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Implementation of Single National Curriculum Mathematics 2020 Intended and Enacted Determinants Perspective at Primary Level in Punjab

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Abstract

The current study was framed to determine the gap between intended and enacted single national mathematics curriculum implementation determinants instructional material, teaching methods, formative assessment, and teachers' professional development. The nature of the study was quantitative descriptive based on the survey method. Single National Curriculum of Mathematics Implementation Questionnaire for Teachers (SNCMIQT) was developed for data collection from public primary school mathematics teachers. Content validity of SNCMIQT was ensured by five curriculum education experts and reliability was calculated employing Cronbach's Alpha score; .918, and used to collect the data from the sample of 230 teachers selected through a simple random sampling technique. The collected data were analyzed by applying descriptive and inferential statistics. The study results revealed that 82% of mathematics curriculum determinants were implemented and an 18% gap existed regarding SNC mathematics. The results further, showed that 78% of instructional materials were in use and a 22% gap existed regarding instructional materials. The results declared that 78% of teaching methods were used according to the SNC and a 22% gap existed in teaching methods. The results declared that 87% of formative assessment techniques were in use, while a 13% gap existed regarding the usage of formative assessment. The results revealed that 87% of teachers were provided with teacher training, while 13% were not provided with teacher training, furthermore, results declared no significant difference between locale curriculum implementation determinants. Based on the results of the study, it was recommended that the government provide funds for mathematics instructional materials; learning labs, teaching kits, and learning gadgets for the mathematics curriculum. The education department and head teachers ensured the implementation of curriculum-based teaching methods and formative assessment strategies. Teachers training institutions may provide mathematics curriculum-based teachers training on the usage of instructional materials, teaching methods, and assessment. Head teachers may bind teachers in using instructional materials, teaching methods, and formative assessment techniques for effective SNC mathematics curriculum implementation.

Keyword: Intended Curriculum, Enacted Curriculum, Single National Curriculum, Mathematics Curriculum Implementation

1. Introduction

It is a deep-rooted fact that curriculum plays a pivotal part in the national development of any country. A curriculum is a plan of study offered by a school through a set of learning experiences (Oliva, 2008). The curriculum is the totality of learning experiences provided to learners in an institution (Marsh & Willis, 2007). The curriculum is the sum of all learning experiences that learner encounters under the direction of school to achieve predetermined learning objectives. Key elements of the national curriculum are objectives, content, teaching methods, and evaluation (Government of Pakistan, 2020). Literature reported the intended curriculum and enacted curriculum as a primary type of curriculum (Posner, 2004; Schmidt, Mcknight & Raizen, 1997; Zhang & Hu, 2010). Intended curriculum refers to the written curriculum document provided by the government to run educational institutions (Posner, 2004). Furthermore, the intended curriculum refers to the plan of a set of learning opportunities comprised of objectives, content, teaching methods, and assessments that engage students in learning during a specific course (Richards, 2001). The enacted curriculum refers to the curriculum that is actually delivered and experienced by the learners in the classroom (Schmidt et al., 1997; Hewitt, 2006). Translation of intended curriculum into enacted curriculum refers to curriculum implementation (Porter & Smithson, 2001). Curriculum implementation refers to the process of putting a curriculum into classroom practices that may contain objectives, content, teaching methods, evaluation, curriculum material, and professional development (Ornstein & Hunkins, 2016; Tanner & Tanner, 2007). The federal government is responsible for national curriculum development but after the 18th amendment in the implementation phase provinces also share their responsibilities on curriculum in Pakistan (Government of Pakistan, 2020). The process of transferring the objectives of the curriculum from paper to practice also refers to curriculum implementation (Hlebowitsh, 2005; Ornstein & Hunkins, 2016; Takahashi,2014). The government of Pakistan decided to restructure the national curriculum of all subjects from primary level to secondary level phase-wise with the nomenclature of a Single National Curriculum (SNC). The first phase of primary-level SNC implementation was completed in 2020. The vision of SNC was the same content, teaching methods, and evaluation for public, private, and deenimadaras. The development of SNC is the gratification of the dream of one nation, one curriculum. The SNC of mathematics 2020 has been designed with the insight of a review of the previous curriculum, discussion with stakeholders, and modern trends in mathematics.

