Goals of the national mathematics curriculum of Pakistan: educators’ perceptions and challenges toward achievement

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Abstract
Purpose – The national mathematics curriculum of Pakistan has emphasized on improving content knowledge, reasoning abilities and problem-solving skills of students about thinking, communicating and solving mathematics (national mathematics curriculum of Pakistan, 2006). Whereas, there is a need to understand the point of view of teachers about the challenges they face in achieving the goals of national mathematics curriculum. This will help leading teacher training institutions to revisit their math teacher continuous professional development (CPD) programs and facilitate school leadership in improving the quality of math education in rural schools of the province. However, the purpose of this research study is to figure out the challenges that teachers are facing while achieving the goals of the national curriculum by teaching mathematics at the primary level in educational institutes of Pakistan.

Design/methodology/approach – In this research study qualitative research approaches have been utilized, in which focus group discussions (FGDs) were used as data collection techniques. Furthermore, thematic analysis of the data led toward the development of four overarching themes such as teachers’ knowledge about mathematics curriculum, challenges relating to mathematics content and pedagogy, difficulties in developing conceptual understanding and designing lesson plans to address students’ diversity.

Findings – The overall findings of this research study suggested that the majority of teachers are facing difficulties in mathematics content teaching such as decimal fraction, unitary method, measurement principles, practical geometry and data handling. Moreover, teachers are also facing challenges and difficulties in developing hands-on and minds-on activities in the teaching of mathematical concepts to the students of primary level in educational institutes of Pakistan.

Practical implications – This research study will facilitate the teachers and stakeholders to address the problematic issues in the domain of content delivery of mathematics. Whereas, this study recommends educating teachers about national mathematics curriculum and to develop a CPD framework for mathematics teachers for the enhancement of their pedagogical content knowledge. The study also recommends orientating school heads about the different aspects of math curriculum so that they can mentor math teachers in achieving math curriculum goals.

Originality/value – This is the first research study of its nature, which targets and highlights the teacher’s perceptions toward the achieving the goals of national mathematics curriculum of Pakistan and addressing the pedagogical challenges faced in mathematics teachers. There is a dearth of studies in mathematics education in Sindh province. The issue is of immense importance, the findings will help teachers to improve mathematics instructions at primary level.

Keywords Mathematics, Curriculum design, Pedagogy, Content knowledge, National plan

1. Introduction
Hu et al. (2018) assert that mathematics is the key subject and the backbone of scientific research and development. Mathematics encompasses abstract thinking, inductive, deductive reasoning and computational skills. Mathematics occupies a very important position at the primary level of education (Kaur et al., 2004). Mathematics has been introduced to strengthen numeracy skills (basic mathematical operation) of children. Robust mathematical skills ensure better learning of mathematical concepts. Duncan et al. (2007)
elaborated that if students are provided long-lasting learning experience in mathematics at an early age, resultantly they will have stronger mathematical understanding in their later age (Cited in Karatas et al., 2017). The literature demonstrates that mathematics is the key subject to understand other subjects and disciplines. Mathematical conceptual understanding ensures success in other areas and subjects and help children to solve daily life problems (Cited in Karatas et al., 2017). Keeping in view the importance of school mathematics, a number of initiatives have been undertaken in Pakistan. One of the initiatives was to reform the curricula of the different subjects such as English, science and mathematics. Since the inception of Pakistan, there have been formulated and implemented three curricula in the subject of school mathematics, i.e. in the years 1975–76, 1984–85, 2000 and 2006. In all these curricula, the national mathematics 2006 curriculum of Pakistan has a different vision about the teaching of mathematics. The basic purpose of this curriculum is to make the paradigm shift from teacher-centered to students’ centered approaches. The national curriculum suggests five standards, i.e. number and operations, algebra, measurement and geometry, information handling and reasoning and logical thinking. Benchmarks are derived from standards and students learning outcomes are based on benchmarks. In order to implement the activities of curriculum at the classroom level, the role of the teacher is significant. Another aspect of knowledge that Shulman mentions is pedagogical content knowledge (Cited in Carrillo-Yañez et al., 2018). The National Education Policy of 1998–2010 (Sharif, 1998) clearly spelled that the teacher is the person who implements educational reforms. The motivation for present study came from the standardized achievement tests (SAT) results. The SAT has been conducted for class V students at provincial level since 2013. The SAT results indicate a very dismal picture of student’s performance with a 12–13% provincial mean score in mathematics in Sindh. Similarly, Tayyaba (2010) describes that learning achievement of primary school children in Pakistan has remained far from satisfaction. The national curriculum-based tests conducted for 12,000 students in mathematics and science indicated a low level of learning among children. This situation led researchers to look at the issue from teachers’ point of view. Teachers have to face different issues and challenges while implementing reforms relating to the curriculum at the classroom level.

