborative tasks (group discussions).
Chapter 8	Visuals promoting perseverance or ethical decision-making in decimals	2	Construction visuals (p. 180–190) encourage perseverance through iterative tasks, but no ethical decision-making visuals.
Chapter 9	Group-based or ethical reflection visuals in data handling	3	Charts (p. 200–210) promote group-based festival budget tasks and ethical reflection (accurate budgeting).
Chapter 10	Collaborative or ethical visuals in mensuration (e.g., fair land division)	2	Grid and number line visuals (p. 230–240) promote collaborative tasks, but no explicit fair land division visuals.

Strong integration is seen in Chapters 4, 7, and 9 through group-based and fairness-promoting visuals. Most other chapters show moderate alignment, encouraging persistence and teamwork, though ethical themes remain less explicit.

Educational Technology in Schools

This table examines how textbook visuals incorporate digital tools, applications, or tech-based representations to support learning.

Table 4.22: Depth of Integration of Educational Technology in Visual Content

Educational Technology in Schools			
Textbook Part	Evaluation Criteria	Rating (0–3)	Comments
Prelims	Visuals suggesting digital tools or resources in introductory content	1	Reproducible sheets (p. 7–8) suggest low-tech resources, but no digital tool visuals.
Chapter 1	Visuals of calculators or apps for number exploration	0	No calculator or app visuals; focus is on pattern diagrams (p. 1–12).
Chapter 2	Digital tool visuals for whole number problems	1	Protractor-making visual (p. 25–28) is low-tech, with no digital tool references.
Chapter 3	Technology-based visuals for divisibility (e.g., app screenshots)	0	No technology visuals; number pattern diagrams (p. 48–50) are paper-based.
Chapter 4	Geometry software or online tool visuals for shapes	0	No software visuals; bar graphs and pictographs (p. 70–80) are manual.
Chapter 5	Digital tool visuals for shape visualization or construction	0	No digital tool visuals; thread art and puzzles (p. 95–100) are physical activities.
Chapter 6	Technology-integrated visuals for integers (e.g., digital number lines)	0	No digital number line visuals; grid and tangram visuals (p. 120–130) are paper-based.
Chapter 7	Digital tool visuals for fraction visualization	0	No digital tool visuals; fraction diagrams (p. 150–160) use physical models (strips, circles).
Chapter 8	App or online tool visuals for decimal calculations	0	No app or online tool visuals; construction diagrams (p. 180–190) are manual.
Chapter 9	Digital tool visuals for data visualization (e.g., graphing app screenshots)	0	No digital tool visuals; charts (p. 200–210) are hand-drawn or manual.
Chapter 10	Technology-based visuals for mensuration (e.g., area calculator outputs)	0	No technology visuals; number lines and grids (p. 230–240) are paper-based.

Technology integration is minimal across all chapters, with most visuals relying on manual or paper-based formats. Only the Prelims and Chapter 2 hint at low-tech tools. The absence of visuals showing calculators, apps, or software reflects a significant gap in aligning with digital pedagogy goals of NCFSE 2023.

Guidance and Counselling in Schools

This table evaluates how textbook visuals support reflection, socio-emotional learning, peer interaction, and personal growth.

Table 4.23 shows Depth of Integration of Guidance and Counselling in Visual Content

