CHAPTER 3: RESEARCH METHODOLOGY

Research methodology refers to the systematic approach and techniques used to collect, analyse, and interpret data in order to answer research questions and achieve research objectives. This section outlines the methodological framework of the study, detailing the research design, population and sampling methods and data collection tools.

3.1 METHODOLOGY

This study employed a mixed-methods research approach, integrating qualitative and quantitative methods to critically analyse the integration of Cross-cutting Themes (CCTs) in the NCERT Sixth Grade Mathematics Textbook, as aligned with the National Curriculum Framework for School Education (NCFSE) 2023. The mixed-methods design combined qualitative content analysis of the textbook with quantitative analysis of survey data from teachers and student-teachers, providing a comprehensive evaluation of CCT representation and stakeholder perceptions.

The qualitative component involved thematic content and visual analysis of the textbook to assess how CCTs—Rootedness in India, Environmental Awareness, Inclusion in Schools, Values and Dispositions, Educational Technology, and Guidance and Counselling—are embedded in chapters, examples, exercises, and pedagogical strategies. This approach enabled an in-depth exploration of the context, depth, and effectiveness of CCT integration, addressing research questions related to alignment with NCFSE 2023 and pedagogical strategies.

The quantitative component included statistical analysis of 45 valid survey responses from teachers and student-teachers, collected via a structured questionnaire. This analysis quantified perceptions of CCT integration using percentages and means to evaluate agreement. Additionally, a quantitative

coding framework measured the frequency and distribution of CCT-related content in the textbook, complementing qualitative findings with numerical insights.

The study adopted a descriptive research design, systematically describing the presence, depth, and pedagogical implementation of CCTs without inferring causality. This design is appropriate for evaluating educational materials and stakeholder perceptions within the Bhopal context, aligning with the study's objectives of assessing NCFSE 2023 compliance.

3.2 POPULATION AND SAMPLE

3.2.1 POPULATION OF THE STUDY:

The population of this study included all sixth-grade mathematics teachers and student teachers who are teaching the newly revised NCERT mathematics textbook, aligned with the NCFSE 2023 guidelines, in Central Government Schools within Bhopal and other Schools associated to Regional Institute of Education through Internship program. Teachers were chosen as they have direct experience with the curriculum and can provide valuable insights into how the textbook is being used in real classroom settings. Student teachers are more in touch with latest changes in the Policies and keen observer to the NCFSE and therefore they were also included.

3.2.2 SAMPLE FOR THE STUDY:

The sample comprised 45 valid survey responses from mathematics teachers in randomly selected Central Government Schools in Bhopal and student-teachers from RIE, Bhopal, who have taught the NCERT Sixth Grade Mathematics Textbook during their internship. Initially, 67 responses were collected, but 22 were excluded due to repetitions or incomplete submissions.

3.2.3 SAMPLING TECHNIQUE:

A random sampling technique was used to select the Central Government Schools located in Bhopal and Schools associated with internship Programme of RIE Bhopal. All mathematics teachers from selected schools and RIE student-teachers associated to internship Schools teaching the Grade 6 Mathematics textbook in these schools were included in the study.

3.3 TOOL

3.3.1 QUESTIONNAIRE

A questionnaire, designed based on the six NCFSE 2023 CCTs, collected data from teachers and student-teachers. Section A gathered demographic information, while Section B included 27 items on a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) to assess perceptions of CCT integration. Open-ended questions captured reflective feedback, supplemented by informal, unstructured interviews to contextualize responses.The detailed questionnaire is attached in the appendices section.

3.3.2 CHECKLIST

A checklist quantified the presence and frequency of CCTs in the textbook's content and visuals. Criteria included mentions of Indian mathematicians or cultural patterns (Rootedness), environmental data exercises (Environment), diverse examples (Inclusion), and tasks promoting perseverance or collaboration (Values), digital tool activities (Technology), and socio-emotional learning content (Guidance).

