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Exploring Factors Promoting Students' Learning in Mathematics at Secondary Level

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Abstract

The present study was based on a survey to explore the factors that are promoting students' learning in Mathematics at secondary level. Twenty Mathematics' teachers serving in public sector of district Lahore were selected purposively from 20 schools as the sample of the study. Structured interview protocol was used as a tool for data collection. The results showed that according to the teachers their students had less positive attitudes towards learning Mathematics because they feel it as boring and difficult subject due to lack of practice, lengthy syllabus and the medium of instruction, i.e. English. If students had weak base at primary level then they preferred to do cramming. That is the reason they face difficulty in conceptualizing many concepts of mathematics. The teachers also highlighted many topics which are difficult for students i.e. general concepts regarding algebra, geometry, set theory, base and number theory, etc. The study also suggested different factors which might promote students' learning in Mathematics at secondary level.

Key words: Learning Mathematics, secondary level.

Introduction

Mathematics dominates almost in every field of our modern society. It plays a vital role in students' progress in school as well as in their daily life activities. Therefore, learning Mathematics skills cannot be neglected. Mathematics curriculum prescribed for secondary classes has a wide range of concepts that have to be learnt and mastered by the students in Pakistan. Learning Mathematics is not enjoyable for all but like a nightmare for majority of students who are studying in secondary schools. Mathematics curriculum contains specialized knowledge which needs certain attitudes, frame of mind (i.e. analytical and logical thinking) and efforts on the part of learners (Government of Pakistan, 2006). Secondary school Mathematics' teacher usually fail to impart and foster these critical abilities in students. It is observed that after passing Grade 10 majority of students fails to make any connection with the subject (Government of Pakistan, 2009).

Mohammad (2002) said that students are focused to memorize mathematics' rules without understanding of what is the need and usability of these mathematics' rules. Students' attitude towards Mathematics signifies interest towards studying Mathematics. It is the disposition of students' towards liking or disliking the study of Mathematics. Mathematics is an interesting subject as Farooq and Shah (2008) said students showed positive attitude towards learning Mathematics. But this is one side of the picture as the researches showed that there are many factors which influence the students' learning in Mathematics.

Amirali and Halai (2010) investigate that there are some factors which are responsible of low quality of Mathematics instruction in secondary schools in Pakistan. The factors are teachers' poor subject knowledge, lacking in pedagogical competence and students' perception about the Mathematics. According to Tayyba (2010), students of middle class were able to

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pass the less difficult questions which required simple mathematical skills. Ali (2011) found in his study that in the classrooms of Gilgit-Baltistan schools, students are not learning Mathematics with deeper understanding.

Mahanta and Islam (2012) studied the attitude of secondary students towards Mathematics and its relationship to achievement in mathematics and found that majority of the boys considered mathematics to be a hard subject but they knew that Mathematics is helpful in the development of mind and girls did not think so. Moreover, students who belong to urban area show more positive attitude than those who belong to rural area. Students whose attitude scores are high they score good marks in Mathematics examination, whereas students having low attitude score got less marks in examination. They investigated that boys showed more positive attitude towards Mathematics than girls. Attitude of students and achievement are also positively correlated.

Ashcraft (2002) described that attitude towards Mathematics was defined as a combined measure of like or dislike towards Mathematics, an inclination to engage in or avoid activities in Mathematics, a belief that one is good or bad at mathematics, and a belief about the usefulness of Mathematics. Students' negative beliefs and attitudes contribute in many of the difficulties they face in learning Mathematics. These negative conceptions diminish students' interest and have a major impact on their Mathematics learning (Amirali, 2010). Students have the ability to be successful in Mathematics, but they believe that they are incapable of success for facing obstacles in developing conceptual understanding and applying procedural skills in Mathematics (Beghetto & Baxter, 2012; Tambychik & Meerah, 2010).Moreover, several scholars revealed that students find Mathematics difficult in understanding language, and problem solving (Chinn, 2011; Lazim, Abu-Osman, & Wan-Salihin, 2004) and lacked many mathematical skills in visualizing number-fact (Tambychik & Meerah, 2010). Generally a strong relationship has been assumed between students' positive attitude towards Mathematics and achievement in the subject (Nicolaidou & Philippou, 2003).

Literature shows that a study was needed to examine the teachers' perception about their students' learning in Mathematics. Because the students of secondary level are the future of our nation, it is necessary to find out the barriers the students have to face in learning Mathematics. This study explores the factors which may influence students' learning of Mathematics and may also be helpful to find out different factors that are important for the development of students' learning of Mathematics. This study might be helpful for the teachers, curriculum planners and policy makers to improve their practices in an effective way.