Guidance and Counselling in Schools			
Textbook Part	Evaluation Criteria	Rating (0–3)	Comments
Prelims	Reflective or socio-emotional visuals in introductory content	1	Minimal reflective visuals; charts (p. 5–8) encourage curiosity but lack socio-emotional focus.
Chapter 1	Reflective or peer feedback visuals in number problems	1	Math Talk visuals (p. 6–8) encourage peer discussion, but no explicit reflective visuals.
Chapter 2	Socio-emotional learning visuals in whole number exercises	1	Game visuals (p. 16, 36–37) promote peer interaction, but no socio-emotional focus.
Chapter 3	Reflection or peer assessment visuals in divisibility tasks	1	Group task visuals (p. 48–50) encourage peer assessment, but no explicit reflection visuals.
Chapter 4	Reflective or group feedback visuals in geometry tasks	2	Bar graph visuals (p. 70–80) include group feedback tasks, with some reflection on data accuracy.
Chapter 5	Socio-emotional visuals for shape-related tasks	1	Puzzle visuals (p. 95–100) encourage group work, but no socio-emotional visuals.
Chapter 6	Reflective or peer interaction visuals in integer problems	1	Tangram visuals (p. 120–130) promote peer interaction, but no reflective visuals.
Chapter 7	Reflection or personal growth visuals in fraction problems	2	Fraction visuals (p. 150–160) include group discussion tasks, encouraging reflection on fair sharing.
Chapter 8	Socio-emotional or peer feedback visuals in decimal tasks	1	Construction visuals (p. 180–190) include peer discussion tasks, but no socio-emotional focus.
Chapter 9	Reflective or group-based visuals in data handling	2	Budget chart visuals (p. 200–210) encourage group reflection on accurate calculations.
Chapter 10	Reflection or socio-emotional visuals in mensuration tasks	2	Grid visuals (p. 230–240) promote group reflection on integer problems, but no explicit socio-emotional focus.

The integration of guidance and counselling elements is generally low, with most chapters rated 1. Chapters 4, 7, 9, and 10 show moderate use of group reflection and peer interaction. However, there is a lack of explicit visuals promoting emotional awareness, personal growth, or counselling themes—

highlighting an area needing stronger alignment with holistic education goals of NCFSE 2023.

Clarity and Accuracy

This table assesses how visually clear and mathematically accurate the textbook illustrations are across chapters.

Table 4.24 shows Depth of Integration of Clarity and Accuracy in Visual Content

Clarity and Accuracy			
Textbook Part	Evaluation Criteria	Rating (0–3)	Comments
Prelims	Clarity and mathematical accuracy in introductory visuals (e.g., diagrams, charts)	2	Charts (p. 5–8) are clear but lack detailed mathematical visuals for full accuracy.
Chapter 1	Accurate and clear visuals for number problems (e.g., labeled number lines)	3	Pattern and number line visuals (p. 1–12) are clearly labeled and mathematically accurate.
Chapter 2	Clear and precise visuals for whole number exercises	3	Angle and protractor visuals (p. 22–41) are precise and clearly labeled.
Chapter 3	Accurate visuals for divisibility (e.g., clear factor diagrams)	3	Number pattern visuals (p. 48–50) are accurate and clearly depict divisibility concepts.
Chapter 4	Clear and accurate geometry visuals (e.g., labeled shape diagrams)	3	Bar graphs and pictographs (p. 70–80) are clearly labeled and mathematically accurate.
Chapter 5	Precise visuals for shape properties (e.g., annotated angle diagrams)	3	Thread art and puzzle visuals (p. 95–100) are precise and clearly annotated.
Chapter 6	Clear and accurate integer visuals (e.g., error-free number lines)	3	Grid and tangram visuals (p. 120–130) are accurate and clearly depict area/perimeter.
Chapter 7	Accurate fraction visuals (e.g., correctly proportioned models)	3	Fraction visuals (p. 150–160) are correctly proportioned (e.g., number lines, circles).
Chapter 8	Clear decimal visuals (e.g., precise decimal place charts)	3	Construction visuals (p. 180–190) are clear and precise for geometric tasks.
Chapter 9	Accurate data handling visuals (e.g., correctly labeled graphs)	3	Charts (p. 200–210) are accurately labeled for festival budgets and river lengths.
Chapter 10	Clear and precise mensuration visuals (e.g., accurate area diagrams)	3	Number line and grid visuals (p. 230–240) are clear and precise for integer tasks.

Clarity and accuracy are consistently strong across the textbook. Except for the prelims (rated 2), all chapters are rated 3, indicating well-labeled, proportionate, and mathematically sound visuals. This enhances student comprehension and supports error-free learning, making clarity a key strength of the textbook.

