Learning in Mathematics: Difficulties and Perceptions of Students

Nasrin Akhter[*]
Nasreen Akhter[**]

Abstract

Many students find their studies in mathematics to be difficult and unrewarding. There is a tendency for students to opt out of studying mathematics as soon as possible. However, mathematics is usually seen to be important and holds a central place in the curricula in most countries. Mathematical ideas find application in numerous areas of life and in many careers. Thus, negative attitudes among students may have important ramifications for career choices and contributions in wider society. This study considered a sample of students (N = 647) from Punjab, Pakistan and collated their perceptions in relation to their learning in mathematic. The tools of data collection of this study were questionnaire. The findings indicate that students show positive attitude and grasp of mathematics content at grade 9th and 10th in mathematics. This was noticed that there were differences in attitude in what is required by the students and what is occurred in classroom where the learners are taught Mathematics. This study suggests the solutions about the competencies of students to work through mathematical difficulties.

Keywords: Learning in Mathematics, Difficulties, Perceptions, Field Dependency

Introduction

In looking at mathematics education, Brown et al. (2008) noted the widespread opinion among learners that mathematics is difficult, with students opting out whenever possible. By contrast in the neighboring country (Scotland), mathematics is a highly popular subject at all levels in school and university (Scottish Qualifications Authority, undated). This illustrates that, while mathematics is seen as difficult and unattractive in some countries, this observation does not apply in all. Sadly, there is a lack of research that explores learning in mathematics to see whether the factors underpinning the differences can be observed.

One of the problems in mathematics arises from its very nature. When learning mathematics, one goal is that students can conduct procedures in order to obtain correct answers. In seeking to achieve this goal, the students are encouraged to practice the

[*]Assistant Professor, Faculty of Education, University of Okara, Okara, Email: nasrin_cs2005@hotmail.com
[**]Assistant Professor, Department of Education, Faculty of Education, the Islamia University of Bahawalpur

procedures. Thus, the procedures are memorized and then automated in the minds of learners (Alenezi, 2008). While this can generate confidence, it often ignores an emphasis that students should understand what they are doing and why they are doing it. In this way, mathematics can be reduced to a process of practicing procedures until they are memorized, with little opportunity to understand what the procedures mean or how they might be applied wider life. In an interesting study, using factor analysis, Almadani et al. (2012) confirmed that examination successes in mathematics depended on recall skills, this broad picture applying to all school subjects. While facts may be memorized in some subject areas, in mathematics it was the procedures that were being memorized.

By its very nature, mathematics makes high conceptual demands on students. It involves procedures that may appear to be abstract and unrelated to life. It has been shown again and again that this places high demands on the limited working memory capacity in learners (Reid, 2009). Working memory is part of brain that helps learners in thinking, comprehension and problem solving skills. It has limited capacity for individuals and help to control comprehension.

This study also seeks to explore the extent of field dependency in learning in mathematics in high school students. Witkin and Goodenough (1981) described that field dependent is a person that cannot detach an item from its context. Field-Dependent individuals can unsatisfactorily separate an item from its background and willingly accept the dominating field. Field-Independent individuals can easily 'break up' an systematized perceptual field and separate willingly an item from its context. Very often, experienced teachers of mathematics hear learners say that, when faced with a mathematics problem they state they are uncertain where to start. This is a classic sign of information overload related to working memory limitations and that is where an understanding of the learner characteristic known as field dependency is central. Field dependency is the extent to which a person can focus on what is essential for a task in hand and instead of; ignoring what is peripheral for that task (Tinajero & Paramo, 1998). This has been considered in detail in the study of mathematics and this learner characteristic is very important in being able to undertake mathematical problems of the sort used in schools (Onwumere & Reid, 2009).

Mathematics is an integral part of the curriculum in almost all the countries of the world. In Pakistan, mathematics is considered a key subject for many fields. Khan (2012) noted that mathematics is not usually a popular subject and is a subject where students face many problems, with many opting out as they are allowed. Ali (2011) considers that, in Pakistan, it is poorly taught. However, teachers can only teach what is mandated for them. Very often, teachers are forced to follow the ways prescribed by textbooks. Procedures are memorized, practiced and then tested in formal examinations, credit being given for the correct conduct of procedures leading to correct answers

(Mohammad, 2002; Amirali & Halai, 2010). One study conducted in Pakistan has shown very clearly that a rigorous curriculum designed by school teachers was much more successful than the curriculum imposed from outside and designed by those outside the classroom (Ali & Reid, 2012). Thus, part of the problem in mathematics education may well be in an inappropriate curriculum.

In Pakistan, the curriculum for secondary grades is arranged under five broad themes and goals: (1) Numbers and Operations, (2) Measurements and geometry, (3) Algebra (4), Information handling, (5) Logical thinking and reasoning. However, if the examinations give the rewards to candidates for the correct conduct of taught procedures, then practicing procedures will become the focus for both teachers and learners. Many studies have considered areas of difficulty in mathematics. For example, Barmby and Harries (2007) investigated the significance of *representations* in understanding of multiplication. Harrie and Patrick (2006) carried out investigation on the array representation in learning multiplication calculations. They used an innovative approach for recording learners work on computer. Matthews and Pepper (2005) examined that the main reasons for giving up mathematics include lack of satisfaction coupled with boredom along with perceived irrelevance. Nardi and Steward (2003) argue that, at age of 12-15, enjoyment is an important feature for learners when seeking understanding.

