Elementary Teachers' Perceptions and Practices of Real-life Application of Mathematics: A Case of a Private School in Karachi

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Abstract

Mathematics is a practical subject and is very important for developing problem-solving skills in learners that will help them in their everyday lives. Nonetheless, it is an unpopular subject among the school learners due to its complexity and existing teaching pedagogies. Also, it is believed that teachers' practices are influenced by their perceptions. Therefore, this study endeavoured to explore the perceptions and practices of elementary mathematics teachers regarding the real-life applications of mathematics. Using a case study approach, mathematics teachers from one private sector school were participants in this research. Data collection tools included individual semi-structured interviews with elementary mathematics teachers to uncover their beliefs and classroom observations to gauge their practices. Thematic analysis was employed to analyse the qualitative data collected. Prominent findings illustrated that teachers' perceptions and understanding of real-life applications of mathematics are limited and are applied minimally in their instructions, while traditional teaching methods dominate the classroom environment. Importantly, participating teachers emphasized the need for teacher training programs focusing on real-life applications in teaching of mathematics. The findings also highlighted that the teachers, school administration, and teacher trainers should work together to revise and adapt pedagogical approaches to effectively integrate real life applications of mathematics into the lessons, enhancing students' mathematical understanding.

Keywords: *elementary mathematics, real-life applications, teacher training*

Introduction

Mathematics has wide applications in our lives and is one of the core subjects taught in schools to develop logical thinking skills (Raman, 2022; Shoaib & Akhter, 2020; Solangi et al., 2021). It aims to develop critical thinking, problem-solving and relational competence in students so that they may solve daily-life problems (Kaya & Keşan, 2023; Marchisio et al., 2022; Solangi et al., 2021). However, despite its importance, mathematics is difficult for learners in most countries globally, and students often find it complex and dry due to the lack of awareness about its applicability and the emphasis on memorizing procedures and formulae (Chand et al., 2021; Chirimbana et al., 2022; Singha et al., 2012; Wijaya et al., 2022; Yong et al., 2018).

Mathematics education is facing challenges across the world, as evident from the examples from England, South Africa, Turkey, Indonesia, even from Finland. In England, despite efforts to reform curricula and improved teaching methods, students still memorize and practice mathematical procedures without understanding their real-life applications (Wright, 2020). The negative experiences associated with the subject are not limited to England. Ncube (2021) states that the situation in South African schools is no different. Despite offering extra classes after school hours, on weekends, and during school holidays, in almost all provinces, South African high schools are not showing substantial improvement in the country's mathematics results. According to Mumcu (2018), Turkish students underperformed in PISA and were unable to apply mathematics in real-life contexts. Basuki and Wijaya (2019) state that Indonesian mathematics classroom is based on rote learning and therefore students lack mathematical reasoning and problem-solving abilities. Even in Finland, where education is highly valued, traditional teaching practices such as the use of textbooks as the main instructional material during math lessons are still common (Lehtonen, 2021).

The local literature also highlights challenges faced by Pakistani students in mathematics, resulting in lower grades in the subject which can lead to decreased motivation among these students (Ashraf et al., 2022; Aslam et al., 2019; Ayub et al., 2021; Malik & Rizvi, 2018). Research indicates that teachers can help to make learning mathematics more engaging and meaningful for students by relating mathematical concepts to real-life problems and experiences (Arthur et al., 2018; Bolstad, 2021; Siregar & Siagian, 2019). To enhance mathematical abilities from an early stage, it is recommended that mathematics be introduced in early primary school through real-life problems (Al-Mutawah et al., 2019).