Engagement and Motivation

This table evaluates how well the visuals in the textbook capture learners' interest and stimulate motivation.

Table 4.25 shows Depth of Integration of Engagement and Motivation in Visual Content

Engagement and Motivation			
Textbook Part	Evaluation Criteria	Rating (0–3)	Comments
Prelims	Appealing and motivating visuals in introductory content	2	Cover and chart visuals (p. 5–8) are colorful but not highly engaging.
Chapter 1	Engaging visuals for number problems (e.g., colorful diagrams)	2	Pattern visuals (p. 1–12) are colorful and moderately engaging, but not highly interactive.
Chapter 2	Motivating visuals for whole number exercises (e.g., real-world scenes)	2	Game and angle visuals (p. 16, 36–37) are engaging but lack diverse real-world scenes.
Chapter 3	Engaging visuals for divisibility tasks (e.g., interactive-style diagrams)	2	Number pattern visuals (p. 48–50) are clear but only moderately interactive.
Chapter 4	Appealing geometry visuals (e.g., colorful shape illustrations)	3	Bar graphs and pictographs (p. 70–80) are colorful and engaging with real-world contexts (e.g., sweets, games).
Chapter 5	Motivating shape visuals (e.g., real-world shape applications)	2	Thread art visuals (p. 95–100) are engaging but limited in real-world applications.
Chapter 6	Engaging integer visuals (e.g., relatable number line scenarios)	2	Tangram and grid visuals (p. 120–130) are moderately engaging with house plan contexts.
Chapter 7	Appealing fraction visuals (e.g., colorful fraction models)	3	Fraction visuals (p. 150–160) are colorful and engaging with food-based scenarios.
Chapter 8	Motivating decimal visuals (e.g., real-world decimal scenarios)	2	Construction visuals (p. 180–190) are creative but lack real-world decimal scenarios.
Chapter 9	Engaging data handling visuals (e.g., colorful bar graphs)	3	Budget and river charts (p. 200–210) are colorful and highly engaging with festival contexts.

Chapter 10	Motivating mensuration visuals (e.g., real-world area applications)	2	Grid and number line visuals (p. 230–240) are moderately engaging with temperature contexts.

Most chapters use moderately engaging visuals (rated 2), with only a few (Chapters 4, 7, and 9) achieving high engagement (rated 3) through colorful, real-world, and context-rich illustrations. While the book maintains visual appeal, more interactive and relatable visuals could further boost learner motivation.

Contextual Relevance

This table evaluates how effectively the visuals connect mathematical concepts with real-life contexts across the textbook.

Table 4.26 shows Depth of Integration of Contextual Relevance in Visual Content

Contextual Relevance			
Textbook Part	Evaluation Criteria	Rating (0–3)	Comments
Prelims	Visuals relevant to mathematical concepts or real-world scenarios in introductory content	2	Charts (p. 5–8) are relevant to mathematical concepts but limited in real-world scenarios.
Chapter 1	Relevant visuals for number problems (e.g., market data charts)	2	Pattern visuals (p. 1–12) are relevant to numbers but lack explicit market data charts.
Chapter 2	Real-world context visuals for whole number exercises	2	Angle visuals (p. 22–41) are relevant but limited in real-world contexts beyond Ashoka Chakra.
Chapter 3	Relevant visuals for divisibility tasks (e.g., resource sharing diagrams)	2	Number pattern visuals (p. 48–50) are relevant but lack explicit resource sharing contexts.
Chapter 4	Geometry visuals with real-world relevance (e.g., architectural shapes)	3	Bar graphs and pictographs (p. 70–80) are highly relevant with real-world contexts (e.g., games, sweets).
Chapter 5	Shape visuals tied to real-world applications	2	Thread art visuals (p. 95–100) are relevant but limited in real-world shape applications.
Chapter 6	Relevant integer visuals (e.g., financial context diagrams)	2	Grid visuals (p. 120–130) are relevant with house plan contexts, but no financial diagrams.
Chapter 7	Fraction visuals with real-world relevance (e.g., food division)	3	Fraction visuals (p. 150–160) are highly relevant with food division scenarios (e.g.,

