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Teacher Reflections on Mathematics Education: Exploring Correlations with Curriculum Alignment and Pedagogical Dimensions under SCF-2011 and NEP-2020 Frameworks

SHAIK SUBHAN,

Research Scholar, Department of Education, Osmania University. Hyderabad, Telangana.

Dr.P.Shankar,

Associate Professor, NIEPA, NEW DELHI

Abstract :

This paper explores relationships between the reflection of teachers, curriculum alignment, and pedagogical practices in secondary mathematics education in terms of the State Curriculum Framework 2011 and National Education Policy 2020. In applying a quantitative correlation design, data were collected from 320 secondary mathematics education teachers about key dimensions: Content alignment, Teaching-Learning Practices, and Textbook Design. It is rather significant how this study emphasized the role of teacher reflections in identifying gaps and enhancing effectiveness in curriculum and textbooks. Findings indicate strong positive correlations between content alignment and teaching practices with stronger links to interdisciplinary connections, assessment strategy, and inclusion practices. Similarly, features of the textbook, including design, projects and activities, and illustrative exercises, were found to have robust associations with teaching efficacy and student engagement. It highlights the requirement for national frameworks of curriculum and learning resources development while maintaining inclusive education and continued teacher skills development. The findings from this research will offer actionable advice to policy makers, teachers, and curriculum developers in refining pedagogical approaches, textbook designs, and offering an equal opportunity to access mathematics education. This research works toward the ever-growing conversation to improve mathematics teaching to address 21st-century demands in the educational setting.

Key words: Mathematics Education, Teacher Reflections, Curriculum Alignment, Pedagogical Practices, National Education Policy 2020 (NEP-2020)

1.Introduction

Mathematics education contributes to and lays the grounds for children's foundational knowledge and critical thinking skills. The subject is part of the very core of logical reasoning and problem-solving and analytical skills at the secondary level; yet, the real benefit from mathematics education can be achieved only with an intricate interplay between curriculum design, teaching practices, and reflections by the teacher. Linkages are ensured with national frameworks such as 'State Curriculum Framework 2011 (SCF-2011) and the 'National Education Policy 2020' (NEP-2020), the purposes of education that would include awareness to inclusiveness, interdisciplinary linkages, and the balancing of learning opportunities.

On the global front, research underscored the role of teacher knowledge, beliefs, and reflections in enhancing mathematical school outcomes (Shulman, 1987; Ball, Thames, & Phelps, 2008). Mathematics education is not only about mastering various aspects of technical knowledge but is also about attaining a relational understanding, according to Skemp (1976). International perspectives recommend the integration of school curricula with classroom practice and teacher professional development in closing the gap between policies on one end and the practice in the classroom on the other (Darling-Hammond et al., 2017; Van de Walle et al., 2018).

In this regard, reforms were brought to the outline of 'National Curriculum Framework 2005' by NEP-2020 for India. In the Indian context, studies so far have highlighted the importance of a sound relationship between teachers' reflections, textbook designing, and curriculum design (Reddy & Sinha, 2010; Bhattacharyya, 2018). These reflections not only suggest lacunae in present pedagogical approaches but also present pragmatic recommendations to direct an enhancement of the active engagement and achievement of students in the process of learning.

This study investigates the relationships between critical aspects of teacher reflections-content alignment, teaching-learning practices and textbook design-chiefly in the backdrop of SCF-2011 and NEP-2020. The study discusses an analysis of teachers' perceptions regarding the reform of the curriculum and professionalism in mathematics teaching. The current research is likely to consolidate key ingredients that help in secondary school mathematics education improvement and prove useful for policy makers, professionals, and curriculum developers.

2. Review of Related Literature

Mathematics has been identified as one of the most important constituents of secondary level learning which ensures easy implementation of logical thinking and problem-solving skills in general for the total cognitive growth of students. This section of the review largely elaborates on related literature concerning curriculum alignment, teachers' reflections, and pedagogy where relevant findings and principles of understanding may well rest on the international and Indian context.

Global Perspectives on Mathematics Education

This is an area of importance in international research regarding the role of teacher knowledge and reflections in mathematics teaching. Shulman (1987) set the lead by propounding the concept of "pedagogical content knowledge" (PCK). In fact, PCK refers to particular forms of knowledge that are different from the knowledge teachers may have acquired when they were students. As a building block on this, Ball, Thames, and Phelps (2008) researched the importance of specific knowledge for mathematics teaching, relating it directly to student understanding. These studies, therefore, tend to foreground the idea that although subject matter knowledge is unavoidable in teaching, the skill of reflecting on and changing instructional practices at times takes precedence over such knowledge.