Problem Statement

Mathematics is not popular among Pakistani students as they find it rough, dry, and difficult to understand. These difficulties are due to traditional teaching methods (Ali et al., 2021; Ayub et al., 2021; Rind & Mughal, 2020). Teachers usually impart textbook content to prepare students for examinations instead of connecting the concepts with real life (Ali et al., 2021; Amirali & Halai, 2021; Ayub et al., 2021; Rind & Mughal, 2020). Although the current curriculum is skill-based, implementation of the skills is missing at schools (Rind & Mughal, 2020). Students' lack of interest is evident in their lower achievement in mathematics as compared to other subjects (Ayub et al., 2021; Khan et al., 2020). Consequently, low achievement in mathematics results in students' boredom, dropout, and less interest in classroom activities (Ayub et al., 2021; Mazana et al., 2019).

The National Education Assessment System (NEAS) administered the Trends in International Mathematics and Science Study (TIMSS) assessment for fourth-grade students in Pakistan. TIMSS evaluates mathematics content knowledge as well as problem-solving, application, and reasoning skills. Pakistan's performance in TIMSS 2019 was unsatisfactory, with a majority of fourth-grade students demonstrating only basic mathematical understanding. They struggled in areas where application, reasoning, and advanced knowledge of mathematics was required (Halai, 2021).

To address these challenges, it is crucial to transform teaching methods from traditional approaches to new pedagogies in order to enhance and sustain the learners' abilities (Ayub et al., 2021). Moreover, Amirali and Halai (2021) emphasize that teachers' practices mainly depend on their beliefs and knowledge about mathematics, so the teachers must be given ample opportunities for professional development where they can reconceptualize the aim of teaching mathematics. Thus, uncovering teachers' beliefs about teaching the real-life applications of mathematics and providing targeted training interventions in this area are imperative.

Purpose of the Study

The purpose of this study is to explore the perceptions and challenges of Pakistani private school elementary mathematics teachers about the real-life application of mathematics. Also, it intends to examine the influence of these perceptions on their classroom practices.

Research Questions

1. What are the perceptions of Pakistani private school elementary teachers about the real-life application of mathematics?
2. What challenges do these teachers face while teaching the real-life application of mathematics?
3. How do teachers' perceptions of the real-life application of mathematics influence their classroom practice?

Significance of the Study

The findings of this inquiry may contribute to a better understanding of Pakistani teachers' perceptions of the real-life application of mathematics. This may further help the stakeholders and policymakers to take necessary actions to revise classroom pedagogies and offer relevant teacher training. This study will contribute to the existing Pakistani literature of mathematics teaching practices.

Literature Review

Keeping in view the purpose and research questions, the literature review includes the concept of real-life applications of mathematics, teaching practices related to real-life applications and empirical studies, both international and national, highlighting perceptions and practices of teachers regarding real-life applications of mathematics.

Mathematics and its Importance in Real Life

Mathematics is an essential subject taught from school to university (Asfar et al., 2022). Additionally, mathematical competence and learning are necessary to address everyday life problems (Kaya & Keşan, 2023; Kong & Matore, 2021; Marchisio et al., 2022;). In today's challenging world, learning mathematics is becoming essential for an individual's real growth (Kaya & Keşan, 2023; She et al., 2018). A student's readiness for life in a contemporary society heavily depends on their mastery of mathematics (Rohatgi & Scherer, 2020).

Teaching Practices under the Umbrella of Real-World Connections

Gainsburg's (2008) seminal work laid the foundation for understanding the integration of real-life connections in mathematics teaching practices. He proposed a range of practices within the horizon of real-world connections. These practices include analogies, word problems, data analysis from daily life, discussion of mathematics around us, hands-on experiences, and performing mathematics in real-life situations. Building upon this foundational work of real-life connections, Kaya and Keşan (2023), further explored the pre-service elementary teachers' perceptions and practices of these connections. Moreover,

Bekiroğlu and Ütkür-Güllühan's (2023) used the classification provided by Gainsburg (2008) to explore real-life applications in German and Turkish grade 4 math textbooks. Gainsburg's classification of real-life connection in teaching practices has been extensively explored by numerous scholars, highlighting its enduring relevance in mathematics education.