SNC mathematics is based on four strands numbers and operations, algebra, geometry and measurement, and data handling and logical thinking at the primary level. These strands serve as the foundation for standards, progression

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grids, and students' learning outcomes. SNC mathematics determinants at the primary level are teaching methods, instructional materials, formative assessment, and professional development (Government of Pakistan, 2020). The teaching method refers to delivering content before learners to facilitate learning. The teacher selects curriculum-based teaching methods according to the needs of content and learners to achieve pre-determined objectives. The teaching methods are a good predictor of students' success. Lecture methods, discussion, demonstration, problem-solving, and contemporary teaching techniques are reported in SNC (Heaton, 2000; Hosal-Akman, & Simga-Mugan, 2010; Government of Pakistan, 2020; Nawaz & Akbar, 2021).

Instructional materials refer to teachers' resources used to facilitate learning and achieve educational goals. SNC mathematics curriculum instructional materials included teacher guides, textbooks, worksheets, geometrical shapes, teaching kits, writing boards, and electronic gadgets to support the teaching-learning process (Brown, 2007; Graves, 2000; Government of Pakistan, 2020). Teachers' professional development refers to the ongoing process of acquiring new knowledge, skills, and attitudes related to the profession. It develops through formal, informal, and non-formal learning opportunities to improve an individual's professional performance. Professional development is essential for teachers about curriculum documents, audio-visual aids, new textbooks, and teaching trends for curriculum implementation (Guskey, 2000; Santrock, 2017). Curriculum-based trained teachers are more efficient in the usage of instructional materials, teaching methods, and assessment (Cohen & Hill, 2001; Nawaz & Akbar, 2019). Teacher professional development enriches teachers' classroom practice about students learning. Teacher professional development regarding pedagogy, textbooks, teaching kits, learning lab, curriculum material, and assessments contribute to effective mathematics curriculum implementation (Government of Pakistan, 2020). Formative assessment is an ongoing assessment feedback technique used by teachers to improve teaching learning process. It is an integral part of the instructional process to improve student performance during the learning. A spectrum of formal and informal assessment strategies are used to gauge the teaching-learning process during mathematics curriculum implementation (Guskey & Sparks, 2004; McMillan, 2021; Ruiz-Primo & Furtak, 2007).

The purpose of the current study was to find out the gap between the intended curriculum and the enacted curriculum during mathematics SNC implementation at the primary level in Punjab. The current study supports in examining curriculum enactment factors instructional material, teaching methods, professional development, and formative assessment of mathematics. The study is helpful for administration, head teachers, and teachers for arranging teaching-leaning resources, teachers training, and formative assessment strategies.

1.1. Objective of the study

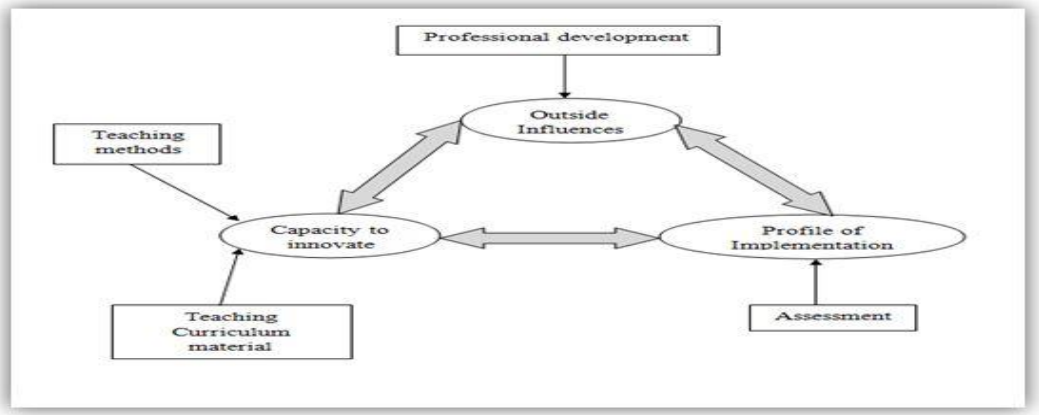
The objectives of the current study were:

1. To identify the gap between the intended and enacted curriculum about teaching methods at the elementary level.
2. To find out the gap between intended and enacted curricula about teaching materials.
3. To explore the gap between the intended and enacted curriculum about formative assessment techniques.
4. To examine the gap between intended and enacted curricula about teachers' professional development.
5. To find out the gap between the intended and enacted curriculum in urban and rural areas.