There are many factors that influence the implementation of the math curriculum. According to Tayyaba (2010), these factors comprised of student’s attitude toward math, school environment, students’ background variables and learning resources. Mohd Rustam (2016) in their study has identified different challenges and obstacles that influence students’ mathematical performance in school. These challenges can be categorized as students-led, parents-led, peers-led, assessment-led and teachers-led. The present study is an attempt to understand which content and pedagogy related challenges teachers face in implementing the activities of the math curriculum at the classroom level as suggested in the national math curriculum of Pakistan.

2. Review of the literature
The purpose of the literature review is to provide a brief overview of education system in Pakistan, to describe the key features of the national mathematics 2006 curriculum, to identify the challenges that come across teachers in achieving the goals of the mathematics curriculum at the classroom level and to highlight the role of head teachers in curriculum implementation in school.

2.1 A brief overview of Pakistan’s education system
Pakistan came into being on 14th August 1947. Pakistan inherited its education system from British India. The British ruled the subcontinent for 200 years. The education system at the
time of independence was divided into religious, private, community and government institutions. Achieving 100% literacy has remained a dream for Pakistan. In 1951, the literacy rate of Pakistan was 16.40%. During the years 2018–19, according to the economic survey of Pakistan, the literacy rate of Pakistan was 62.3%. Since the inception of Pakistan, several educational policies and plans were introduced to root out literacy and improve education in the country. One thing was common in all these policies, these policies were designed very well, and the targets set were optimistic. Unfortunately, none of the policies were implemented in true spirit. The reasons for non-implementation were many but the key one was scarce human and material resources, low political commitment and frequent change of governments.

Despite low educational profiles in achieving the targets of literacy, compulsory primary education and quality of education, yet Pakistan has shown its commitment toward education. Pakistan is one of the signatories of education for All (EFA), Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs). According to the Pakistan Economic Survey 2018–19, Pakistan is on the 150th position out of 189 countries with the Human Development Index (HDI) value of 0.562. Pakistan hardly spends 2.4% of its GDP on education during 2017–18. The education system of Pakistan is divided into 4-tiers i.e. pre-primary, elementary (grade 1–8), secondary (grade 9–12) and higher education. Different subjects are taught at different levels of education. English, local language (Sindhi/Urdu), science, Islamiat and mathematics are compulsory subjects.

2.2 Key features of national mathematics 2006 curriculum of Pakistan

The national mathematics 2006 curriculum of Pakistan comprises of five standards as shown in Figure 1. Mathematics is the dynamic subject which aims to boost thinking ability, calculation and computation skills and ability to pursue tasks through problem-solving approach. (Hu et al., 2018). The national curriculum is a source to implement the aims of education in the country. It helps in the achievement of mathematics learning objectives. The mathematics curriculum framework articulates the way the content will be pass on to students. Whether it should be teacher-centered or student-centered? (Pan, 2005, Cited in Hu et al., 2014). The 2006 national curriculum is significant as it is based on standards and skills-based paradigms. Within each standard, there have been suggested certain benchmarks. The benchmarks help to attain competencies at each level of development.

![Figure 1. Showing mind map of mathematic standards](image-url)
The benchmarks have been derived from standards. The detailed description of standards and benchmarks are provided in Table 1.