Active learning in mathematics through real-life experiences is crucial. However, studies show students face difficulties linking math to real-world contexts (Kaya & Keşan, 2023). The aims of mathematics education in the Pakistani educational milieu also suggest an application of mathematics concepts in real-life situations and the development of problem-solving skills (Akhter & Saeed, 2018).

International Empirical Studies

Several international studies illuminated the importance of teaching real-life applications of mathematics. Among these, the significant contribution is of Gainsburg (2008), who conducted a mixed-method study in the USA to explore real-life connections in mathematics at the secondary level. Based on the findings from the survey, interviews, and observations, she concluded that although the teachers often make real-world connections while teaching mathematics, mostly these connections are brief and require no thinking from the students. The teachers under study also opined that they faced obstacles, such as a lack of resources, training, and ideas for teaching real-world applications in mathematics. Hence, she recommended further studies to investigate the beliefs of the teachers about teaching mathematics applications and the influence of such perceptions on their practices.

Kaya and Keşan (2023) in their study based in Turkey, investigated preservice elementary mathematics teachers' perceptions of using real-life connections in story problems. They underscored the significance of integrating real-life situations into mathematical contexts to enhance students' understanding and application of mathematical concepts.

Another study conducted in Turkey by Bekiroğlu and Ütkür-Güllühan (2023) with the purpose of analysing real-life activities in 4th-grade mathematics textbooks of Germany and Turkey, using Gainsburg's (2008) classification. Their findings revealed that textbooks from both the countries primarily featured "word problems" with real-life contexts. The study suggested a need for more activities related to real data analysis in these textbooks.

Kenedi et al. (2019) conducted a study in Indonesia to explore the connection abilities of elementary students while solving mathematical problems. Finding showed that the ability to

make connections in mathematics among elementary students was not satisfactory. Additionally, they elaborated that the teachers taught mathematics by explaining the material on the blackboard without making any effort to connect mathematics concepts to real life. The authors underscored that connection ability in mathematics is key for students because it increases their cognition, and they can better remember, understand and apply the concepts in their lives.

Bolstad (2021), conducted a study in Norway to comprehend the characteristics of students who study mathematics in grade 9. Data from interviews and observations indicated that some students believed mathematics to be crucial for their lives, while others expressed that the subject was quite dry and not usable in their daily lives. Results further indicated that some students connected a few mathematical problems with shopping and cooking, while most students related mathematics with performing calculations and practicing solutions. According to the author, grade 9 students could only connect basic mathematical concepts with real life, which indicates that the teachers are not preparing the students for 21st century skills.

Karakoç and Alacacı (2015) conducted a study in Turkey to explore the opinions of high school mathematics teachers and academic heads of mathematics about teaching of real-life application of mathematics. The findings determined that teachers considered connecting mathematics with real life as a source of students' motivation and interest in the subject and contributed to improved student achievement. However, the challenges to teaching real-life applications of the subject included time constraints, extensive syllabus, and lack of training in this respect.

Al-Mutawah et al. (2019) conducted a mixed-method study in Bahrain to measure the mathematical abilities of high school graduates. The results suggest that students' abilities in mathematics are confined to the procedural aspect of the mathematics problems, while their conceptual understanding is not up to the mark. Therefore, the authors recommended teaching mathematics with real-life examples from the early grades to enhance learners' conceptual understanding of mathematics.

Although literature highlights the relevance of teaching mathematics with real-life applications, Mosvold (2008) recommended that even though teaching maths in a real-world context is significant, other factor such as different cultural and social exposure are highly

relevant in this connection. In his perspective, meaningful real-life applications of mathematics should be taught in accordance with their contexts.

National Empirical Studies

Regarding real-life application of maths in the Pakistani educational context, Ayub et al. (2021) conducted mixed-method research in Balochistan public schools with two hundred students and thirty teachers of grades 7th and 8th to study the impact of interactive pedagogies on mathematics achievement of elementary students. One of the findings indicated that the teachers were teaching mathematics via traditional methods and students underperformed in the subject. Therefore, the authors suggested that teachers must relate mathematics concepts with their implications in daily life.