Objectives of the Study

The objectives of the study were to:

i. Investigate the students' conceptual difficulties that they face in learning Mathematics at secondary level
ii. Examine the reasons of students' conceptual difficulties that they face in learning Mathematics at secondary level.
iii. Identify the factors that can enhance students' learning in Mathematics at secondary level.

Research Questions

In light of the above objectives, following research questions were explored:

i. What are the students' conceptual difficulties that they face in learning Mathematics?
ii. What are the reasons of students' conceptual difficulties that they face in learning Mathematics?
iii. Which are the factors can enhance students' learning in Mathematics at secondary level?

Research Methodology

The study was descriptive in nature. Qualitative survey method via structured interview protocol was used for data collection.

Population of the Study

The population of the study was comprised of all secondary school Mathematics' teachers serving in public sector of district Lahore.

Sample of the Study

Two stage sampling was used. At first stage 20 schools were selected with the help of convenient sampling i.e. 10 male and 10 female schools respectively. In second stage, 10 male and 10 female mathematics teachers were selected purposively from each school. In total, 20 Mathematics' teachers were selected from the Lahore District as the sample of the study.

Instrumentation

A structured interview protocol for teachers who are teaching Mathematics at secondary level was developed by the researchers after reviewing the related literature and identifying key themes and consulting these, i.e. attitude investigation towards learning Mathematics, type of learning activities, examination of conceptual difficulties, misconceptions while learning Mathematics, teaching strategies for difficulties and identification of factor promoting students' learning in Mathematics.

The questions of interview were finalized after consulting with the experts in the related field of education and research. The validity of interview protocol was ensured through repeated discussions with experts in the research and assessment. The instrument was improved in the light of their valuable comments.

Data Collection

The researchers visited the schools and a formal permission from the heads of the schools was sought. A consent form was prepared and distributed among the Mathematics' teachers indicating the purpose of the study, possible risks and benefits of the study to observe research ethics. The researchers explained to participants that their responses and the school identities were kept anonymous and confidential. Moreover, the researchers recorded all the interviews after taking permission from the participants and take field notes with the help of moderator. The first interview was completed in 10 minutes. Second interview was completed in 12 minutes.

Data Analysis and Interpretation

The data of interview was analyzed through thematic analysis by putting them into identical categories. However, the striking responses are quoted in the way the respondents responded.

1. What is the attitude of students towards learning Mathematics at secondary level?

Ans: It is revealed from collected data through interview protocol that six respondents (teachers) said the most of the students showed positive interest towards learning Mathematics at secondary level. One of the female teacher said that "*most of the students are eager to learn about those techniques which are used in Mathematics"*. On the other hand, two teachers said that in their classrooms students are lazy, careless and show negative attitude towards learning Mathematics. Similarly, four teachers believed that students find Mathematics as a difficult and boring subject. They said their students show less attitude towards learning Mathematics. In contrast, seven respondents said that in their classroom students show mix interest. They said some students show

positive and other show negative attitude towards learning Mathematics.

2. How far students take interest in learning Mathematics?

Ans: It is disclosed from the collected data that according to three teachers, average number of the students take interest in Mathematics. While six teachers said that their students take less interest in learning Mathematics. One of the female teacher said that "*30 to 40% students in her classroom show positive and rest of them show negative attitude towards learning Mathematics"*. But a male teacher said that "*mostly students take deep interest in learning Mathematics"*. Seven teachers said students show positive attitude towards learning Mathematics in their classroom and the students' positive attitude response rate vary from 70 to 80 %. One female teacher said that "*many students are keen to learn Mathematics because they know very well that Mathematics is the mother of all subject*". Similarly, another female teacher said that "*most of the students are interested in learning Mathematics as they know its importance in life*".

3. What type of learning activities students generally do in a Mathematics classroom under your guidance?

Ans: In response to question about type of learning activities students generally do in a Mathematics classroom, 10 teachers said that there is no activity in Mathematics at secondary level except demonstration method i.e. the use of blackboard which is used by mostly teachers in their classrooms. It means that teachers solve all the questions and students only copy it. One male teacher said that "*I always invite the students to solve the sums on the board*. Another male teacher said that "*I divide the sums in different parts and ask students to solve any part. It is the best source to encourage students*".

Likewise six teachers said that students perform different activities under their guidance i.e. group work, play cards and model charts. One female teacher said that "*I try to make play cards and charts which can make effective students learning*". Another female teacher said that "*under my guidance students make list of formulae that are used in Mathematics. I involved them in group discussions and make team to do tasks*". What are the main conceptual difficulties do students face in learning Mathematics?