As Kilpatrick, Swafford, and Findell (2001) point out, mathematical proficiency encompasses essential strands like conceptual understanding and procedural fluency to develop an appropriate balance in instruction. Boaler (2016) adopts the approach of "mathematical mindsets" as a strategy to make students more engaged and resilient. This literature emphasizes that reflective teaching calls for curricular changes to adjust the needs of students differently.

Aligning with the curriculum was also a core concern of global studies. Cai et al. (2017) reviewed cross-national comparative studies on mathematics and found that there is a positive relation between coherent curriculum objectives and teaching strategies to enhance student outcomes. Darling-Hammond et al. (2017) argued that professional development should be of such a nature that it will enable teachers to alter their practice to align more closely with the learning objectives. Such findings indicate a coherent relationship between curricular design, teaching practices, and reflections on the teacher's part.

Indian Scenario of Mathematics Learning

NCERT (2005) and reforms, 'National Education Policy 2020', have provided considerable importance to mathematics learning and teaching in India as a critical tool for the development of thinking skill and problem-solving ability, though the goals of mathematics education are yet to be approached. Reddy and Sinha (2010) also indicate that changes in learning outcomes in rural and urban areas are related to differences in instruction and resources. Teacher reflection has been noted as an important condition for improvement in mathematics education in India. For instance, Bhattacharyya (2018) illustrates how the review of curricula and textbooks by teachers guides changes the curriculum needs to undergo for better instruction. Gupta and Tandon (2020) studied the views of teachers of NEP 2020, and their inference was that the learning outcomes in mathematics should be equitable by following inclusive interdisciplinary practices.

Another is curriculum objectives in alignment with teaching-learning practices and textbook design. Mukhopadhyay and Narula (2015) researched professional development for mathematics teachers in India, citing

the need for continuous support and materials to bridge the gap between policy and practice. Studies by Ramanathan and Kapur (2017) pointed to fair and inclusive approaches, especially in mixed classroom settings.

Role of Textbooks and Pedagogical Dimensions

The textbooks are the central body for the formation of mathematics instruction. Internationally, as it was described by Mason, Burton, and Stacey (2010) about the importance of textbooks that make learners smart in their thinking and problem solving. In the Indian scenario, NCERT's (2006) document position on teaching mathematics emphasized that textbooks for the students should reflect the national curriculum objectives and have interesting activities, illustrations, and exercises.

For example, studies like Rao and Rani (2007) have demonstrated interplay across different contexts between textbook design and teachers' reflections pointing out that well-designed instructional material is indeed very much in relation with good teaching practices. On the other hand, textbooks need to be contextualized to cater for the heterogamous needs and requirements of Indian classrooms underlined by Kaur (2012).

Synthesis and Research Gap

The reviewed literature puts forward teacher reflection, curriculum alignment, and textbook design as pivots of mathematics education. Evidence worldwide suggests that professional development and reflective teaching practices have a strong basis and are effective for mathematics instruction. In India, by existing policy frameworks like NCF-2005 and NEP-2020, one can say that there is a sound base; however, it is only through the empirical study done at the secondary school level that these dimensions can be tied up together to fill in the vacuum.

It bridges this research gap by examining the correlations between teacher reflections and key dimensions of pedagogy in the context of SCF-2011 and NEP-2020. The focus on secondary -level mathematics education aims to provide action points that are actionable for improving curriculum design, teaching practice, and textbook development.

3. Objectives and Hypotheses of the study

Objectives of the study:

1. To analyze the significant relationships among teachers' reflections on the State Curriculum with respect to various pedagogical dimensions, including content alignment, teaching-learning practices, and interdisciplinary linkages.

2. To examine the correlations in teachers' reflections on the Mathematics Textbook concerning its physical features, content alignment, projects and activities, and illustrative exercises**. Hypotheses of the study:**

1. There is a significant relationship in the teachers' reflections on the State Curriculum with respect to different dimensions.

2. There is a significant relationship in the teachers' reflections on the Mathematics Textbook with respect to different dimensions.

4. Methodology

It employed a correlation design of a quantitative nature to examine the teacher's reflections and pedagogical dimensions at the secondary level in mathematics education. In the analysis of feedback, the researchers selected 320 teachers. To process the feedback, Pearson's correlation coefficients were used to derive findings. The PFDT, COPS, PA, and IEE are the main variables. The strength and nature of these correlations have been assessed for statistical significance at the 0.01 level.

5. Results and discussion

5.1 Correlation Analysis of Dimensions (Table-1):

Correlation results of the teachers' reflections on the State Curriculum with respect to different dimensions.

Hypotheis-1: There is a significant relationship in the teachers' reflections on the State Curriculum with respect to different dimensions.