Noreen and Rana (2019) conducted an experimental study in Punjab public schools to find the effect of the activity-based and traditional methods of teaching mathematics on elementary students' learning outcomes. Based on pre and post-tests, they found differences in the performance of both controlled and experimental groups, the students treated with activity-based methods performed better in the post-tests. They further concluded that students involved in meaningful activities could better understand the concepts and apply the knowledge in real-life situations.

In a comparative study of mathematics curriculum of Secondary School Certificate (SSC - Matric Board) and General Certificate of Education (GCE - O-Level), Akhter and Saeed (2018) analysed the teaching approaches and assessment practices of both systems. They concluded that there was no significant difference between the two systems in approaches to teaching mathematics as both systems focused on preparation for examinations. However, in GCE, teachers stressed on conceptual understanding while in SSC system teachers focused on drills and memorization. Findings also showed a significant difference in the assessment practices of both systems. GCE assessments are beyond textbook questions and assess real-life applications of the concepts, while the SSC question papers showed the repetition of textbook questions with no real-life applications. The authors concluded that there was a need to include real-life application-based questions in instruction and assessment to achieve better comprehension of mathematical concepts.

Ali et al. (2021) conducted an experimental study in a primary school in Swat to investigate the effects of Collaborative Instructional Strategy (CIS) on fifth-grade students' mathematics achievement. The findings highlighted the prevalent reliance on textbook instruction by primary level mathematics teachers, with limited emphasis on the constructive concept of mathematics.

Hussain (2018) conducted a quantitative analysis in Sindh public schools to assess the performance of class IV students in mathematics achievement tests. The study revealed that primary math teachers often dominated the classroom, resulting in limited student engagement, decreased motivation, and lower academic performance.

In conclusion, empirical studies in the Pakistani educational context emphasize the need for incorporating real-life applications and interactive pedagogies in mathematics instruction. Traditional teaching methods have been associated with lower achievement and limited student engagement. To enhance mathematics education, teachers should relate concepts to daily life and promote meaningful activities in the classroom.

Research Methodology

The current study is based on a case study approach under the qualitative research paradigm because it allows the researchers to examine a bounded system in detail. According to Creswell (2007) “A case study research involves the study of an issue explored through one or more cases within a bounded system” (p. 73); Merriam (2009) also defines it as “an in-depth description and analysis of a bounded system” (p. 40). Furthermore, case studies are relevant when the researchers want an in-depth description of the phenomenon of interest (Yin, 2018). This study also aimed at obtaining detailed insights of the perceptions and practices of teachers of one institution.

Unit of Investigation

The case for this research was a private school in Karachi, Pakistan. The school follows matriculation system and has separate branches for boys and girls. In Pakistan, matriculation refers to the completion of ten years of education in school. The unit of analysis within the case included elementary mathematics teachers.

Participants

Elementary mathematics teachers were participants of this study. A total of eight teachers were observed and interviewed.

Criteria for the Selection of Participants

The researcher selected the teachers through a purposive sampling technique. In this sampling technique, the characteristics of the population are defined then the population of interest is located (Johnson & Christensen, 2004). Table 1 shows the criteria for the selection of teachers for this research.

Table 1

Criteria for the selection of participants

Grade level	Elementary
Subject	Mathematics
Number of teachers	All teachers meeting the criteria

Data Collection Tools

1. Semi-structured Interviews

Individual semi-structured interviews with eight elementary level mathematics teachers of one private sector school were conducted. Semi-structured interviews allow a researcher to have in-depth responses to a predetermined set of questions supplemented by probes (Creswell, 2007). The interviews with the teacher lasted for twenty-five minutes on average. The researcher sought permission for data collection from the principal, and all teachers signed the consent letter in adherence to the protocol. All interviews were bilingual, using both Urdu and English because the teachers were hesitant to give interviews only in English. The interview protocol comprised eight questions to know the perceptions of the teachers. These questions were adapted from Karakoç and Alacacı (2015) as they had a similar research purpose to this study.

