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Evaluation of teachers' views on the use of learning technologies in mathematics lessons in preschool and primary schools

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Abstract

The purpose of this research is to evaluate the problems encountered in the process of realizing the continuity of preschool and primary school mathematics education and to determine the use of technology in mathematics education in line with the opinions of teachers. The research is a phenomenological study within the scope of qualitative research method. The research was conducted with 40 classroom teachers working in various primary schools in the province of Almaty, Kazakhstan, in the 2020-2021 academic year. The research data were collected with a semi-structured interview form prepared by the researcher and consisting of five open-ended questions, and analyzed with the descriptive method. As a result of the research, students were found to be prejudiced against the course, and the inadequacy of course materials, learning methods and techniques, and course activities were shown as the reasons that negatively affect education. In addition, it has been determined that the rate of teachers to prefer classical methods in education is much higher than new learning methods and techniques and use of technology.

Keywords: Mathematics; mathematics education; preschool mathematics education; primary school mathematics education; teachers' opinion.

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1. Introduction

In today's world, the importance given to the content of education is increasing as education systems prepare children for the future. One of the main tasks of the education system is to raise a free, developed and educated, competitive person who adapts to the needs of changing times (Vitvitskaya, 2006). In this context, the teaching of mathematics education in the preschool period and elementary school period is an area that should be carefully planned. It is possible to say that children's mathematical abilities improved from an early age before starting school education (English and Mulligan, 2013). Teachers are of great importance in reinforcing these mathematical abilities that occur at a young age. The mathematics-related speeches and activities of preschool teachers to improve students' perceptions of mathematics and to endear them to mathematics will ensure that mathematics takes place in the students' lives (Ocal, 2020).

1.1. Theoretical and conceptual framework

In the Republic of Kazakhstan, preschool education and training of the child up to the age of six is provided by the family or by preschool institutions starting from the age of one. Preparing children for school is mandatory and is free of charge in government institutions. Preschool preparation is carried out in the family, preschool organizations, preparatory classes of schools (Zhumasheva, 2018). Math skills are defined as one of the early academic skills in preschool. Skills such as large-small concepts, numbers, total, subtraction, division, recognition, naming, matching, comparison, grouping, sorting, geometry and spatial logic, modeling, measuring, charting are considered within the scope of mathematical skills (Charlesworth, 2015). In addition, skills such as thinking with symbols, understanding mathematical relationships, comprehending processes, thinking with mathematical symbols are defined as mathematical skills (Forgetful, 2007; Cumhur and Tezer, 2019).

Math activities in preschool education have a significant impact on students gaining all these skills. Considering that preschool is very important in mathematics education, the planning of education, accurate determination of methods and techniques to be used in planning and the role of teachers in the education process should not be ignored. With all these plans to be made, the student's cognitive learning potential can be increased by preventing the problems that the student may experience in the following periods (Wortham, 2006; Uzunboylu and Selcuk, 2016). Preschool is the platform where the effects of informal math experiences of students in later teaching lives are determined for the first time (Steel and Blood, 2011).

Mathematics teaching plays a systemic role in education, in the development of human cognitive abilities, affecting the teaching of other disciplines, including the development of logical thinking. For his successful life in modern society, everyone needs quality knowledge of mathematics. Preschool and primary school are an important opportunity for children to develop their thinking skills in mathematics. During this period, the teacher should try to make the learning process as interesting and humane as possible for each child to help students evaluate themselves and succeed in learning. (Tadzhigitov and Nurahmetova, 2020).

In math lessons, the teacher chooses ways of cognition, taking into account the cognitive abilities of the students. With the help of cognitive pathways, it equips students with mathematical knowledge and skills, creates a system of mathematical concepts and improves the ability to apply knowledge in practice. In the learning process, a combination of methods usually needs to be applied. In the classroom, the teacher chooses teaching methods not only to present and reinforce the mathematical information system, but also to create conditions for the development of cognitive activity. Teaching methods follow the objectives of the course and aim to solve the tasks specified in it. As a result, students learn the material and the teacher reaches the planned result (Mikahailova et al., 2008; Bagriyanik and Karahoca, 2016).