2.3 Goals of teaching mathematics and challenges for mathematics teachers
The goals of teaching mathematics as suggested in national curriculum for mathematics (2006) are to develop mathematical proficiency skills among students. The curriculum not only focuses on the development of intellectual ability of the child but also has keen interest in the development of aesthetics sense, social skills, physical wellbeing and emotional stability of the child. Stacey (2005) states that one of the goals of the national curriculum for

<table>
<thead>
<tr>
<th>Standard(s)</th>
<th>Competencies</th>
<th>Benchmarks</th>
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<tbody>
<tr>
<td>Number and operations</td>
<td>Identify numbers, ways of expressing numbers and effects of operations in different situations Calculate confidently with fractions, decimals and percent</td>
<td>Read and write Roman numbers up to 20 Read, write, compare and identify place value of numbers up to 1,000,000,000 Add and subtract numbers of different of arbitrary size Multiply and divide up to 6-digit numbers by two- and three-digit numbers Differentiate between even and odd, prime and composite numbers Use of 4 basic math operations on numbers and fractions</td>
</tr>
<tr>
<td>Algebra</td>
<td>Analyze number patterns and interpret mathematical situations by working on algebraic expressions, inequalities, relationships and equations</td>
<td>Clarify and analyze patterns, classify missing numerals and elements in a pattern or sequence and determine a rule for repeating and extending patterns Practice symbolic notation to represent a statement of equality or inequality</td>
</tr>
<tr>
<td>Measurement and geometry</td>
<td>Identify measurable attributes of objects Construct angles and two-dimensional figures Analyze characteristics and properties of geometric shapes and develop arguments about their geometric relationships.</td>
<td>Identify straight line, curved line, square, rectangle, triangle, circle and oval Add, subtract and convert standard unit of length, weight/mass, capacity/volume, time, money and temperature Draw, label and classify lines, angles, quadrilaterals and triangles based on their properties Analyze characteristics and properties of geometric shapes and develop arguments about their geometric relationships Calculate the perimeter and area of a square, rectangle and triangle by using formulas</td>
</tr>
<tr>
<td>Information handling</td>
<td>Collect, organize, analyze, display and interpret data/information</td>
<td>Relate data and interpret quantities represented on charts, tables and different types of graphs and make predictions based on the information</td>
</tr>
<tr>
<td>Reasoning and logical thinking</td>
<td>Observe real life situations by identifying mathematically valid arguments and drawing conclusions to Increase their mathematical reasoning</td>
<td>Explain method and reasoning when solving problems involving numbers and data</td>
</tr>
</tbody>
</table>

Table 1. Description of standards and benchmarks in 2006 mathematics curriculum
mathematics is to inculcate problem solving skills among teachers and students. This is considered as 21st century skill. Problem solving involves variety of skills such as the ability of reflection, analysis, interpretation, prediction and evaluation. The majority of school curriculum around the globe considers problem solving an important task. Teachers face difficulties in improving the problem-solving abilities because of its complex nature. There are multiples reasons about non-implementation of curriculum activities in mathematics classroom. Huo (2004) mentions that when teachers attempt to use child-oriented curricular approaches in the classroom, it becomes difficult and challenging because of teachers own personal and cultural beliefs about teaching and learning. The lack of teaching resources is also a hurdle. It is noted that teachers' own knowledge and understanding about curriculum goals, standards, benchmarks and competencies are limited and they do not refresh their knowledge. There is a gap between their present professional knowledge and the requirements of new professional standards and benchmarks of the curriculum. Due to this reason teachers face difficulty in implementing the curriculum.

One of the hurdles that come across teachers in implementation curricular reforms in the math is the lack of cognitive skills to comprehend the reforms. Professionally sound teachers can take decisions at the classroom level which facilitates them to introduce reforms effectively. (Cited in So and Kang, 2014). According to Nolder (1990), numerous factors can hamper the implementation of mathematical curriculum reforms and innovations. These factors are concerned with teachers and the context where reforms are taking place. The high expectations of community and parents, the nature of examination (rote – memorization based), lack of teaching material, teachers lack of knowledge and understanding about educational reforms, time constraints, lack of professional support from the educational management team, lack of monitoring and lack of incentives for reform implementers lead toward the non-implementation. Taylor and Vinjevold (1999) are of the view that mathematics is not a theoretical subject. Mathematical understanding requires full knowledge of mathematical algorithms and understanding of connections that interwoven different mathematics concepts. If teacher’s conceptual understating of the concepts presented in the mathematical lesson is poor consequently it will be a great hurdle in improving students’ subject matter knowledge. Schwartz and Cavener (1994) express that a school is the miniature of the society where human relations prosper, thinking systems emerge. Students and teachers ‘learn how to behave and do acceptable things? To implement the goals of teaching mathematics, we have to deal with a different belief system that teachers held about mathematics teaching-learning. Preconceived beliefs become a hurdle while implementing a new curriculum in the classroom. According to UNESCO (2005) the use of ineffective mathematics pedagogy leads to low academic achievements among students in mathematics. Teachers’ pedagogy is an important tool in improving the quality of teaching. Norton (2019) acknowledges that teachers’ mathematics subject matter knowledge plays an important role in improving students’ mathematics content knowledge and their learning outcomes. Strong content knowledge help teachers to do better teaching.