1.2. Theoretical Framework

The current study was based on Rogan and Grayson's (2003) theoretical framework of curriculum implementation that consisted of the profile of implementation, capacity to innovate, and outside influences. The profile of implementation consists of classroom interaction and assessment. The capacity to innovate includes factors supporting physical resources, teacher factors, factors, and school ecology and management, and outside influences include professional development, change forces, monitoring, and support of learners.

Researchers designed the current study on four dimensions of SNC mathematics implementation based on Rogan and Grayson's (2003) theoretical framework instructional material, teaching methods, professional development, and formative assessment.



2. Literature review

Curriculum refers to learners' experiences planned inside or outside school (Marsh & Willis, 2007). A curriculum is a plan for achieving intentions, a system for dealing with people or fields of study (Oliva, 2008; Ornstein & Hunkins, 2016; Tanner & Tanner, 2007). Intended curriculum refers to the formal plan of what is to be taught in educational institutions. Intended curriculum refers to the written documents provided by the government to run educational institutions to obtain pre-determined objectives. This includes the objectives, content, teaching methods, and assessment and guidelines for implementation. The intended curriculum is a document provided by educational authorities to ensure consistency and coherence in what students are expected to learn. The intended curriculum is the official plan of learning and set of guidelines developed by educational authorities on what students are expected to learn (Yeung et al., 2012; Posner, 2004; Schmidt, McKnight, & Raizen, 1997). Enacted curriculum refers to the enactment of the intended curriculum into classroom levels. Enacted curriculum refers to what is actually delivered by teachers and learned by students. Enacted curriculum refers to the enactment of the intended curriculum into classroom levels. Intended curriculum refers to written curriculum and enacted curriculum refers to curriculum that actually takes place in the classroom. Enacted curriculum refers to the enactment of the intended curriculum into classroom levels (Gehrke et al., 1992; Porter & Smithson, 2001; Schmidt, McKnight, & Raizen, 1997). Various factors teaching methods, instructional materials, assessment strategies, classroom context, and available resources influence the enactment of the intended curriculum (Porter & Smithson, 2001). The process of putting curriculum into practice to achieve the objectives for which they were designed is known as curriculum implementation. It is the act of bringing an educational program into action. The process of putting a plan of sets of learning into action refers to Curriculum implementation. It is related to executing the plan into practice. Curriculum implementation is the enactment of pre-planned learning resources into classroom practices. Curriculum enactment is a complex process that requires time, resources, and technically trained personnel (Fatima, 2024; Kelly, 2009; Murphy, 1991; Ornstein & Hunkins, 2016; Takahashi, 2014). Public, private, and deenimadaris institutions are functioning in isolation for curriculum implementation in Pakistan. The government of Pakistan decided to develop and launch SNC phase-wise at primary, elementary, and secondary levels to bridge in the country. In Phase I primary-level curricula started for Urdu, English, Social Study, General Science, General Knowledge, Islamiat subjects, and mathematics academic year 2020–2021(Government of Pakistan, 2020).

Mathematics is considered the mother of all subjects that deal with the study of numbers, quantities, shapes, and space using symbolic logic and abstract reasoning. Mathematics is an important subject at all levels of education globally to develop logical thinking and analytical reasoning among students. It encompasses various disciplines including arithmetic, geometry, algebra, calculus, and statistics (Arisoy & Aybek, 2021; Burton, 2011). SNC mathematics was developed at the state level for public, private, and deenimadari but there is a significant disparity among streams of curricula (Government of Pakistan, 2020). SNC mathematics determinants are teaching methods, instructional materials, formative assessment, and professional development.