Table-1: The table shows an analysis by Correlation of the teachers' reflections on the State Curriculum with respect to different dimensions

Dimensions		CA	TLP	AE	IL	IEP	RSPD	SHEF
CA	Pearson Correlation	1	.903	.836	.868	.885	.855	.770
	Sig.		0	0	0	0	0	0
	N	320	320	320	320	320	320	320
TLP	Pearson Correlation	.903	1.00	.854	.821	.912	.879	.787
	Sig.	0.00		0.00	0.00	0.00	0.00	0.00
	N	320.00	320.00	320.00	320.00	320.00	320.00	320.00
AE	Pearson Correlation	.836	.854	1.00	.834	.809	.769	.769
	Sig.	0.00	0.00		0.00	0.00	0.00	0.00
	N	320.00	320.00	320.00	320.00	320.00	320.00	320.00
IL	Pearson Correlation	.868	.821	.834	1.00	.844	.858	.792
	Sig.	0.00	0.00	0.00		0.00	0.00	0.00
	N	320.00	320.00	320.00	320.00	320.00	320.00	320.00
IEP	Pearson Correlation	.885	.912	.809	.844	1.00	.909	.840
	Sig.	0.00	0.00	0.00	0.00		0.00	0.00
	N	320.00	320.00	320.00	320.00	320.00	320.00	320.00

RSPD	Pearson Correlation	.855	.879	.769	.858	.909	1.00	.837
	Sig.	0.00	0.00	0.00	0.00	0.00		0.00
	N	320.00	320.00	320.00	320.00	320.00	320.00	320.00
SHEF	Pearson Correlation	.770	.787	.769	.792	.840	.837	1.00
	Sig.	0.00	0.00	0.00	0.00	0.00	0.00	
	N	320.00	320.00	320.00	320.00	320.00	320.00	320.00
**. Correlation is significant at the 0.01 level (2-tailed).								

***CA**= Content alignment with the objectives of SCF – 2011/NEP2020 alignment with the objectives of SCF – 2011/NEP2020. **T LP**= Teaching- Learning Practices. **A E**= Assessment and Evaluation. **IL**=Interdisciplinary linkages. **I E P**= Inclusion and Equitable Practices. **R S P D**= Resource availability, Support and Professional Development. **S H E F**= Stake Holders' Engagement and Feedback*

The analysis given in Table-1 very clearly depicts strong correlations between the reflections of teachers regarding the State Curriculum with other pedagogical dimensions. An important correlation coefficient is elicited in the Content Alignment (CA) dimension as it indicates whether the curriculum was aligned with State Curriculum Framework 2011 and National Education Policy 2020 objectives. It shows high correlation coefficients for Teaching-Learning Practices (TLP) at 0.903, Assessment and Evaluation (AE) at 0.836, Interdisciplinary Linkages (IL) at 0.868, Inclusion and Equitable Practices (IEP) at 0.885, Resource Availability, Support, and Professional Development (RSPD) at 0.855, and Stakeholders' Engagement and Feedback (SHEF) at 0.770. Similarly, the TLP dimension is associated strongly with CA that manages to acquire a maximum value of 0.903, followed closely by AE at 0.854, IL at 0.821, IEP at 0.912, RSPD at 0.879, and SHEF at 0.787 that strongly interact with each other within these educational disciplines.

Other dimensions are AE, IL, IEP, RSPD, and SHEF, which have also shown a high interdependence of each. For instance, IEP has been very highly correlated with CA at 0.885, TLP at 0.912, and RSPD at 0.909. This shows the part played by inclusion and equity in reconciling curriculum and teaching practice. In the same sense, RSPD also has close correlation as with CA at 0.855, and TLP at 0.879, also highly related with IEP at 0.909, indicating that resources and professional training play an important role in building greater teaching effectiveness. These findings validate the hypothesis that all dimensions are significantly interconnected and, therefore, that of teacher reflections contributes comprehensively toward curriculum effectiveness and pedagogical practices.

5.2 Analysis of Teacher Reflections on Textbooks (Table -2):

Correlation results of the teachers' reflections on the Mathematics Textbook with respect to different dimensions.

Hypotheis-2: There is a significant relationship in the teachers' reflections on the Mathematics Textbook with respect to different dimensions.