2.4 School leadership and the attainment of curriculum goals

The role of school head teacher/principals is vital in school success and improvement. School principals influence teaching and learning process because of their significant role in school decision-making regarding curriculum planning and implementation (Robinson, 2011, Cited in Li et al., 2016). One of the roles of head teachers is to support teachers in their instruction. This role is viewed as instructional leadership. This role takes the forms of understanding and implementing curriculum management, monitoring teaching-learning process and facilitating teachers in their professional development. The ultimate purpose of instructional leadership is to improve students’ achievement by fortifying teachers’ instructional practices.
3. Methodology
The present study is qualitative. Qualitative research is “a research paradigm which emphasizes inductive, interpretive methods applied to the everyday world which is seen as subjective and socially constructed” (Anderson, 1987, p. 384, cited in Hatch, 2002). The qualitative study provides opportunities for observing processes, social behaviors and interactions in diverse settings (Cited in Miedijensky and Abramovich, 2019). Qualitative research methods help researchers to get an in-depth understanding of the phenomenon studied and have a chance to communicate with research participants and their actions (Hatch, 2002). Believing in the paradigm that knowledge is not fixed, there are multiple interpretations of reality. This led us to choose qualitative research. To get an in-depth understanding of what kind of challenges come across teachers while fulfilling the requirements of the national math curriculum at the classroom? the qualitative approach seems appropriate for the present study.

3.1 Research participants and research location
The participants of the study consist of primary school teachers (PSTs). These PSTs are full-time teachers. Their duty hour starts from 8:00 a.m. to 1:00 p.m. These PSTs have been working in government schools for the last many years. In government schools, teachers supposed to teach all subjects. They are not designated, subject experts. The basic criteria for the appointment of PSTs are a bachelor’s degree in arts/science and education. No professional experience required to become PSTs in Sindh, Pakistan. It is interesting to mention here, if a teacher joins the job, the headteacher of the school ask him/her about the subject he/she would like to teach. If his/her first choice is language or science or mathematics, he/she is given that subject throughout his/her teaching career. PSTs attend general training sessions in teaching methods and content knowledge. Hardly any teachers had attended specific training in science and mathematics.

The study was conducted in government schools. These schools have been situated in District Sukkur. Sukkur is the third-largest city of Sindh province. These schools are situated in Sukkur City. The total number of schools in Sukkur city is 49. Sukkur is the third-largest city of Sindh province. Sindh is the second largest province of Pakistan. According to the Annual School Census (2016–17), the total number of PSTs in Sukkur is 2,731 (male = 2,160 and female = 571). The student enrollment at the primary level is 96,200 (male = 57,586 and female = 38,614).

3.2 Sampling strategy
The criterion-based sampling strategy was used in selecting the schools. In criterion sampling, those cases are selected that fulfill certain criteria that are predetermined (Patton, 2002, p. 238). These schools were selected on the basis of students’ low-test scores in Standardized Achievement Tests. Teachers from six government schools were chosen for focus group discussion (FGD). In order to protect the confidentiality, the names of schools have been changed. The mean score of each school in the SAT is given below in Table 2:

The SAT examination composed of multiple-choice questions, extended response questions and constructed response questions. The assessment framework of the SAT follows the guidelines of the national math curriculum of Pakistan. All these schools are located in different locations in the city. The results of schools show poor performance of students in class V math. This was the impetus to know the difficulties of teachers in teaching math.