2. Classroom Observations

Evidence collected through observations helps add more information about the problem under study. It adds rigour to the research and confirms the data collected through interviews (Yin, 2018). The researchers conducted observations in elementary mathematics classrooms to explore if the teaching practices reflected real-life applications of mathematics. The classroom observation parameters were adapted from Gainsburg (2008).

Data Analysis

The researchers followed the procedure of qualitative data analysis recommended by Saldana (2013). The steps for qualitative analysis are as follows:

Step 1: Data Layout

The researcher recorded and transcribed the interviews and typed the observation field notes to prepare data for coding and analysis. Text formatting was double-spaced with wide margins for writing codes using MS Word.

Step 2: Pre-Coding

All transcriptions were read to have a general sense of the data.

Step 3: Coding

According to Saldana (2013), codes possess primary content of the data. First cycle coding included in- vivo codes that are directly taken from what the participants had said themselves. However, descriptive coding was used for observations.

Step 4: From Codes to Categories

Through constant comparative analysis, the codes were classified to categorise. This process helped data to be segregated, grouped, and regrouped to consolidate meaning.

Step 5: From Codes and Categories to Themes

Second cycle coding included the comparison of major categories which were consolidated in various ways to get themes.

Ethical Considerations

The researchers followed all ethical measures to ensure the preservation of the identity of the institute and participants by not revealing their names. Moreover, the principal of the institute was informed about the research purpose and procedures, and the data collection proceeded after pursuing the principal's permission. Additionally, the data collection was followed by seeking the consent of the participants.

Results

Following are the findings from interview data.

Teachers' Perceptions of Real-Life Applications of Mathematics

1. Pragmatic Application of Mathematics

All teacher participants opined that mathematics is seen all around them, in buying and selling, in their kitchen and cooking and also in measurements required for the construction of bridges and buildings. They agreed that the subject was helpful in their daily lives, and also that mathematics and real life are closely connected. Furthermore, the teachers also related mathematics with other disciplines like physics, chemistry, biology, and computer programming. One of the teachers made the following comment: "*Calculations and measurements in construction are significant applications of mathematics… Real-life*

application of math is in building and bridges." Another teacher described this association by saying: "*Mathematics is the king of all subjects*."

2. Benefits of Teaching Real-Life Applications of Mathematics

Conceptual Understanding of Mathematics

Responses from participants projected that students found it easier to understand and retain mathematical concepts when connected to real life. One of the participant teachers elaborated: "*It helps them to reason why we are learning a mathematics concept*."

Another teacher, while sharing the positive impacts of teaching real-life applications of mathematics, shared: "*It will strengthen their mathematics concepts and enable them to use mathematics in real life situations… the fear of mathematics will be reduced*."

Another respondent said the following:

> "*If a child goes to a shop and buys something. He would know how much he has to pay and get the money in return. Nobody will ever be able to deceive a person who knows mathematics; it is important in real life*."

Development of Thinking Skills

Most of the respondents expressed the view that teaching real-life applications of mathematics will be helpful in the development of the thinking skills of the learners. One of the teachers said that it would develop problem-solving skills in the learners and would enable them to solve problems that occur in their daily lives.

Another teacher expressed her views on the impact of teaching real-life applications of mathematics by saying:

> *…the impact will be positive, as it (real-life applications of mathematics) will stimulate their thinking process. Normally, we ask students to copy the solution from the whiteboard. However, if they experience themselves, it will make them ask questions, eventually, resulting in their conceptual understanding*.

Another teacher opined:

> *…it will expand their thinking abilities... like if we ask them to solve questions, it confines their thinking. While if we connect the concepts with real life, they will explore more. If you give one real-life example, they will bring more for you by exploring their environment*.