3.3.3 CONTENT ANALYSIS TOOL

This tool provided a structured framework to evaluate the content of the NCERT Grade 6 Mathematics Textbook in alignment with the NCFSE 2023**.**

It assessed how well the textbook integrates six Cross-Cutting Themes (CCTs)—Rootedness in India, Environmental Awareness, Inclusion in Schools, Values and Dispositions, Educational Technology, and Guidance and Counselling—along with four pedagogical and contextual parameters: Teacher–Student Relationships, Interdisciplinary Learning, Contemporary Relevance, and Digital Compatibility. Each theme or parameter is examined through **a** 0–3 rating scale based on depth and pedagogical significance. This rating scale is described more in the appendices section.

3.3.4 VISUAL ANALYSIS TOOL

The Visual Analysis Tool is a research-oriented framework designed to systematically evaluate visuals in the NCERT Grade 6 Mathematics Textbook for their alignment with NCFSE 2023. It integrates six Cross-Cutting Themes and four pedagogical aspects into a unified 0–3 rating scale, enabling consistent, evidence-based assessment. The tool emphasizes not just presence but depth and instructional value of visuals, supporting both quantitative scoring and qualitative insights. It aids in identifying curricular alignment, thematic integration, and pedagogical strengths or gaps, making it a valuable instrument for textbook analysis and educational research.This rating scale is described more in the appendices section.

3.4 PROCEDURE OF THE STUDY

The study was conducted through a rigorous, multi-phase procedure to ensure systematic data collection, analysis, and interpretation, aligning with best practices in mixed-methods research. The process began with the development of the research tools, starting with the questionnaire, which was carefully designed to align with the six CCTs of NCFSE 2023. The initial draft was crafted based on a thorough review of the NCFSE 2023 document and relevant educational literature to ensure theoretical grounding. The questionnaire was then reviewed to validate its content and alignment with

study objectives. Feedback was incorporated to refine question clarity, ensure relevance to CCTs, and enhance response reliability, resulting in a final version with 27 Likert-scale items and open-ended prompts.

Simultaneously, the checklist, content analysis codebook and visual analysis codebook, were developed, drawing on NCFSE 2023 guidelines and existing frameworks for textbook analysis. Each tool was piloted on a sample chapter of the NCERT Sixth Grade Mathematics Textbook to test clarity, applicability, and rating consistency. Pilot feedback from two RIE student teachers led to minor adjustments, such as clarifying rating scale descriptors and adding specific examples for each CCT, ensuring robust evaluation criteria.

Data collection proceeded in three stages over a four-week period to accommodate the diverse schedules of teachers and student-teachers. In the first stage, the questionnaire was administered to 67 participants from randomly selected Central Government Schools in Bhopal and RIE-affiliated internship schools. Distribution occurred through both in-person sessions at schools and secured online platforms to maximize accessibility. Participants were briefed on the study's purpose, confidentiality measures, and instructions for completing the questionnaire, ensuring informed consent. Of the 67 responses, 45 were deemed valid after screening for completeness and originality.

In the second stage, informal, unstructured interviews were conducted with 45 participants. Interviews were held in person at school premises or via telephone, lasting 15–20 minutes each, and guided by open-ended prompts such as "How does the textbook incorporate cultural contexts?" or "What challenges do you face in using its visuals?" Responses were audio-recorded with consent, transcribed verbatim, and coded for themes related to CCT integration, providing rich qualitative data to complement survey findings.

In the third stage, the entire NCERT Sixth Grade Mathematics Textbook was analysed using the structured checklist, content analysis codebook and visual analysis codebook. The checklist quantified the frequency of CCTs across chapters, while the codebooks rated depth on a 0–3 scale (Absent, Superficial, Moderate, and Profound).

Data analysis integrated qualitative and quantitative approaches. Quantitative data from the questionnaire and checklist were entered into spreadsheets and analysed using descriptive statistics (percentages and means) to summarize perceptions and CCT frequency. Qualitative data from interviews and open-ended responses were analysed using thematic coding, with initial codes derived from NCFSE 2023 CCTs and emergent themes identified through iterative review. The content and visual analysis codebooks provided structured frameworks for qualitative depth analysis, with findings triangulated across tools to ensure validity.