Instructional materials refer to the learning resources and tools used by teachers to put the intended curriculum into classroom practices. Textbooks, teacher guides, teaching kits, writing boards, and learning labs are mathematics curriculum implementation tools (Government of Pakistan, 2020). Textbook refers to print material used by students and teachers during the teaching-learning process (Graves, 2000; Remillard, 2005). Textbooks are primary educational tools in the Pakistani educational context to support the teaching-learning process. Textbooks must be aligned with the curriculum and provide a structured pathway for teachers and students to follow particular subject content. Teachers and students mostly follow textbook content and consider it a sole source of learning (Apple, 2014). A teacher guide is a teacher manual to support instructional strategies. Teacher's guides included lesson plans, learning activities, and supplementary materials to help teachers deliver the content during the teaching-learning process (Glatthorn, 1987). Learning materials improve learning (Ediger & Rao, 2006; Nawaz, 2020; Tayyab, Umer & Sajid 2022). A study was structured by Adesua (2015) to explore instructional material at the secondary school level. The study used descriptive expose-facto research based on the survey method. Multistage sampling was used to collect a sample of 1150 data from the respondents. Pearson product-moment correlation was used to analyze the collect the data. The results of the study revealed that there was a significant relationship between school curriculum implementation and instructional materials. A study was framed by Ningi (2023), to examine the influence of instructional materials on curriculum implementation in Kaduna Nigeria. The sample of the study was 183 public school teachers. The results of the study revealed that instructional materials influence curriculum implementation, furthermore, there was a significant relationship between urban and rural school teachers on the utilization of instructional materials for curriculum implementation.

A spectrum of teaching methods demonstration, inquiry, brainstorming, discovery, math lab, practical work, problem-solving, and cooperative learning are reported in SNC of mathematics. Teaching methods facilitate teachers during instruction (Government of Pakistan, 2020; Nawaz & Akbar, 2021). A study was framed by Nawaz and Akbar (2021) to examine curriculum-based teaching methods in Punjab Pakistan. The sample of the study comprised 2,880 teachers selected through a multistage random sampling technique. The collected data were analyzed through descriptive statistics and independent sample t-tests. Results of the study reported that teachers were making 56% use of curriculum-based teaching methods and there is no significance between urban and rural teachers' curriculum implementation. A study was structured by Lumadi (2014) to explore factors influencing curriculum implementation

by teachers in Kaduna Nigeria. The sample of the study was 160 teachers and the mixed-methods research design used a survey method to collect data from respondents. The findings of the study revealed that teachers faced problems during curriculum implementation.

Teachers' professional development improves teachers' classroom practices in the teaching-learning process. Teacher training, workshops, group discussions, seminars, textbook training, classroom management, assessment, and lesson planning are stated in SNC mathematics. Professional development enriches teachers' teaching practices (Government of Pakistan, 2020; Guskey & Sparks, 2004; Nawaz, 2020). A study was structured by Dilshad et al., (2023) to explore problems of SNC implementation in Punjab Pakistan. Mixed-methods research approach was used to collect the data from teachers. The sample of the study consisted of 40 teachers selected through purposive sampling techniques. The results of the study showed that up to 90% of SNC was implemented in Schools. Another study was designed by Nawaz and Akbar (2019) to explore the gap between the intended and enacted curriculum regarding professional development for curriculum implementation in public schools in Punjab Pakistan. The sample of the study consisted of 361 teachers working in public sector secondary schools. The data were collected through a stratified multistage random sampling technique. The collected data were analyzed by applying mean, percentage, standard deviation, and independent sample t-tests. The results of the study demonstrated that 34 % of teachers were provided with training, and no significant difference was observed between urban and rural teachers on curriculum implementation. Curriculum-based teacher training sensitizes and enhances teachers' awareness and practices toward formative assessment practices for curriculum implementation (Naseer & Akbar, 2020).

Formative assessment is a tool used to provide feedback to teachers and learners during the teaching-learning process. It is designed to help students improve their learning by identifying their strengths and weaknesses and to help teachers enhance their teaching practices by understanding how well students are grasping the material. Formative assessment technique homework, shape identification concepts, quizzes, geometrical shapes, diagrams activities, and classroom activities are provided in SNC mathematics (Government of Pakistan, 2020). Assessment improves learning (Irons & Elkington, 2021; Nawaz & Akbar, 2022). A study was framed by Nawaz and Akbar, (2022) to explore the gap between intended and enacted formative assessment strategies in Punjab Pakistan. The sample of the study consisted of 361 teachers working in public sector schools in Punjab. A stratified multistage proportionate sampling technique was used to collect the data from the respondents. The results of the study showed that 60% of formative assessment techniques were used and a 40% gap existed between intended and enacted formative assessment techniques during curriculum implementation. Furthermore, results declared no significant difference between the usage of assessment techniques by teachers' locality; urban teachers used more formative assessment techniques as compared to rural teachers for curriculum implementation. (Nawaz, 2020) structured a study in Punjab on physics curriculum implementation and reported a gap between curriculum implementation factors.