In recent years, the use of technology in preschool and elementary school mathematics education has become a necessity, and the use of technological resources has started to play an active role in learning

(Orphan and Ak, 2010). Dynamic and visual learning environments created with technology positively influence our perspective on mathematics education not only in terms of teaching and learning strategies, but also in terms of the content of mathematics education. In mathematics education, it will make it easier for teachers to use technology when creating conceptual and transactional knowledge in the minds of students. In this sense, it is possible for teachers to teach mathematical concepts and students to embody concepts with pre-planned technology-supported courses (Karadag and McDougall, 2009).

In this era called the information age, changing and developing technology has prevented traditional content in education and led to new needs in teaching. Today, the concept of teaching has shifted from classical teaching to technology-supported modern education (Alakoc, 2003). Research shows that as a result of the rapid spread of technology, expectations regarding the use of technology in the teaching environment have increased (Baki, Yalcinkaya, Ozpinar and Uzun, 2009). The main purpose of the mathematical teaching process is the formation of students' knowledge, creative thinking, scientific attitude and activity, development of independent learning skills, targeted, systematic use of special pedagogical methods (Zhumanova, 2020). Accordingly, it is thought that the use of technology in mathematics teaching will have positive effects on learning.

This research evaluates the problems faced by teachers, solutions to these problems, the methods and techniques they use in mathematics education, and their views on the effective use of technology in mathematics education in order to educate students in order to carry out the continuity of preschool and primary mathematics education. This research is important in terms of new teaching strategies that can be created in the light of these views.

1.2. Related research

The positive attitude of the students towards mathematics will be made possible by the efforts of the teachers in ensuring this and the methods and techniques they will apply (Metin, 2001). The teacher has a big role to play in determining the negative attitudes of students towards mathematics and in math success (Kuzu and Caliskan, 2018). Kebritchi, Hirumi and Bai (2008) In their study, they suggested that concepts related to mathematics should be taught to students primarily in daily life, reinforced by life and experiences, and gained with fun games and real materials. At the same time, they emphasized that concepts related to mathematics should be understood by associating them with all other areas of development. Forgetful, (2007) evaluated the math skills of primary and second graders according to their pre-school education status. In his study, he found that children who received preschool education were more successful in math learning than children who did not receive pre-school education.

Kalhotra (2013) described the lack of work environment and computers at home as factors that negatively affected math teaching, while Tachie and Chrishe (2013) based the failure of students on the negative attitude of teachers and lack of teaching methods. Fan, Zhu and Miao (2013) concluded in their study that students did not benefit sufficiently from textbooks and therefore failed maths.

In addition, it is seen that a lot of research has been done on technology integration in mathematics teaching. Bozkurt and Cilavdaroglu (2011) did not consider the use of technology, especially computer software, of primary school mathematics teachers, and stated that this was a major deficiency in technology integration. Erduran and Tasdan (2018) found that mathematics teachers found the use of technology in mathematics teaching positive, but had problems in integrating technology into the course. Baki and the other (2009) evaluated the views of primary mathematics teachers and elementary math teacher candidates on the integration of technology into the course. They stated that teachers and teacher candidates have technology literacy but are low in their competence.

When the factors affecting mathematics education and research on the use of technology in mathematics education are examined; In general, it was concluded that students who developed mathematic skills with qualified education programs emphasized the effects of teaching methods and

techniques on learning had a higher opportunity to continue this development. Teachers have a great duty to ensure that student success in mathematics education can be sustained throughout life and that the mathematics foundation can be established in a sound way. Therefore, in this research, the opinions of teachers who played an active role in making mathematics permanent in learning were evaluated.

1.3. Purpose of the research

This research aims to provide solutions in line with the views of primary mathematics teachers on what new practices may be aimed at improving the continuity of mathematics teaching in the preschool and primary education process. Accordingly, the following questions will be answered.

1. What are the problems teachers face in math education?

2. What are the recommendations for the implementation of the continuity of preschool and primary mathematics education and the studies that can be done to solve the problems encountered?

3. What are the methods and techniques used by teachers in mathematics education?

4. What is the frequency with which teachers use technology in mathematics teaching?

5. What are the teachers' views on the effective use of technology in mathematics education?

2. Method and Materials

This section provides information on the research model, research group, data collection tools, data collection process and data analysis process.