Development of Interest Towards the Subject

Participant teachers unanimously agreed that real-life connections in mathematics would develop the learners' interest in the subject. Most teachers think that students get bored with procedural tasks in mathematics, and real-life examples and application of the subject will develop their interest. One of the teachers expressed it by saying:

> "*… definitely, if students find the concepts relevant to their lives, they will take interest in the subject… it is very simple that they will understand the purpose.*"

Another teacher said: "*… Their anxiety towards mathematics will reduce once they start implementing math in their lives."*

A participant teacher, while sharing the drawbacks of not teaching math with real-life applications, said: "*Going forward, they (students) will not be able to implement the concepts in their lives if not taught that way.*"

The same participant further elaborated: "*If we give real-life examples, it will help them understand better, and they will be able to help their siblings in mathematics."*

Overall, the findings suggest some positive outcomes of teaching real-life applications of mathematics.

3. Relevance of Teaching Real-life Applications of Mathematics

Almost all the teachers responded that teaching real-life applications of mathematics is appropriate for all grade levels. While expressing her opinion, one of the teachers said: "*Although primary grades are more appropriate for teaching math applications, we should teach this across levels."* Another teacher said: "*To develop an interest in younger children, there must be more real-life applications with a reduced syllabus*." He added, "*In higher grades, we can just teach a few practical life examples*."

However, contrary to the above, one of the respondents said:

> "*Primary level students find it difficult to connect (with real-life examples) compared to secondary level students. Secondary level students should have more exposure to real-life mathematical applications, so that they can understand better*."

Challenges in Teaching Real-Life Applications of Mathematics

1. Time Constraints

All teachers expressed that teaching mathematics with real-life applications would require detailed lesson planning and preparations. Also, it would take up a lot of instructional time in which they are required to complete the syllabus.

One of the participants said: "*There will be challenges, but I am not sure if this will be time-consuming if we divide students into groups and ask for daily-life examples related to the topic*."

Another teacher said:

> *We will have to plan the lessons on a different pattern; this will consume our time. Additionally, it will take time to execute, and we will not be able to complete our syllabus. Consequently, we will be left behind as compared to other subjects.*

Even though most teachers said teaching real-life applications of mathematics is time-consuming, one of them emphasized that despite the challenge of time management, real-life application should be taught

"*We should teach real-life applications of mathematics concepts as it is a good thing. If things were in the hands of the teacher, she could easily get this done without any problem*."

Although all participants talked about time constraints, one of the teachers talked about the workload.

Expressing herself, she said:

> "*If we want to introduce real-life applications of the concept, we must first reduce the workload on teachers. This mind-set needs to be changed, and teachers must be less loaded with administrative tasks*."

2. Lack of Resources and Knowledge

While discussing the challenges elementary teachers face in Pakistan, the participants said that teachers in Pakistan lack facilities and resources. They neither have technological resources, nor do they receive proper professional development. They also emphasised that teachers have to learn the real-life applications themselves before teaching this to the students, as teachers lack understanding of the real-life application of mathematics.

One of the participants said:

> *The teachers perceive that it will be difficult for students as well as difficult for the teachers to teach. They do not understand this (real-life applications of mathematics). Therefore, they are hesitant in adopting it in their lessons*.

Another teacher gave a reason why teachers are not motivated to teach real-life applications of mathematics by saying: "*Although teachers are qualified, they are underpaid."*

Another teacher specified lack of technological resources by saying: "*Teachers are not equipped with technology in Pakistan*."

Most of the teachers agreed that they faced challenges regarding lengthy syllabi and lack of time and resources for incorporating real-life pedagogies in maths teaching.

Regarding suggestions for improvement, most teachers talked about teacher training.

Teachers Training

While giving suggestions for improvement, the teachers highlighted the importance of training teachers. One of the respondents suggested:

> *Train the teachers to teach students in a way that leads them from concrete to abstract. Secondly, train them to teach according to the level of the students. Finally, teach them concept-wise real-life applications of mathematics*.