Ans: According to gathered data, six teachers said that students have weak and no clear basic concepts therefore they face difficulties in learning Mathematics. One female teacher said that "*students generally face difficulty in solving algebraic expression, its addition and subtraction. They also fail to understand that zero is positive or negative*".

One male teacher said that "*students face difficulty to solve LCM and they are not completely aware of positive and negative signs during addition and multiplication*". Twelve teachers described the different topics which students generally feel difficult to understand and solve i.e. set theory, base and number theory, geometry, algebra, short and long algebraic expression, general concepts, definitions and problems of statement.

4. In your opinion, why do students face these conceptual difficulties?

Ans: It is illustrated from the opinions of nine teachers that their students have weak base at primary level. As they teach to do cramming from the start of their schooling instead conceptualized learning. One female teacher said that "*students face difficulties in learning Mathematics because they have less interest and do only cramming instead of conceptual learning*". Another male teacher said that "*up to middle level students have weak back grounds and lack of maturity so they behave non serious in the classroom therefore they face conceptual difficulties*". Five teachers said that mostly students neither practice and nor revise their Mathematics classwork at home and they show careless attitude towards learning

Mathematics.

One male teacher said that "*due to lengthy syllabus most of the Mathematics ' teachers of public and private schools have main focus to complete this on time therefore they ignore to teach conceptually and just work on black board and students just copy all*". Contrary to these responses a male teacher said that "*some students look afraid and absent mind in the class*". Another male teacher said that "*most of the students are passive learners and shy. They don't ask questions about their difficulties while lecture in classroom. When teacher ask that are you understanding and students just said yes and nothing".* A female teacher said that *"now students face difficulty to express and interpret the geometry and its content as medium of instruction and book are change in English".*

5. What elements outside the classroom influence students' learning in Mathematics at secondary level?

Ans: Data elucidated that according to eight teachers there are no elements outside the classroom which influence students' learning in Mathematics at secondary level. On the other hand, five teachers said that there are some elements outside the classroom influence students' learning in Mathematics at secondary level e.g. lack of proper guidance and time management. A female teacher said that *"when the students are at home, they waste their time and frequently social media".* Another male teacher said that "*students have different type of friendships outside the classroom. Therefore they gave less time to learn at home*. Likewise a male teacher said that *"due to policy 'maar nahi pyar' and favoritism students become more careless and independent*". Two teachers said that some students have financial issues at home therefore they pay less attention to study at home. Similarly, two teachers said that some students are mostly involved in school's co-curricular activities like sports, debates, and drama etc. so these elements outside the classroom influence students' learning in Mathematics at secondary level.

6. What kinds of misconceptions students generally develop while learning Mathematics in classroom?

Ans: It is discovered from the data that four teachers said there are no misconceptions that students generally develop while learning Mathematics in classroom because students just do cramming and misconceptions exist where conceptual study exist. On the other hand, seven teachers said that students think that Mathematics is boring, difficult and very hard to understand therefore they don't try to understand nor practice this at home. Three teachers said students try to learn Mathematics like theory and try to learn by heart. Three teachers said that students develop misconceptions about DMAS rules, sets, functions, factorization, algebra, geometry and integer.

Opposing to the above responses, three teachers have no idea that either students develop misconceptions while learning Mathematics in classroom or not because due to limited time and large syllabus their main focus is to finish the syllabus before examination.

7. What teaching strategies do you implement in your classroom to help the students to overcome those difficulties?

Ans: In response of question about teaching strategies that are implemented in classroom to help the students to overcome those difficulties, it is revealed that different teaching strategies were used in the classroom. One female teacher said that *"if any students face difficulty in leaning Mathematics, I do repeated discussion and try to clear the basic concepts which are helpful to understand the concepts*". Another female teacher said *"I develop short questions and multiple choice questions so that it can help students for better understanding*". Likewise a female teacher explained that "*if students face any difficulty then I change my method of lecture method*

to discussion method and also take extra period for students' clarification".

Nine teachers said they used drill method i.e. ask students to do more practice in classroom and also try to explain their basics concepts. Moreover six teachers used different audio video aids to increase students' interest. One male teacher said that *"I encourage students to ask questions so I can help them to solve their problems*". Furthermore another male teacher said that "*I take weekly test so that students become more conscious about the learning and give more time to learning Mathematics*".