2.1. Research method

This study was carried out using qualitative research method. The opinions of mathematics teachers were analyzed with phenomenologic study from qualitative research perspectives. Qualitative research helps to understand the opinions taken from participants in depth, but is not interested in objective, measurable behaviors and attitudes by nature, but with emotional and conceptual responses (Karatas, 2015). Data sources in phenomenologic studies (phenomenology) are individuals or groups that experience the phenomenon that the research focuses on and may express or reflect this phenomenon. Phenomenology research can provide examples, explanations and lives that provide results to help better recognize and understand a phenomenon (Karatas, 2015). Factual studies focus on cases that we are aware of but do not have an in-depth and detailed understanding of (Buyukozturk et al. 2019).

2.2. Participants

The research was conducted in Almaty, Kazakhstan, with 40 classroom teachers who were working in various primary schools in the 2020-2021 academic year and who agreed to participate voluntarily in the study.

Features of the gender and professional experiences of the teachers participating in the study are given in Table 1.

Table 1. Distribution of teachers by gender and professional experience

Professional experience	Gender		Sum
	Female	Male	
0-5 Years	8	7	15
6-10 Years	5	10	15
11-15 Years	4	3	7
16 Years and above	-	3	3

Sum	17	23	40

When the professional experiences of the teachers participating in the study are examined, it is seen that the majority of teachers are concentrated between 0-5 years and 6-10 years. The teacher with 11-15 years of experience is 7 and the teacher with 16 years or more experience is 3. In addition, when the table was examined, it was observed that the male teachers who participated in the study were in the majority compared to female teachers and there were no female teachers who participated in the study with 16 or more experiments.

Data collection tools

In the research, the semi-structured interview form was used as a data collection tool. Semi-structured conversation; it is the interview technique that allows the researcher to rearrange and discuss the interview questions created by preparing the interview questions in advance, but providing flexibility to the people investigated during the interview (Ozmen and Karamustafaoglu, 2019). The questions on the semi-structured interview form are open-ended questions that allow teachers to express their opinions in their own words. Research questions were prepared in parallel with the sub-objectives of the research by conducting a comprehensive literature review. A pilot study was carried out by applying the semi-structured interview form consisting of 5 open-ended questions to a total of two teachers, one woman and one male, and with this study, the clarity of the questions was examined and the final form of the form was created. Teachers participating in the pilot were not included in the research group.

Data collection process

The semi-structured interview form was delivered to the teachers who participated in the study via the Internet. Qualitative study by internet provides the researcher with opportunities to expand the research area, privacy and non-deciphering to the immediate environment, time and space flexibility, permanent and continuous communication and multi-data collection opportunities by going beyond geographical boundaries (Karatas, 2015). Accordingly, easy-to-reach status sampling was used in the study. Since easy-to-reach situation sampling is applied, there is no regional distribution and internet route is used. Easily accessible status sampling is one of the non-selective sampling types. Due to the limitations that exist in terms of time, money and labor, it is described as the most widely used type of sampling in qualitative research, which can be defined as the selection of sampling from easily accessible and applicationable units (Karatas, 2015). Accordingly, semi-structured interview forms filled out and submitted by 40 teachers who voluntarily participated in the research were evaluated.

2.5. Data collection analysis

The data obtained in the research were evaluated through descriptive analysis. In the descriptive analysis, the research findings are supported by including excerpts indicating the opinions of the participants in the research and the findings are organized and presented to the reader. There are stages in the descriptive analysis of creating a framework for data analysis, processing data according to this framework, defining the findings and interpreting the defined findings (Karatas, 2015). In this research, semi-structured interview forms submitted by the researcher to the participants were read meticulously and similar concepts were put together and categories were created. In addition, the opinions of some participants were directly shared in order to support the categorical findings of the study.

3. Results

In this section, teachers' answers to 5 open-ended questions in the semi-structured interview form prepared for the research will be evaluated.

The opinions of the teachers who participated in the study about the problems they encountered during mathematics teaching are included in Table 2.

Table 2. What are the problems teachers face in math education?