One more teacher recommended saying: "*Teachers must receive training on using tech resources. They must know how to use YouTube for searching videos*."

Teaching Practices Related to Real-Life Applications of Mathematics

Classroom Observations

In addition to individual interviews, the researchers observed classroom practices of the teachers interviewed, using an observation guide comprising three main elements:

1. Practices related to real-life applications in math classrooms.
2. Format of the lesson: methods of connecting mathematics to real situations.
3. Students' engagement: ways of students' engagement in the connection.

1. Practices Related to Real-Life Applications in Math Classrooms

All 8 teachers started their classes by introducing the topic. Additionally, at the beginning of the lessons, some teachers related the concepts to real life by giving simple analogies and examples. During observations, one of the teachers connected the 8-point compass rose with a Ferris wheel and a clock. Later, clockwise and anti-clockwise directions were explained by drawing arrows on the whiteboard. The resources used by the teacher were a whiteboard and a marker with the workbook.

Another elementary mathematics teacher started the lesson by demonstrating a simple analogy while explaining the factorization of algebraic expressions. The teacher tried to connect factorization with a real-life example using visualization. She gave a pointer and a scale to one student, another pointer and a pencil to another student. Then she asked which element was common between the two. Students responded by saying 'pointer'; the teacher then demonstrated factorization as [pointer (Scale + pencil)]. After sharing the example, the teacher continued teaching the concepts on the whiteboard.

Only 1 out of 8 teachers used ''hands-on'' representations of the mathematics concept "HCF". The teacher showed that she had 15 apples (red cards) and 40 bananas (yellow cards). She told the students that she wanted to distribute these equally among students. To how many students could she distribute these equally? She guided the students about how they could solve this problem using HCF. She elicited the correct response from students and demonstrated the solution. She further led the class by explaining HCF word problems using a whiteboard.

2. Format of the Lesson

All the teachers brought examples to discuss in their lessons. They discussed at least one real-life example related to the topic under consideration; for instance, one teacher brought the example of the Ferris wheel and wall clock to explain angle rotation. Another teacher connected the concept of in-circle with a wall clock and navigating compass. The teacher teaching algebraic identities asked students for examples of how we use this concept. The students related the topic to the area of a square field. After sharing the examples, the teachers followed the method of teaching step-by-step concepts. Only 1 out of the 8 teachers taught "word problems", that too was explained by the teacher. The format of the lesson was based on guided practice where teachers were explaining the concepts using a whiteboard while students were asked to copy the solution from the board.

3. Students' Engagement

The students were passive in all the observed classes. The students were mostly engaged in doing textbook exercises or responding to the teacher's occasional questions which were related to the procedural solution of the exercises.

It was observed that teachers were using a limited amount of time on making real-life connections in mathematics and the rest of the time was consumed for lesson explanation. Out of total fifty minutes of classroom instructions, only 5 to 8 minutes were devoted to real-

life connections. It was also observed that there is not much "talk" about the real-life application of mathematics in the classroom, it is followed as a part of the lesson.

Discussion

Teachers' Perceptions of Real-Life Applications of Mathematics

Considering the perceptions and understanding of the teachers regarding the real-life application of mathematics, most participants approached the concepts at the surface level. Their perceptions of maths and real-life applications of mathematics were very limited and none of the teachers could give detailed responses while explaining the application of mathematical concepts in real life. These results coincide with the findings of Kabar (2018), who also found that teachers' perceptions of real-life applications of mathematics are limited. However, the results of the current study differed from the findings of Siregar and Siagian (2019), who elaborated that in the Indonesian context, secondary school teachers had a comprehensive understanding of mathematics connections with real life.