3.3 Data collection strategy
FGD was used as a data collection tool to elicit the views of teachers about their difficulties in achieving the objectives of the curriculum while teaching math. FGD used as a data collection
strategy on the assumption that knowledge is constructed socially. While designing FGD, the framework provided by Pamela (2004) was taken into consideration. The key features of this framework include the inclusion of 7–12 persons in the FGD, selection of teachers having common professional characteristics (qualification, context, experience and teaching math). Both structures and unstructured approaches were used while asking questions from the group. In our discussion, teachers were orientated about the discussion and its purpose. The total number of FDGs conducted was six. In each discussion, 7–9 teachers including the headteacher of the school participated. Researchers facilitated the group discussion. Each FGD lasted about 50–70 min. The discussion was started with the introduction of the facilitator and respondents. The facilitator started discussion while considered the following:

1. Sharing the purpose of the FDG
2. Getting verbal consent of respondents to be part of FDG and permission to audio record the proceedings of FDGs
3. Share the current state of math education and SAT results
4. Sharing the importance of numeracy skills and mathematics in the 21st Century
5. An ice-breaking activity
6. The setting of norms for FDG (The FDGs questions are placed at Appendix)

3.4 Data analysis
For the analysis of data, the work of different researchers was considered. For example, the framework of Braun and Clarke (2006, Cited in Miedijensky and Abramovich, 2019) and the framework of Braun and Clarke (2006) used as guideline.

Following steps were taken for data analysis:

1. Tape recorded the six FDGs
2. The discussion was undertaken in local languages i.e. Sindhi and Urdu. Both Sindhi and Urdu are the official languages of instruction in government primary schools of Sindh province.
3. Transcribe the FDGs
4. Translate the Urdu and Sindhi into English for further analysis
5. Read transcripts again and again for making familiarity with the text (Colaizzi, 1978)
6. Using Braun and Clarke’s (2006) framework for the analysis of data. This framework comprised of familiarity with the data, making initial codes, looking for themes, reviewing themes, stating themes and write-up.

<table>
<thead>
<tr>
<th>School</th>
<th>SAT results 2015–16 (%)</th>
<th>SAT results 2016–17 (%)</th>
<th>Numbers of teachers selected for focus group</th>
</tr>
</thead>
<tbody>
<tr>
<td>School A, Boys</td>
<td>21.31</td>
<td>25.97</td>
<td>6</td>
</tr>
<tr>
<td>School B, Girls</td>
<td>25.92</td>
<td>18.23</td>
<td>5</td>
</tr>
<tr>
<td>School C, Girls</td>
<td>20.66</td>
<td>44.38</td>
<td>6</td>
</tr>
<tr>
<td>School D, Boys</td>
<td>21.31</td>
<td>24.03</td>
<td>7</td>
</tr>
<tr>
<td>School E, Boys/ Girls</td>
<td>16.7</td>
<td>13.64</td>
<td>6</td>
</tr>
<tr>
<td>School F, Boys</td>
<td>17.4</td>
<td>18.84</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 2. Showing SAT results (mean score) of 6 selected schools in grade V mathematics
The analysis led to the emergence of themes: knowledge of teachers about national math curriculum, issues and challenges relating to content and pedagogy, logical thinking and problem-solving skills, design of lesson plan and teaching diversity.

4. Findings and interpretation of focus group discussion

The purpose of FGD was to elicit the views of teachers about math curriculum, content and pedagogy related difficulties, challenges in designing lessons that aim to improve and address reasoning abilities and diversity among students. (The guided protocol for FGD is placed at Appendix).

The detailed account of FGD is provided as under:

About national mathematics curriculum document, the majority of responses suggested that teachers have not seen the curriculum document. Their responses also indicated that “curriculum and syllabus are the same things” (Excerpt is taken from Focus group discussion, October 2019). Teachers’ responses further showed that textbooks represent the curriculum.

Regarding the national mathematics curriculum, teachers viewed about the curriculum:

It is the sum of different topics and subtopics. The curriculum is a guiding document that is developed by the government. The curriculum helps teachers with teaching methods. It is written in the curriculum about the detail of topics. For example, in Number concepts which are related topics such as place value, fraction, multiples, and factors. The curriculum provides information about assessment methods. The mathematics curriculum has different topics such as geometry, number line, rectangles, percentages, measurement etc. (Excerpt taken from Focus group discussion, October 2019).