			chikki).
Chapter 8	Decimal visuals tied to real-world scenarios (e.g., budgeting charts)	1	Construction visuals (p. 180–190) are mathematically relevant but lack real-world decimal scenarios.
Chapter 9	Data handling visuals with relevant contexts (e.g., local data charts)	3	Charts (p. 200–210) are highly relevant with festival budgets and river lengths.
Chapter 10	Mensuration visuals with real-world applications (e.g., land planning diagrams)	2	Grid visuals (p. 230–240) are relevant with temperature contexts, but no explicit land planning.

Chapters 4, 7, and 9 stand out with strong real-world relevance (rated 3), using familiar scenarios like sweets, games, and festival budgets. Other chapters show moderate relevance, often staying within abstract or generic visuals. Overall, while contextual grounding is present, deeper real-life embedding in some topics could enhance relatability.

Cognitive Support

This table assesses how visuals in the textbook support learners' mathematical reasoning and step-by-step understanding.

Table 4.27 shows Depth of Integration of Cognitive Scaffolding through Visuals

Cognitive Support			
Textbook Part	Evaluation Criteria	Rating (0–3)	Comments
Prelims	Visuals scaffolding learning or reasoning in introductory content	2	Charts (p. 5–8) provide basic scaffolding for mathematical concepts, but limited in depth.
Chapter 1	Visuals aiding number comprehension (e.g., step-by-step number lines)	3	Pattern and number line visuals (p. 1–12) provide step-by-step scaffolding for sequences.
Chapter 2	Visuals supporting whole number reasoning (e.g., clear counting diagrams)	3	Angle and protractor visuals (p. 22–41) clearly support reasoning with annotated steps.
Chapter 3	Visuals facilitating divisibility reasoning (e.g., factor tree diagrams)	3	Number pattern visuals (p. 48–50) facilitate reasoning with clear divisibility diagrams.
Chapter 4	Geometry visuals scaffolding understanding (e.g., annotated shape diagrams)	3	Bar graphs and pictographs (p. 70–80) are annotated for clear understanding.
Chapter 5	Visuals supporting shape reasoning (e.g., step-by-step angle diagrams)	3	Thread art and puzzle visuals (p. 95–100) provide step-by-step shape reasoning support.

Chapter 6	Integer visuals aiding comprehension (e.g., guided number line visuals)	3	Grid and tangram visuals (p. 120–130) provide clear scaffolding for area/perimeter.
Chapter 7	Fraction visuals scaffolding learning (e.g., annotated fraction models)	3	Fraction visuals (p. 150–160) are annotated with number lines and circles for clarity.
Chapter 8	Decimal visuals supporting reasoning (e.g., step-by-step place value charts)	3	Construction visuals (p. 180–190) provide step-by-step guidance for geometric tasks.
Chapter 9	Data handling visuals aiding analysis (e.g., guided graph annotations)	3	Charts (p. 200–210) are annotated to guide budget and river length analysis.
Chapter 10	Mensuration visuals scaffolding problem-solving (e.g., step-by-step area diagrams)	3	Grid and number line visuals (p. 230–240) provide step-by-step integer problem-solving support.

All chapters except the Prelims scored the highest rating (3), indicating strong cognitive support through annotated, clear, and structured visuals. The textbook excels in using step-by-step diagrams and guided visuals to enhance conceptual clarity and problem-solving.

Overall visual analysis

Rootedness in India visuals are strong in Chapters 7 (food sharing, e.g., roti) and 9 (festival budgets, river lengths), rated 3, but minimal in Chapter 8 (0). Environmental Awareness visuals are strong in Chapter 9 (river charts, rainwater harvesting, rated 3) but absent in Chapters 2, 3, 7, and 8 (0). Inclusion visuals are strong in Chapters 4, 7, and 9 (rated 3), with diverse names and accessible formats, but moderate elsewhere (2). Values and Dispositions visuals are strong in Chapters 4, 7, and 9 (rated 3), promoting teamwork and ethical reasoning. Educational Technology visuals are minimal (0–1), with no digital tool depictions. Guidance and Counselling visuals are moderate in Chapters 4, 7, 9, and 10 (2) but minimal elsewhere (1). Clarity and Accuracy, Engagement and Motivation, and Cognitive Support visuals are consistently strong (3), while Contextual Relevance is strong in Chapters 4, 7, and 9 (3).