Regarding the benefits of teaching real-life applications of mathematics, participants agreed that connecting mathematics concepts with real life would result in a conceptual understanding of mathematics. Additionally, they opined that students would be able to develop proper reasoning, which will help them use mathematics confidently in their everyday lives. This finding corroborates with the studies of Kenedi et al. (2019) and Siregar and Siagian (2019), who also asserted that mathematical connections help strengthen conceptual understanding and help learners relate mathematics concepts to everyday life.

Moving further, teachers considered connecting mathematics with real life will help in the development of the cognitive skills of the students. According to them, it would expand thinking as learners attempt to make connections. Also, it will create interest in mathematics. Siregar and Siagian (2019) and Karakoç and Alacacı (2015) also discussed the same findings. They also found that the teachers consider connecting mathematics with real life as a source of motivation and creating students' interest. Further, it helps in developing concepts, thinking, and problem-solving skills. However, according to Mosvold (2008), connecting mathematics with everyday life may create confusion and difficulties for students in comprehending the concepts as they belong to different cultural and social exposures. Hence, in his opinion, students should be trained in relevance to their contexts.

Challenges in Teaching Real-Life Applications of Mathematics

The teachers underscored a few challenges they faced while teaching real-life applications of mathematics. These challenges include time constraints, a lengthy syllabus, and a lack of

resources. Most teachers expressed that teaching mathematics with real-life applications would require detailed lesson planning and preparations. Also, it will take a lot of instructional time in which they are required to complete the syllabus. One of the teachers opined that if the requirement is to teach real-life applications of mathematics, then schools must reduce their administrative responsibilities and related workload. Also, highlighted the challenge of a lack of resources and knowledge. These results corroborate the findings of Gainsburg (2008), Karakoç & Alacacı, (2015) and Siregar & Siagian, (2019) as these authors also discussed the same constraints faced by their teachers, which confine them to make mathematical connections with real life.

Teaching Practices Related to Real-Life Applications of Mathematics

Results from classroom observations determined traditional teaching of mathematics, with only a few instances of real-life connections in the form of word problems and simple analogies. The connections made by the teachers were brief, and no elaborative discussions and thinking took place in the lessons. Students were not engaged when teachers explained the content using a whiteboard, while students took time to copy problem solutions from the board. These findings from classroom observations align with the results of Gainsburg (2008), who also asserts that teachers made brief real-life connections with no thinking required from the students. Furthermore, findings by Kenedi et al. (2019) also reveal that classroom practices were based on traditional methods where the teachers taught using the blackboard without any effort to connect mathematics concepts with real life.

Teachers Training

The results of the current study make a strong case for teacher training. The teachers shared the need for training in using technology. Moreover, they shared that teachers require training in making effective connections in mathematics classrooms. These findings coincide with Ayub et al., 2021, Gainsburg (2008) and Karakoç and Alacacı (2015). Professional training will motivate and develop teachers to adopt innovative strategies and make relevant connections in mathematics classrooms that will pave the way for critical thinking in students.

Conclusion

Insights achieved from this study are very relevant for mathematics teachers, school administrators, teacher educators, and above all, for teacher trainers who develop training programs for mathematics teachers who need to consider real-life connections in mathematics in their forthcoming training sessions. Moreover, teachers should welcome innovations and

consider the importance of teaching mathematics with real-life applications for achieving better outcomes.

This qualitative study has attempted to explore the perceptions and practices of mathematics teachers regarding real-life applications of mathematics. It has contributed to Pakistani academic literature because there are very limited number of empirical research on real-life applications of mathematics. Moreover, this study has also endeavoured to create awareness in teachers about the requirements of teaching mathematics. Additionally, the study underscored the need for teacher training and development to equip the teachers with the technology and strategies to make better connections. The challenges cropped out of the interviews will help school administrators and teacher educators to accommodate and reduce the workload so that teachers may focus on their classroom teaching.

However, this study has its limitations which include the non-generalizability of the findings since it is a qualitative case study with few participants. Future researchers may adopt experimental methods to examine the effectiveness of teaching mathematics with real-life applications with interviews of students for an in-depth understanding of their experiences with the new approach.

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