Teachers did not provide any opportunity to attend any training session that orientates them about the mathematics curriculum. One of the teachers complained that “I have been serving in primary school and teaching mathematics for the last 30 years. I have attended one pre-service course before joining the teaching profession. This was a Primary Teachers Course. But I have not attended any in-service-training on mathematics” (Excerpt is taken from Focus group discussion, October 2019).

Teachers felt comfortable in teaching different mathematical areas such as numbers, types of numbers, place value, multiples, factors, fraction, types of fraction, percentage, angles, triangles, its types, rectangles and averages. At the primary level, teachers design, conduct and assess tests by themselves; therefore, they are not worried about the coverage of course. Many important topics from all mathematical standards such as numbers, fractions, unitary method, measurement and practical geometry have been skipped by teachers.

Regarding the content areas in which teachers feel less comfortable, teachers indicated many mathematical content areas that they found difficult in teaching. Teachers have shown their interest to improve these content areas. These areas are the construction of number line, graphical representation of decimal fraction, unitary method, measurement (Conversion) and its principles, construction of triangle, lines, rectangles, square, parallelogram, cubes and area of a triangle, rectangle and circle. Teachers also felt difficulty in teaching concepts such as data handling, drawing different types of graphs, interpretation of data. Teachers were facing difficulty in teaching word problems effectively.

Teachers were not aware of the “Logical thinking” the 5th “Standard” in the math curriculum. They were of the view that teaching content areas were enough. One of the teachers replied:

Whenever I teach numbers and fraction concepts, I try my best to relate it with daily life examples. I always ask them to bring an example of 1/3, ½, ¼ from daily life. Students’ examples are very interesting. For example, when I was teaching in one of the primary schools of rural areas of Sindh, a
student, brought her lunch. Her lunch included one bread (Roti) and a boiled egg. She divided her bread into two pieces then four pieces. She briefed the class about the concept of half. (Excerpt taken from Focus group discussion, October 2019).

Teachers’ responses indicated that they focus only on examples given in the textbook. They hardly refer to other teaching material for the development of logical thinking in mathematics which is one of the standards of the national math curriculum.

While asking to share any example to improve students’ conceptual understanding:

Generally, teachers refer to examples of the textbook. Most of the examples of textbooks promote procedural understating among children. There are some examples in each topic that focus on conceptual understating. Teachers hardly focus on such an example because of the lack of teaching material such as charts, graph paper and worksheets. Teachers help students in finding the area(s) of rectangle, triangle and circle but they do not relate it with graphical representation. As a result, rote memorization of formula promotes among children. This situation can also refer to teachers’ beliefs about mathematics. During the discussion, the researcher asked a question from teachers about the definition of mathematics. The majority of responses indicated that “mathematics is the collection of formulas and teacher’s responsibility is to help children in solving these formulae”. Teachers expect students to learn these formulae. They were not interested in conceptual understanding. These responses indicated that the majority of teachers were behaviorists in their approach.

Regarding designing lesson plans, teachers’ responses were almost similar. While teaching, teachers had their lesson objectives with them. The senior teachers told that they start teaching by writing the topic on board.

For example, one senior teacher told: “if my topic is number then I write numbers from 0, 1, 2, 3, ————-50 then I separate even, odd, natural, whole, prime, composite numbers. Then I explain the properties of numbers before the students. Students learn the properties of numbers such as commutative and associative properties of numbers”. (Excerpt is taken from Focus group discussion, October 2019).

Teachers’ responses further indicated that they explain the topics by themselves and then give similar examples to students. The majority of these examples were from prescribed mathematics textbooks. Hardly any examples from other books are taken. At the end of the lesson, students are assessed from the same examples. When the researcher asked about the strategies about the improvement of mathematical language during delivering the lesson, teachers’ responses were about the use of Urdu or Sindhi language. Teachers had no idea of the importance of mathematical language. Similarly, about establishing the mathematical connection before the start of a new concept, teachers’ responses were not so encouraging. It was also pointed out by teachers that giving feedback to students sometimes becomes difficult for them.