Table-2: The table shows an analysis by Correlation of the teachers' reflections on the Mathematics Textbook with respect to different dimensions

Dimensions		PFDT	COPS	PA	IEE
PFDT	Pearson Correlation	1	.728	.799	.778
	Sig. (2-tailed)		.000	.000	.000
	N	320	320	320	320
COPS	Pearson Correlation	.728	1	.868	.879
	Sig. (2-tailed)	.000		.000	.000
	N	320	320	320	320
PA	Pearson Correlation	.799	.868	1	.901
	Sig. (2-tailed)	.000	.000		.000
	N	320	320	320	320
IEE	Pearson Correlation	.778	.879	.901	1
	Sig. (2-tailed)	.000	.000	.000	
	N	320	320	320	320
**. Correlation is significant at the 0.01 level (2-tailed).					

PFDT*=Physical Features and Designing of Text book,* ***COPS****= Content alignment with the objectives of SCF – 2011/NEP2020, Organization and Presentation Style,* ***PA****= Projects and Activities,* ***IEE****= Illustrations, Examples and Exercises.*

Table-2 expresses Pearson correlation coefficients of the different dimensions of teachers' reflective insight towards the Mathematics textbook. The PFDT regarding the content dimension has shown high correlations with other dimensions like COPS (0.728), PA (0.799), and IEE (0.778). Likewise, the COPS dimension is very closely related to PFDT (0.728), PA (0.868), and IEE (0.879), so there is a strong stress on how well-organized and aligned textbook components support effective teaching.

These are the high correlations of the PA dimension with PFDT (.799), COPS (.868), and IEE (.901) that made this dimension crucial to the development of interactive and interesting instructional methods. Likewise, the IEE dimension correlates highly with PFDT (.778), COPS (.879), and PA (.901), which will emphasize the utility of good illustrations and exercises for effective teaching. These results provide evidence of interdependence between

these dimensions and validate the assumption that reflections by teachers on the mathematics textbook are significantly interrelated across different aspects of pedagogy. This therefore opens up to the great importance of textbooks in informing good teaching practice that is both inclusive and reflective.

Discussion

The study's findings indicate that during secondary-level mathematics education, the critical inter connections of teacher reflections relate to curriculum alignment and pedagogical practices. The fact that all of them demonstrated significant correlations sets an imperative to view the design of the curriculum and textbooks in its entirety as part of a much more comprehensive approach to address the objectives set under SCF-2011 and NEP-2020 .

Correlation Between Curriculum Alignment and Teaching Practices

The study manifested highly significant r-value correlation between Content Alignment (CA) and Teaching-Learning Practices (TLP) at r=0.903, meaning the better the curriculum is aligned with national educational objectives, the more defined and effective practices will become. Similar international research findings by Ball, Thames, and Phelps in 2008 also point out the significance of specialized knowledge in teaching aligned with curriculum frameworks.

Importance of Inclusive and Equitable Practices

These, such as Inclusion and Equitable Practices (IEP), were largely associated with Content Alignment at r=0.885 and Resource Availability, Support, and Professional Development (RSPD) at r=0.909. Such inferences imply that, in the present case, in order to accommodate the diverse needs of students, equitable practices in the classroom are required, as Ramanathan and Kapur pointed out in 2017. Their implications are that, in the current case, in order to reflect favorably on the inclusive policies discussed within NEP-2020, adequate resources and support would have been required.

Teacher Reflections on Textbook Design

Correlation results from Table-2: Indicates the significance of textbook attributes to the effectiveness of teaching. For instance, the PA dimension was highly correlated with PFDT (r = 0.799) and IEE (r = 0.901). This is in agreement with the international studies like Mason, Burton, and Stacey (2010), which emphasized the type of textbooks, which require active learner involvement and provoke critical thinking.

Professional Development as a Catalyst

The close link between RSPD and TLP with a correlation of r=0.879 strengthens the argument that professional development builds the competencies of the teacher that makes practice adaptation in effective ways. It supports

the claim by Darling-Hammond et al. that professional development helps improve policy implementation on practical levels in terms of bringing alterations.

Implication for Policy and Practice

Such high correlations of dimensions validate the hypothesis that teacher reflections are strongly related to the curriculum and textbook dimensions. Some actionable insights are derived for policymakers and teachers as follows:

1. Curriculum Designers: Should focus the content towards practical, interdisciplinary teaching strategies that will impact learning in classrooms.

2. Teacher Training Programs: Should make professional development modules a priority, focusing on reflective practices and inclusivity.

3. The textbook developers: should therefore, be informed that they also have to draw attention to activity, illustrations, and design features which support different learner profiles and engagement.

Conclusion

The study extends the importance of reflections by teachers as a machinery of feeding back into curriculum and teaching practices for better improvement. Frameworks such as SCF-2011 and NEP-2020 help bring about a more inclusive, engaging, and more effective mathematics learning environment within education systems. More future studies could extend the study as far as the longitudinal impact besides bringing in qualitative richness for research insights in teacher narratives.

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