	F	%
Students' biased attitude towards the course	32	80
Students' inability to implement new learning	28	70
Students coming unprepared for class	22	55
Slow processing speeds of students	21	52,5
Difference in students' learning levels	20	50
Lack of materials to reinforce learning	16	40
Inadequate activities in textbooks	13	32,5
Lack of methods to be applied in the course	12	30
Inadequate parent teacher cooperation	5	12,5

80% of the teachers surveyed showed the biased attitude of the students towards the course as one of the problems that teachers encountered in mathematics education. Teachers defined 70% of students as not being able to implement new learning, 55% being unprepared for class, slow processing speeds of 52.5% and differences in learning levels by 50% as problems encountered in mathematics education. 40% of teachers described lack of materials to reinforce learning, 32.5% described inadequate activities in textbooks and 30% as a problem, while 12.5% referred to lack of parent teacher cooperation.

Some of these issues expressed by teachers as follows;

Teacher coded T1; First, students are biased against mathematics. The fear of mathematics is a major obstacle to them learning math. In addition, learning is not permanent because they cannot bring the information they have learned to life. Since not all students have the same level and the same level of perception, there are difficulties in mathematics education.

T21 Coded Teacher; Students do not repeat the information they have learned in class at home. They come unprepared for class. I don't think the activities in textbooks are enough for students to reinforce knowledge only in the classroom environment.

Teacher with Code T37; Students have different interests and learning levels. As such, it is necessary to take care of each of the students separately and take the time. Parents need a sensitive attitude in the process of consolidating the information learned at home. He needs to encourage the student to do their homework at home. The fact that the course is a straight narrative and not being colored with fun games also causes problems in collecting the student's interest in the course.

As it is understood from the responses of teachers, many problems are encountered during mathematics education, but it is seen that the problem that teachers express most often is the students' bias towards the lesson.

The teachers who participated in the research have their opinions on the continuity of preschool and primary mathematics education and their suggestions for the studies that can be done in order to solve the problems encountered are included in Table 3.

Table 3. What are the recommendations of teachers for the implementation of the continuity of preschool and primary mathematics education and for the studies that can be done to solve the problems encountered?

	F	%
Rearranging the content of textbooks in accordance with new learning methods	33	82,5
Reorganization of course contents according to learning methods and techniques such as project-based, collaborative, doing and technology-based learning	30	75
Organizing lessons to allow frequent repetition with students	28	70
Activities should be planned to change students' attitudes towards the course	25	62,5
Low-level students should be given additional lessons	16	40
Diversify course materials and organize fun activities	13	32,5
Give students an incentive to work in a home environment	9	22,5
Ensuring parent teacher collaboration	5	12,5

82.5% of the teachers surveyed recommended that the content of textbooks be rearranged in accordance with new learning methods. 75% of teachers stated that the course contents should be rearranged according to their learning methods and techniques such as project-based, collaborative, collaborative, doing and technology-based learning. While 70% of teachers said that lessons should be arranged in such a way that they are repeated frequently with students, 62.5% said that activities should be planned to change the attitudes of the students towards the course. Teachers stated that 40% of low-level students should be given additional lessons, 32.5% should be diversified and fun activities should be organized, 22.5% students should be given an incentive to work in a home environment, and 12.5% should be provided with parent teacher cooperation.

Some of these solution recommendations are expressed by teachers as follows;

Teacher Coded T5; I think that textbooks should be organized in accordance with new learning methods in order for mathematics education to become more fun and a education that students participate in with pleasure. The possibility of using technology in class could also be a way to reinforce learning. Some activities could also be effective to change the negative attitudes of the students.

Teacher coded T13; Students need to do it again to reinforce the subject. Unfortunately, the curriculum is not suitable for repetition. It is necessary to take more care of students who learn later. Additional lessons must be arranged for them. Making the course more fun can be made possible by increasing the course materials.

Teacher coded T39; Processing courses and organizing textbooks accordingly can be practices that will increase the permanence of mathematics education in such a way that students cooperate and develop projects. Awarding well-prepared assignments or projects can also increase students' motivation. Of course, it is also important for parents to support their children at home and to cooperate with teachers.

In line with the responses of teachers, reorganizing the learning methods and techniques of textbooks, course contents, motivating students and making the lesson fun is of great importance in solving problems in order to ensure the continuity of mathematics education.

The methods and techniques used by the teachers who participated in the study in mathematics education are included in Table 4.

Table 4. What are the methods and techniques used by teachers in mathematics education?