3. Research Methodology

The current study used quantitative descriptive research based on the survey method to explore the gap between intended and enacted curriculum implementation determinants of mathematics; instructional material, teaching methods, formative assessment, and professional development. The sample of the study was 230 teachers selected through a simple random sampling technique. Single National Curriculum of Mathematics Implementation Questionnaire for Teachers (SNCMIQT) was developed by researchers and comprised of instructional material 8-items, teaching methods 20-items, professional development 8-items, and formative assessment 7-items. The total items of SNCMQIT were 43 regarding SNC mathematics implementation. In the **SNCMQIT** three points Likert-type rating options; yes, up to some extent, and no were used to collect the data from respondents. Content validity of the SNCMIQT was ensured from five curriculum education experts and reliability of SNCQMIT was ensured through Cronbach Alpha score .918. The collected data were analyzed with the help of SPSS, Mean, Standard deviation, frequency, and percentage, furthermore, an independent sample t-test was used to measure significant differences between urban and rural teachers' curriculum implementation.

Table 1: Instructional Materials

Sr #	Statements	N%	UTSE%	Y%	M	SD
1	Mathematics teacher guide was provided to me.	4	9	87	2.82	0.48
2	Mathematics textbooks were timely provided to students.	6	12	82	2.76	0.55
3	Low Cost No Cost material is used for teaching Mathematics.	11	17	72	2.60	0.68
4	Mathematics learning Material is available in the school.	12	18	70	2.56	0.71
5	Mathematics Teaching kit was provided to me.	12	18	70	2.58	0.69
6	I used mathematics geometric box for lessons.	12	13	75	2.63	0.69
7	I used electronic gadgets during teaching.	9	10	81	2.72	0.61
8	I used writing board to draw concepts in class for learning.	4	8	88	2.84	0.46
	Overall	**9**	**13**	**78**	**2.70**	**0.61**

Table 1 interpretation depicted that mathematics learning material and teaching kits are the indicators which used less during curriculum implementation, as indicated by their low mean scores of 2.56 and 2.84 and higher standard deviations of 0.69 and 0.71, respectively. Moreover, table 1 shown that 78% of teaching materials are implemented, while there is a gap of 22%.

Table 2: Teaching Methods

SR No	Teaching Methods	N	UTSE	Y	Gap %	M	SD
1	Discussion Methods	4	9	87	13	2.82	0.48
2	Inquiry Based Learning	6	12	82	18	2.76	0.55
3	Brainstorming	11	17	72	28	2.60	0.68
4	Discovery Method	12	18	70	30	2.56	0.71
	Overall	**8**	**14**	**78**	**22**	**2.69**	**0.61**

Table 2 delineated that Discovery method is not properly implemented in Curriculum, as shown in a low mean of 2.56 and a higher SD of 0.71. The analysis shows that 78% of teaching methods are implemented whereas a gap of 32, suggesting a generally positive perception of the implementation of teaching methods.

Table 3:Professional Development

Sr #	Statements	N%	UTSE%	Y %	M	SD
1	Training on SNC mathematics curricula was provided to me.	5	5	90	2.84	0.47
2	SNC mathematics enactment guidelines were provided to me.	5	7	88	2.83	0.48
3	Training on mathematics textbooks was provided to me.	4	8	88	2.83	0.48
4	Training programs enhanced my mathematics skills.	5	8	87	2.82	0.49
5	Training helps me in developing geometrical concepts skills.	5	9	86	2.80	0.51
6	The PD programs offer follow up programs.	5	10	85	2.79	0.52
7	I participated in professional development activities.	6	10	84	2.77	0.54
8	I received training on SNC mathematics implementation.	5	10	85	2.81	0.50
	Overall	**5**	**8**	**87**	**2.81**	**0.50**

Table 3 described that the participation of teachers in professional development is not up to the mark and Less training on mathematics textbook is not provided to teachers which show the lack of curriculum implementation, as indicated by low mean scores of 1.49 and 1.42 and high SD of 0.86 and 0.89, respectively. The analysis prescribed that 87% of professional development are effectively given, while there is a gap of 13%.