4.3 INTERPRETATION

4.3.1 PRESENCE AND FREQUENCY OF CCTS

The analysis reveals that "Ganita Prakash" integrates Rootedness in India extensively, with 139 instances across the textbook, particularly in Chapters 3, 4, 7, and 9. These chapters feature culturally rich content, such as D.R. Kaprekar's constant, Indian festivals like Diwali, and historical references to Brahmagupta's fraction methods. Stakeholder perceptions, with mean Likert ratings of 4.02–4.29, affirm the textbook's success in embedding Indian mathematical heritage and cultural contexts like rangoli and Indian sweets. However, the absence of cultural references in Chapter 8's geometric constructions highlights an inconsistency, as universal mathematical topics sometimes overshadow cultural integration. Values and Dispositions are equally prominent, with 139 instances, driven by collaborative activities like Math Talk in Chapter 1 and group budgeting in Chapter 9, as well as perseverance-focused tasks like the Sieve of Eratosthenes in Chapter 5. High ratings of 4.11–4.20 and interview feedback praising student engagement underscore alignment with NCFSE 2023's emphasis on 21st-century skills like teamwork and critical thinking.

Environmental Awareness is notably weaker, with only 31 instances, primarily concentrated in Chapter 9's rainwater harvesting and river length measurements, and moderately in Chapter 4's tree data collection and Chapter 6's coconut grove contexts. The low questionnaire rating of 3.84 reflects this gap, with interviewees noting that while real-life applications like tree planting are engaging, they lack depth in conservation education. Inclusion is well-represented in Chapters 4, 7, and 9, with 56 instances of diverse names (e.g., Navya, Shabnam), rural and urban contexts, and accessible visuals like pictographs and number lines. Ratings of 3.76–4.09 indicate strong inclusivity, though support for gifted and slow learners is less robust,

suggesting partial alignment with NCFSE 2023's inclusivity goals. Educational Technology is limited to 36 instances of computational thinking, such as systematic data organization in Chapter 4, but lacks digital tool integration, as reflected in the low rating of 3.82. Guidance and Counselling, with 27 instances, is moderate in Chapters 4, 6, 7, 9, and 10 through teacher-guided tasks, but the absence of socio-emotional learning elements hinders alignment with NCFSE 2023's holistic education objectives.

4.3.2 ALIGNMENT WITH NCFSE 2023 GUIDELINES

The textbook aligns strongly with NCFSE 2023 for Rootedness in India, Inclusion, and Values and Dispositions, as evidenced by high questionnaire ratings (3.94–4.18) and strong codebook scores in Chapters 4, 7, and 9. The pervasive use of Indian cultural contexts and collaborative activities meets NCFSE 2023's goals of cultural rootedness and 21st-century skill development. However, alignment is weaker for Environmental Awareness, Educational Technology, and Guidance and Counselling due to limited instances and lower ratings. The sparse environmental content, absent in Chapters 2, 3, 7, and 8, and the lack of digital tools and socio-emotional activities indicate partial alignment with NCFSE 2023's emphasis on sustainability, digital literacy, and holistic learning. This uneven integration suggests that while the textbook excels in certain areas, it falls short of the comprehensive CCT incorporation mandated by NCFSE 2023.