When the researcher asked about addressing diversity in the mathematics classrooms, teachers responded that they use the same teaching strategies for every student. They described that it was challenging for them to use different teaching strategies for every student. The majority of teachers use chalk and talk methods and drill and practice methods for teaching numbers and tables. Teachers were aware of group work, cooperative teaching strategies and inquiry-based methods and problem-solving method but they hardly used these strategies in their mathematics classroom. On the other hand, when the researcher asked teachers how did they teach mathematical word problems? The majority of responses showed that teachers first read the problem aloud and then write the problem on the board. Teachers then figure out the data and use formula.

No specific problem-solving strategy/framework used for solving word problems. There is no emphasis on improving the problem-solving abilities of children. Regarding the type of teaching resource use in the mathematics classroom, teachers responded that they draw
Teachers complained about the existing textbooks of mathematics. They were of the view that this textbook did not contain guidelines and activities that help them to teach textbooks effectively and according to the expectations of the curriculum.

The analysis of focus group data led to the emergence of the following key themes:

(1) Knowledge of teachers about national math curriculum,

(2) Issues and challenges relating to mathematics content and pedagogy

(3) Difficulties in developing conceptual understanding among students

(4) Difficulties in designing a lesson plan to address students’ diversity

5. Discussion

This paper has described the main characteristics of the national mathematics curriculum document of 2006 and to share views/reflections of teachers about the challenges and issues they face in aligning their teaching practices with curriculum standards. The national mathematics (2006) curriculum of Pakistan has certain distinguishing features that make this curriculum different from the 2002 curriculum of Pakistan. These characteristics include the inclusion of mathematical standards such as five standards, i.e. number and operations, algebra, measurement and geometry, information handling, reasoning and logical thinking. The focus of the curriculum is developing mathematical proficiency skills such as reasoning ability, problem-solving ability, ability to insert ICT skills and abilities to relate mathematics with daily life among children. In this curriculum, it is emphasized that teachers should make the paradigm shift from their traditional role of knowledge giver. The curriculum proposes teachers to engage students in mathematical tasks through inquiry-based and problem-solving approaches. Within standards, there are benchmarks. Students learning outcomes are derived from these benchmarks. The curriculum provides an assessment framework. This framework suggests the use of multiple assessment techniques. The purpose of assessment is to enhance students’ ability about mathematical communication, reasoning ability, capacity to connect mathematical concepts and connect mathematics with daily life. The curriculum also suggests the development of teachers’ manuals and modules in order to facilitate them in the process of teaching and learning. Data obtained from the FGD revealed that teachers’ knowledge about key features of the mathematics curriculum is limited. Teachers were not aware of the standards and competencies outlined in the curriculum. They were well informed about students learning outcomes. Teachers did not provide any opportunity to attend any training session that orientate them about the mathematics curriculum. Teachers teach selected concepts from the textbook and skip many important strands such as unitary method, measurement, data handling and practical geometry. Teachers face difficulty in designing teaching resources and manipulative in mathematics. There is a scarcity of teaching resources such as mathematical kits in primary school. One of the key objectives of the curriculum is to develop students’ mathematical proficiency skills which were missing from the teaching-learning of government school teachers. One of the findings of the present study reveals teachers’ preference toward the promotion of rote memorization of mathematical procedure and formula and they design their teaching according to it. Teachers’ reflections indicated a very less focus on the motivation and engagement of students in the teaching-learning process. The National Council of Teachers of Mathematics (NCTM, 1991) stresses on mathematical conceptual understanding rather than a procedural one. The conceptual understating discourages rote memorization of algorithms and makes the teaching-learning process effective. (Cited in Ernest, 2014).
The entire focus of teaching is to deliver and improve students’ mathematical content knowledge. Teachers hardly focus on the improvement of problem solving, reasoning and communication skills of children. The findings revealed that teachers do not use any specific problem-solving strategy/framework in solving mathematical word problems. It was revealed that no brainstorming and mind-mapping strategies were used by teachers. It is challenging for teachers to implement math standards with behaviorist mindset because the activities outlined in the math curriculum of Pakistan are based on the constructivist theory of learning and it becomes difficult for teachers to make a paradigm shift from teacher-centered to student-centered. Findings of the present study indicate that a large number of teachers in government primary schools who teach math have not been fully successful in achieving the objectives of math 2006 curriculum because of their inclination towards behaviorist teaching-learning styles. This finding is in line with Handal and Herrington (2003) who state that teachers who believe in behaviorist school of thought influence negatively the implementation of reforms that requires constructivist-orientation. Schwartz and Cavener (1994) also support the findings of the study that preconceived beliefs of teachers about teaching and learning of math obstruct teachers to implement curricular reforms in the classroom.