	F	%
Expression	40	100
Question and answer	38	95
Problem Solving	35	87,5
Brainstorming	23	57,5
Argument	15	37,5
Showing And Making	9	22,5
Cooperation	6	15

When teachers were asked about the methods and techniques they used in mathematics education, all of the teachers stated that they used the narrative technique. In addition, teachers stated that they benefited from 95% Q&A, 87.5% problem solving, 57.5% brainstorming, 37.5% discussion, 22.5% demonstration and 15% collaboration methods and techniques.

Some of these methods and techniques are expressed by teachers as follows;

Teacher Coded T11; I mostly process the lesson using plain narrative. I also identify their shortcomings with their answers by asking questions to students. Sometimes we discuss with the students the accuracy of their answers.

Teacher with Code T30; First of all, I'm going to talk about it. Then I show the students the solutions on the board. I make them think about the problem I'm giving them. Usually after the topic narration, I mainly enable them to solve problems in order to reinforce the subject.

Teacher Coded T35; After the lecture, I ask the students about the points they do not understand. We reinforce the subject with the question-answer method. I have students brainstorming to help them find new solutions for problem solving. I want students to solve some problems together by dividing them into groups.

Based on the answers given by the teachers, it is seen that all the teachers use the narrative technique, and almost all of them benefit from the question-answer technique. A small number of teachers stated that they use demonstration and collaboration methods and techniques alongside other methods.

The frequency of using technology in the teaching of mathematics by the teachers participating in the research is given in Table 5.

Table 5. What is the frequency of teachers' use of technology in teaching mathematics?

	F	%
Always use	3	7,5
Often use	4	10
Sometimes use	12	30
Rarely use	16	40
Never use	5	12,5
Sum	40	100

The teachers participating in the research were asked about the frequency of using technology in teaching mathematics. 40% of the teachers stated that they use it rarely, 30% sometimes, 12.5% never, 10% often, and 7.5% always.

The frequency of using technology in mathematics education was expressed by the teachers as follows;

Teacher coded T4; I teach the course mostly with the method of explanation and question and answer. Unfortunately, the school environment and teaching materials do not support technology-based education.

Teacher Coded T21; I sometimes use computers and the internet to present different examples to students and to apply activities in addition to the textbooks.

Teacher Coded T23; In order to increase student participation in the lesson, I rarely find some games that reinforce the subject. Of course, it is not possible to find a game for every subject. With these games, students both reinforce their learning and have a fun activity.

Based on the answers given by the teachers, it is seen that the frequency of using technology in mathematics teaching is quite low.

The views of the teachers participating in the research on the effective use of technology in mathematics education are given in Table 6.

Table 6. What are the teachers' views on the effective use of technology in mathematics education?

	F	%
Effective use of technology reinforces learning	35	87,5
Effective use of technology removes preconceptions about mathematics	31	77,5
Effective use of technology provides a fun learning environment	26	65
Effective use of technology encourages students to work at home	23	57,5
Effective use of technology increases student motivation and ensures continuity in learning.	21	52,5
Effective use of technology increases student participation in the lesson.	9	22,5
Effective use of technology allows students to devote more time to the lesson.	4	10

In Table 6, teachers' views on the effective use of technology in mathematics teaching are evaluated. 87.5% of the teachers stated that the effective use of technology will reinforce learning, 77.5% will eliminate prejudices, 65% will provide a fun learning environment, 57.5% will encourage them to work at home, 52.5% stated that it would provide continuity in learning by increasing motivation, 22.5% would increase participation in the lesson, and 10% would consider allocating more time to the lesson.

The effective use of technology in mathematics education was expressed by the teachers as follows;

Teacher Coded T4; The use of technology can increase the student's learning speed and make mathematics not boring. It allows children to devote more time to lessons.

Teacher Coded T19; Students get bored quickly when the same type of lecture method is used. I think it is extremely important to use technology to enable them to learn while having fun.

Teacher Coded T21; Students are afraid of math class. I support the effective use of technology to show that this fear is unfounded, to break prejudices, to provide more enjoyable learning and to make learning permanent.

It is seen that all of the teachers support the effective use of technology in mathematics education. The vast majority of teachers have a common view that using technology in education will reinforce learning.

4. Discussions

The findings obtained from the research reveal that the most common problem that teachers encounter in mathematics education is students' prejudiced attitude towards the lesson. Dursun and Dede (2004) revealed in their study that the fact that mathematics is a difficult subject to learn has an effect on students' negative attitudes.