8. What factors you think can enhance students' learning in Mathematics at secondary level?

Ans: Data elaborated different factors which can promote positive attitude of students towards learning Mathematics. One male teacher said that "*there must be some activities in the Secondary Level Mathematics and algebra must be teach scientifically with proper equipment*". Another male teacher said that "*some workshop must be conducted at secondary level so that positive attitude of students' learning in Mathematics can been hence and they may come to know the usability of Mathematics in their daily life".* Similarly another male teacher said that *"teacher must teach Mathematics with giving daily life examples".* Two teachers said that students' positive attitude towards learning mathematics can be promoted if we change our teaching style and clear the basic concept at primary level i.e. conceptual teaching learning process instead of cramming Mathematics.

Moreover four teachers said that in their opinion students' attitude can be promoted by giving appreciation and confidence to the students to ask questions which help them to do practice and participate in class as they are shy students. One female teacher said that "*teachers and parents' cooperation can be developed for discussion about time management and proper environment of study at home which can enhance students' learning in Mathematics".* Another male teacher said that *"if we teach the students in proper airy, green and natural atmosphere then it refresh students mind and it can enhance students' learning".* That teacher also said that he was already practicing this strategy and it really works and gave positive response. Similarly a female teacher said that *"friendly environment in classroom is also helpful to enhance students' learning Mathematics".*

Additionally, four teachers said that different teaching strategies must be used other than lecture like group discussions, daily tests, presentations, quizzes, objective type questions and different type of competitions can enhance students' positive attitude but still some students had poor attitude of learning towards Mathematics. Students had weak base at primary level towards learning Mathematics. One male teacher said that *"before starting the lecture teachers must revise students' previous knowledge via asking different questions and assure students' readiness for new lecture"*. Contrary to above factors two teachers said that the syllabus of Mathematics at secondary level is difficult and lengthy. They try to apply different teaching strategies but they fail to enhance students' positive attitude towards learning Mathematics. Similarly a female teacher said that *"nothing can change students' attitude towards learning Mathematics neither fine nor anything else, they are careless and lazy*".

9. How frequently you share these problems with your colleague to discuss alternative solution to enhance students learning in Mathematics?

Ans: It is disclosed from the data that 17 teachers share these problems with their colleague. They discuss alternative for easy solution and to enhance students learning in Mathematics in different timings i.e. daily, weekly, sometimes and whenever it is needed. A female teacher said that *"I discus problems with previous class teacher for alternate solution of the problems".*

Contradictory to all only two teachers said that they don't share these problems with their colleague to discuss alternative solution to enhance students learning in Mathematics because now they have sufficient teaching experience and they can solve those issues by themselves.

Conclusion

It is concluded that the attitude of the majority of the students was positive. As they teach to do cramming from the start of their schooling instead conceptualized learning. Consequently they generally face difficulty in solving many concepts of mathematics i.e. short and long algebraic expression, its addition and subtraction, geometry, algebra, set theory, base and number theory, general concepts, definitions and problems of statement, understanding the zero that it is positive or negative, LCM and positive and negative signs during addition and multiplication.

Moreover, according to the teachers most of the students were shy. They did not ask questions about their difficulties while teacher present in classroom. When teachers ask that are you understanding and students just said yes and nothing more than this. Likewise teachers believed that students neither practice nor revise their Mathematics classwork at home so they showed careless attitude towards learning Mathematics. Teachers also disclosed that syllabus of Mathematics at secondary level is very lengthy therefore mostly Mathematics' teachers of public and private schools have main focus to complete this on time. So that is the one more reason that they ignore to teach conceptually and just work on black board and students just copy all. The result of the study also showed that according to teachers their students face difficulty to express and interpret the geometry and its content as the medium of instruction and book are English.

It is also concluded that different factors can be used which promote positive attitude of students towards learning Mathematics i.e. use of knowledge and examples about usability of Mathematics in their daily life, teachers and parents' cooperation about time management and proper environment of study at home.

Recommendations

On the basis of findings following recommendations were made:

1. Audio and visual demonstration might done to support lecture and opportunities for students to work in groups.
2. Teachers might provide friendly atmosphere so that every student can ask question easily without any fear.
3. Conceptual and activity based learning from the primary level might provide to the students rather than just cramming.
4. Workshops, quiz programs and competitions might held regarding Mathematics at secondary level.
5. Teachers might involve students in learning Mathematics via appreciation to enhance their confidence to ask questions.
6. Teachers and parents might develop cooperation to discuss time management and proper environment of study at home.
7. Teachers might discuss the previous lecture and assure student' readiness for new lecture.

Implications of the Study

Explored factors in the study can provide wide and more beneficial results if primary and elementary levels are involved in it. In the light of recommendations provided, the results will bring about positive change in promoting mathematics learning at primary and elementary level. This particular research can be one of the basis for the further research in perspective of secondary school will bring about positive change in promoting mathematics learning at primary and elementary level. This particular research can be one of the bases for further research in perspective of secondary school students.

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