According to the findings of the study, one of the issues which inhibit teachers to insert critical thinking skills in mathematical activities is existing system of students’ assessment. There is no weightage given to thinking skills. As Majeed et al. (2001) endorse that the present examinations value teacher-oriented teaching and a very little space for students to demonstrate their thinking skills. The main focus of assessment is on regurgitation of formula and rules. The study findings reveal that giving feedback in mathematics is challenging for them. This has been confirmed by Mellone et al. (2020) in their study. They found that teachers face difficulties in providing feedback to students’ work and productions. This aspect needs improvement in teacher education or continuous professional development (CPD) programs as well. The study results further show that existing textbooks of mathematics do not contain enough guidelines for teachers to use address the learning needs of different learners and it also not helpful in achieving the objectives of the curriculum. Bruhn and Hasselbring (2013) stated that meeting the needs of various learners in schools is important and textbooks should be aligned with prescribed standards of the curriculum (Cited in Cruz, 2018). The study findings also suggested that teachers hardly get any professional support from school heads in implementing mathematics curriculum goals (i.e. content, pedagogy and resources). Research demonstrates that principals’ leadership for teacher professional growth is viewed as “an essential mechanism for deepening teachers’ content knowledge and developing their teaching practices” (Desimone et al., 2006, p. 181, Cited in Li et al., 2016).

6. Conclusion
Since the establishment of Pakistan, education has been given less importance because of political turmoil. Successive governments developed education policies and plans. All these policies and plans were very much optimistic. While designing these policies and plans, it was not considered the cognitive abilities of the people who implement these policies and plans. A similar situation happened to the mathematics curriculum. The recent mathematics curriculum is one of the finest documents in the history of Pakistan. The curriculum was developed in 2006 but existing mathematics textbooks were aligned with this curriculum during 2012–2016, this is the dilemma. We know math is an important subject at the primary level in Pakistan. Our future generation cannot survive without problem-solving and reasoning skills. If we want to make Pakistani nation mathematical literate, we have to focus our attention on the development of mathematical proficiency skills of teachers and students. There is an urgent need to orientate teachers about this curriculum. The leading teacher
training institution, i.e. provincial institution of teacher education (PITE) Sindh should
develop a CPD framework for mathematics teachers in Sindh. The focus of CPD should be the
enhancement of mathematical pedagogical content knowledge of teachers. The Education
and Literacy Department, the government of Sindh, should allocate funds for the
development of teaching kits in mathematics. Teachers of government primary schools
may be provided opportunities to observe mathematics lessons of another reputable school
system such as Sukkur IBA community colleges, Beaconhouse and city school system. This
will help teachers to change their preconceived beliefs of teaching and learning mathematics.
It is also suggested to create space in terms of time and resources for teachers to attend
mathematical Olympiads and other competitions. The study also recommends orientating
head teachers about the national mathematics curriculum of Pakistan. Head teachers should
be provided training in developing support mechanism for mentoring teachers in schools.
School head teachers should also be prompted on merit basis. The existing model of head
teachers’ promotion is based on seniority. This model has been prevalent in Pakistan since its
inception. This model is losing its credibility. It is suggested that the merit of head teachers’
promotion should be determined through annual performance appraisals.

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teachers’ beliefs about mathematics education in terms of their experience and structure of their


Further reading

Appendix

FGD: Questions

1. Have you seen national mathematics curriculum document?
2. What do you know about the national mathematics curriculum of 2006?
3. Have you been orientated about curriculum?
4. In which content areas you feel more comfortable?
5. In which content areas you feel less comfortable?
6. How do you insert logical thinking skills in activities?
7. How do you ensure conceptual understanding of children?
8. How do you design and assess your lesson?
9. How do you ensure teaching diversity in mathematics classroom?
10. To what extent prescribed textbooks of mathematics help you in teaching math according to the goals of math curriculum?
11. What kind of professional support you get from school heads in teaching of mathematics?

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