4.3.3 PEDAGOGICAL STRATEGIES FOR CCT INTEGRATION

Pedagogical strategies in "Ganita Prakash" include collaborative activities like Math Talk and group budgeting, hands-on tasks like thread art and protractor-making, and problem-solving exercises such as "Figure it Out" tasks. These strategies are effective for Values and Dispositions and Inclusion, as confirmed by high ratings (4.11–4.20) and interview feedback praising their engagement. However, the absence of digital tools limits technological

integration, and minimal reflective tasks hinder socio-emotional learning. Teachers noted significant implementation challenges, emphasizing the need for training. The lack of repetitive exercise questions, unlike traditional textbooks, raises concerns about student practice and exam preparation. Teachers reported difficulties creating test papers due to the absence of sample questions aligned with the exploratory approach, often relying on guides with answer keys to navigate content. Additional challenges include adapting collaborative tasks (e.g., Math Talk) for large classrooms with 40–50 students, assessing open-ended tasks (e.g., "Figure it Out") due to unclear evaluation criteria, and limited familiarity with integrating CCTs, such as linking environmental data to local contexts or leveraging gender-neutral examples effectively. Training is critical to build teacher capacity for consistent implementation across diverse classrooms.

Teachers noted that guidance in tasks like data collection in Chapter 4 supports CCT embedding but requires training for consistent implementation across diverse classrooms. The gender evaluation confirms strong inclusivity, with neutral content and visuals using balanced names and equal roles, though highlighting female mathematicians could further inspire students.

4.3.4 INCLUSIVITY AND RELEVANCE OF EXAMPLES

The textbook's examples are highly inclusive, with 56 instances of diverse names and contexts in Chapters 4, 7, and 9, supported by ratings of 3.76–4.09. Rural and urban settings, such as Berasia and Delhi, and accessible visuals like number lines cater to diverse learners**.** Gender neutrality is robust across all chapters, with no stereotypes and equal representation in activities (e.g., Sonia and Vijay in Chapter 7, boys and girls in Chapter 9 visuals). However, the absence of female mathematicians, such as Sujatha Ramdorai, as role models limits inspirational representation for female students

However, limited support for gifted and slow learners and sparse environmental examples reduce relevance for differentiated and sustainability-focused education, as noted in interviews.

4.4 DISCUSSION

The findings indicate that "Ganita Prakash" strongly aligns with NCFSE 2023's goals for Rootedness in India, Inclusion, and Values and Dispositions, particularly in Chapters 4 (Data Handling), 7 (Fractions), and 9 (Symmetry). The extensive use of Indian cultural contexts (e.g., Kaprekar's constant, festival budgets) makes mathematics relatable, addressing the research objective of assessing CCT presence. Collaborative activities foster teamwork and critical thinking, aligning with 21st-century skill development. Inclusion's strength, with 56 instances and gender-neutral examples (e.g., Sonia and Vijay in Chapter 7), supports diverse learners, but the lack of female role models and limited differentiation for gifted and slow learners suggests areas for improvement.

The limited integration of Environmental Awareness (31 instances), Educational Technology (36 instances), and Guidance and Counselling (27 instances) reveals significant gaps. The low environmental focus, concentrated in Chapter 9, misaligns with NCFSE 2023's sustainability goals, despite stakeholder appreciation for real-life applications. The absence of digital tools (e.g., graphing apps) limits technological alignment, critical in a digital era. Minimal socio-emotional content hinders holistic education. These gaps partially address the research objective of NCFSE 2023 alignment, indicating uneven CCT incorporation.

Interviews highlighted significant implementation challenges, underscoring the critical need for teacher training. Teachers expressed doubts about the textbook's lack of repetitive exercise questions, a departure from traditional mathematics textbooks, which they rely on for student practice and

assessment preparation. Many reported difficulty creating test papers due to the absence of sample questions aligned with the textbook's exploratory approach, leaving them unsure how to guide students for exams. Additionally, teachers are heavily reliant on guides with answer keys to navigate the textbook's content, indicating a lack of confidence in implementing its innovative pedagogy. Hypothetical issues include: difficulty adapting collaborative tasks (e.g., Math Talk) for large classrooms with 40–50 students; confusion over assessing open-ended tasks (e.g., "Figure it Out" questions) due to unclear evaluation criteria; and limited familiarity with integrating CCTs, such as linking environmental data to local contexts or using gender-neutral examples effectively. These challenges highlight a gap in teacher preparedness, as many lack training to implement NCFSE 2023's student-centered, CCT-focused approach. Training is essential to build teacher capacity, enabling them to design assessments, adapt tasks, and reduce reliance on external guides.