Table 4: Formative Assessment Techniques

SR No	Statements	N%	UTSE%	Y%	M	SD
1	I assigned mathematics homework to the students.	5	10	85	2.79	0.51
2	I assess analytical skills of students by class activities.	6	10	84	2.78	0.53
3	I assess reasoning skills of my students with class tests.	6	10	84	2.78	0.54
4	I assess arithmetic concepts through questions-answers.	5	10	85	2.80	0.51
5	I assess shape identification concepts group-discussion.	4	7	89	2.84	0.45
6	I assess logical skills of students through quizzes.	4	6	90	2.85	0.45
7	I assess presentation skills through diagrams activities.	4	6	90	2.86	0.44
	Overall	**5**	**8**	**87**	**2.82**	**0.49**

Table 4 demonstrated that Analytical skills and reasoning skills of students are not implemented in curriculum, also has low mean score of 2.79 and 2.78 respectively and higher SD of 0.53 and 0.54 respectively. The analysis fetched that 87% of formative assessment are implemented in curriculum, while there is a gap of 13%.

Table 5: Curriculum implementation determinants

Sr. #	Determinants	N	UTSE	Y	Gap%	Mean	SD
1	Teaching Materials	9	13	78	22	3	1
2	Teaching Methods	8	14	78	22	3	1
3	Professional development	5	8	87	13	3	1
4	Formative assessment	5	8	87	13	3	1
	Overall	**7**	**11**	**82**	**18**	**3**	**1**

Table 5 demonstrated analysis of teaching methods that 82% of teaching methods were implemented and 18% gap exists.

Table 6: Independent Sample T-Test on Overall Factors Wise SNC Mathematics in Terms of Locality

		M		SD		t	dif	
Sr No.	**Statements**	**U**	**R**	**U**	**R**			**Sig**
1	Teaching Materials	2.70	2.68	0.67	0.56	1.47	228	0.09
2	Teaching Methods	2.76	2.73	0.59	0.64	0.28	228	0.45

	Professional					-1.34	228	
3	Development	2.79	2.85	0.53	0.45			0.26
4	Formative Assessment	2.79	2.86	0.53	0.43	-0.88	228	0.05*
	Overall	**2.76**	**2.78**	**0.58**	**0.52**			**0.21**

Table 6 depicted formative assessments formulated significant results, with mean scores of 2.79 in urban areas and 2.86 in rural areas. This difference is supported by a significant t-value of -0.88 and significance 0.05, suggesting that the Curriculum implementation these strategies is better in urban areas. However, there are no significant differences observed in rest of the determinants.

4. Conclusion

The current study results reported that 78% of instructional materials were in use and a 22% gap existed for teaching materials including textbooks, teacher guides, teaching kits, writing boards, and learning labs. The results depicted that 78% of teaching methods encompassed inquiry-based learning, brainstorming, discovery method, and discussion methods were in use and a 22% gap existed for mathematics curriculum implementation. The results reported that 87% of teachers were provided with professional development comprising Teacher training, workshops, group discussion, seminars, textbook training, classroom management, assessment, and lessons and a 13% gap existed in mathematics curriculum implementation. The results delineated that 87% of formative assessments incorporated homework, shape identification concepts, quizzes, geometrical shapes, diagrams activities, and classroom activities in use and a 13% gap existed in mathematics curriculum implementation.

5. Discussion

The results of the current study revealed a gap between the intended and enacted curriculum, furthermore, there was no significant difference between rural and urban teachers' curriculum implementation determinants. The current study results were consistent with Nawaz's (2020) study on curriculum implementation factors, teaching method 56%, formative assessment 64%; teacher training 34 %, consistent with Adesua (2015) that there was a significant relationship between school curriculum implementation and instructional materials and were significantly related to the academic performance of students. In the same way, Ningi's (2023) study results declared that there was a significant relationship between instructional materials and curriculum implementation, also consistent with Dilshad et al., (2023) study results that 90% of SNC instructional material of schools in use for curriculum implementation in Punjab Pakistan.

6. Recommendations

On the basis of the results of the study, it is recommended that policymakers provide mathematics curriculum resources. Curriculum developers include modern trending mathematics content based on daily life applications focusing on the context of the country. Teacher training institutions focus on content-based teaching methods Formative assessment techniques professional development training. The school education department allocates funds to purchase mathematics curriculum implementation material. Head teachers bound teachers using curriculum-based instructional material, teaching methods, and formative assessment techniques for effective curriculum implementation.

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