In their study, Yenilmez and Dereli (2009) examined the factors that create negative prejudice against mathematics in primary schools and found that the beliefs of all students that they will fail in mathematics stemmed from the teacher. Students state that they will like the lesson if they like the teacher in terms of personality and the way the lesson is handled. Based on this result, it can be said that the teacher has a significant effect on the students' negative prejudice towards mathematics.

The reorganization of the content of the textbooks in accordance with the new learning methods took the first place among the suggestions for the work that can be done in order to ensure the continuity of preschool and primary school mathematics education and to find solutions to the problems encountered. Tasdemir (2011) reached a conclusion that supports the research findings in his study and concluded that the topics in the mathematics textbook are not sufficient to encourage students to question, research, examine and direct them to other sources. In addition, Khalidova and Tapan-Broutin (2017) concluded in their study that the problems in the geometry units of the 5th grade mathematics textbooks are not given in a certain order.

When asked about the methods and techniques teachers use in mathematics education, it was seen that all of the teachers used the lecture method. Toptas (2012) stated in his study that the method most frequently used by teachers in mathematics education is the question-answer method. Findings of the research show parallelism with this research and reveal that a great majority of teachers use the question-answer method. Examining the studies in which the methods teachers use in other lessons are examined, it is seen that methods such as lecture, question-answer, drama and discussion are used. When we look at the studies on the methods used by classroom teachers in other lessons, it is seen that methods such as narration, question-answer, discussion and drama stand out (Dogan 2004; Aykac, 2011; Taskaya & Surmeli, 2014).

When asked about the frequency of using technology in teaching mathematics, it was concluded that the teachers participating in the research rarely and sometimes use technology. In the studies conducted on the use of technology in education by teachers, results similar to the results of this study were obtained, and it was determined that they did not use new technologies sufficiently in the teaching environment. In similar studies, it has been determined that teachers do not use new technologies sufficiently in teaching environments (Isman, 2002; Akpinar, 2003).

When the teachers' views on the effective use of technology in mathematics education are evaluated, it is seen that teachers support the use of technology and all of them express positive opinions about the benefits of technology in education. It has been reported that the effective use of technology reinforces learning, eliminates prejudices, provides a fun learning environment, encourages working in a home environment, increases motivation, provides continuity in learning, increases class participation and the time that the student will allocate to the lesson. In the study of Ural (2015), it was determined that teachers consider the use of information and communication technology useful in terms of motivating students, providing permanence and attracting attention. In addition, in the

study of Ural (2015), it was stated that the inclusion of technology in the learning and teaching process is insufficient and traditional teaching is continued.

5. Conclusion

When the research findings are evaluated, mathematics is defined by the teachers as a subject in which students are prejudiced. Due to prejudice, problems such as difficulty in implementing new learning, not preparing for the lesson, and comprehension difficulties arise. In addition to the problems arising from the students, the inadequacy of course materials, learning and teaching methods and techniques and course activities, and the disconnection in school-family cooperation are also shown as the reasons that negatively affect education. The solution proposals put forward in this direction are to increase student motivation, to diversify the course content and materials, and to work on teacher-parent cooperation. Research findings and studies in the field reveal that the rate of teachers' preference for classical methods is much higher than new learning methods and techniques and the use of technology. On the other hand, teachers have a high level of awareness of the benefits of technology-based education despite their tendency to classical methods.

As a result, the sustainability of preschool and primary school mathematics education depends on eliminating the problems defined by the teachers, equipping the education programs and contents suitable for the technology age with new learning methods and techniques, transforming the student's perception of mathematics from negative to positive, and teachers playing an active role in this whole process.

6. Recommendations

Mathematics textbooks should be arranged in such a way as to enable students to learn by doing and to take a more active role in the lesson, by being equipped with new methods and techniques that support learning, motivating them in terms of content. In-service training programs should be organized regarding the use of technology and the appropriate school environment that will enable teachers to provide technology-based mathematics education.

Seminars should be organized to explain the necessity of working at home in order for students to learn mathematics education permanently, and parents who are the providers and followers of this. In order to make students love mathematics, to break prejudices and to provide learning motivation, competitions, events and fun activities should be organized in schools.

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