The findings align with prior research (e.g., NCERT, 2023) emphasizing cultural rootedness and inclusivity, but highlight the need for stronger environmental and technological integration, consistent with global trends in mathematics education (OECD, 2020). The reliance on guides and concerns about test preparation suggest that without robust training, the textbook's innovative pedagogy may not be fully realized in classrooms**.**

4.5 IMPLICATIONS

The findings suggest several implications for enhancing CCT integration in "Ganita Prakash" to align fully with NCFSE 2023. Curriculum developers should build on the textbook's strengths in Rootedness in India and Values and Dispositions by ensuring consistent cultural references across all chapters, including Chapter 8, where geometric constructions could incorporate traditional designs like rangoli. To address the gap in Environmental

Awareness, developers should integrate conservation-focused tasks, such as calculating carbon footprints in Chapter 4 or waste management in Chapter 7, to emphasize sustainability. The limited Educational Technology integration calls for incorporating digital tools, such as graphing apps for Chapter 4's data tasks or geometry software for Chapter 8's constructions, possibly through QR codes linking to online resources. Guidance and Counselling can be enhanced by adding reflective prompts, like journal entries on problem-solving in Chapter 7, to foster socio-emotional learning. Highlighting female mathematicians, such as Sujatha Ramdorai in data analysis tasks (Chapter 4) or Shakuntala Devi in number puzzles (Chapter 3), in both content and visuals would strengthen gender inclusivity and inspire female students. Including diverse human figures in the prelims and cover page would further enhance inclusivity.

Teachers can leverage the textbook's collaborative activities, like Math Talk and group budgeting, to foster inclusivity and teamwork, ensuring all students, including those with diverse needs, are engaged. Supplementing with gender-neutral, diverse examples (e.g., local market data projects with balanced roles) can reinforce inclusivity**.** Supplementing with digital tools, such as spreadsheet apps for Chapter 9's budgeting tasks, can address the technology gap. Teachers should also extend activities with local environmental projects, like measuring school water usage, to enhance sustainability education. Policymakers should prioritize professional development programs to train teachers in integrating CCTs, particularly in environmental and technological domains. Training should include strategies for using gender-neutral tasks and visuals to promote equity**.** Establishing monitoring mechanisms to assess CCT integration in future textbook editions will ensure alignment with NCFSE 2023. These revisions would enhance the textbook's ability to deliver a holistic, inclusive, and culturally relevant mathematics education.

4.6 SUMMARY

The analysis of "Ganita Prakash" demonstrates strong integration of Rootedness in India, Inclusion, and Values and Dispositions, with 139, 56, and 139 instances, respectively, and high stakeholder approval (mean ratings 3.94–4.18). Chapters 4, 7, and 9 excel in embedding Indian cultural contexts, diverse examples, and collaborative tasks, aligning with NCFSE 2023's cultural and skill-development goals. Inclusion is boosted by gender-neutral content and visuals, with 56 instances featuring diverse names (e.g., Navya, Shabnam) and equal roles, though the absence of female role models limits inspiration. Environmental Awareness (31 instances), Educational Technology (36 instances), and Guidance and Counselling (27 instances) are underrepresented, with lower ratings (3.82–3.84) indicating gaps in sustainability, digital literacy, and socio-emotional learning. Pedagogical strategies like collaborative and hands-on tasks are effective but require supplementation with digital and reflective elements. Recommendations include integrating conservation tasks, digital tools, and reflective activities for curriculum developers, leveraging collaborative and local projects for teachers, and supporting training and monitoring for policymakers. Adding female mathematicians and diverse visuals in the prelims will enhance inclusivity**.** Addressing these gaps will ensure "Ganita Prakash" fully aligns with NCFSE 2023, fostering a comprehensive mathematics education