In a wider sense, research shows consistently that learners naturally want to make sense of what they are being taught. This observation stems right back to the work of Piaget (Wadsworth, 1979) and was very evident in the study of Skryabina when she looked at what attracted learners into studying physics (Reid & Skryabina, 2000). The principle led to the idea of the applications-led curriculum where the themes being studied were determined by an analysis of the needs of the learners in the context of their age, culture and lifestyle (Reid, 2000). Alenezi (2008) considered the place of applications in the teaching and learning of mathematics and noted that this presented very specific difficulties in that the incited capacity of working memory could not cope with the mastering of a mathematical procedure, understanding what that procedures meant and seeing how it could be applied?

In considering any mathematical task, the learner has to cope with the procedure to be followed and any mathematical representation being used. The working memory may be able to cope with this but has little or no capacity left to consider any understanding of the concepts underpinning the procedure or situations where the procedure might be applied. The evidence shows clearly that difficulties in mathematics can largely be explained in terms of the limitations of working memory capacity. In this context, Alenezi (2008) observed that the best way forward is to concentrate on practicing the procedures until these are automated. Automated procedures take up very little working memory space, leaving capacity for the learner to

consider understanding and applications. However, if the examination procedures reward the correct conduct of procedures and the curriculum is overloaded, there is no time or motive for the hard-pressed teacher to consider either understanding or applications, leaving the learner dissatisfied.

Statement of the Problem

While mathematics is logical in nature, it is also somewhat abstract and that, while it applies widely in life, it is difficult to make these applications real and tangible to young learners. The present study was regarding "Attitude in Learning Mathematics: High School Students' Perceptions, Difficulties and Field Dependency in their Mathematics studies". Objectives of the study were to explore:

1. The high school students' perceptions and attitudes towards mathematics.
2. The challenges and difficulties related to mathematics performance.
3. The relationship between mathematics achievements and age with the field dependency.

Research Questions

This study targeted to answer following questions

1. What are the high school students' perceptions towards mathematics learning and experiences in the classroom?
2. What are the difficulties the students encounter in their mathematics experiences?
3. What is the relationship between mathematics achievements and age with the field dependency of students?

Significance of the Study

The study anticipates shedding light on the solution of the conceptual mathematics difficulties students usually face in secondary classrooms in Pakistan. This study will help students to gain command over subject content at secondary level in mathematics. There seems to be a huge difference between; what is required by the students and what happens in the classroom where students learn Mathematics? This study may recommend about the in competencies of students to work through mathematical difficulties by majority of students in secondary mathematics. This study also anticipates exploring the reasons of the lack of critical thinking and problem solving in Pakistani students and search out; why students fail to apply their knowledge of mathematics to the novel situations.

Research Methods and Sample

A quantitative investigation using a questionnaire of 45 items was made to examine high school students' attitude and difficulties in mathematics learning and experiences in the classroom. The questionnaire was developed by the researcher by

look at the themes from the literature to examine high school students' attitude and difficulties in mathematics learning and experiences in the classroom. Internal consistency of 45 items was measured by Cronbach's Alpha statistic that was 0.94. Moreover, Johnston Figure test (1976) Field dependency (a standardized test) was used to explore the level of field dependency of students. Six hundred and forty seven students from science group, aged approximately 14-16 were selected from 4 districts in Punjab, Pakistan. The sample contained; 43% male and 57% female; 65% urban and 35% rural; 35% public and 65% private school; 58% 9th class and 42% 10th class students. Data was collected during school hours and analyzed through percentage and chi-square test.

Findings of the Study

The overall picture gained by considering the response data is now presented. The responses regarding perceptions, attitudes, and difficulties are presented in the form of percentage.

Perceptions of Students in Mathematics Learning

Table 1 from the first section of the questionnaire explore how do the students perceive about their learning in mathematics?

Table 1

Perceptions of students in mathematics learning

Statements	*SA*	*A*	*N*	*DA*	*SDA*
I entirely comprehend my lessons.	44	46	6	3	1
I like teaching method of my teachers	53	36	5	4	2
I truly comprehend the procedures in class.	33	48	11	5	3
I do not like doing too much class work daily.	28	28	15	17	12
I dislike home task because I can't do it independently.	19	18	15	24	24
There is sufficient revision at school to help me comprehend well.	37	41	7	10	5
I think tuition is necessary to get good marks in mathematics.	41	27	9	14	9
I tend to panic near the exam.	16	30	19	19	16
I find it problematic to revise the entire year syllabus in the annual examinations.	17	34	11	25	13
I do not like short questions because I cannot express all that I know.	10	16	11	35	28

I like multiple choice questions in mathematics exam.	53	28	6	7	6
I *realize* that the allowable time for mathematics paper is insufficient.	30	31	11	18	10
If I have problem in understanding something new, I seek help from my teacher.	46	37	6	7	4
If I have problem in understanding something new, I seek help from my tutor.	35	31	10	17	7
When the mathematics marks of student improve, it is due to his own hard work.	51	28	9	6	6
I feel difficulty in learning a topic because I did not understand previous ideas.	17	32	16	25	10
Teacher question in class helps my understanding.	54	34	4	4	4
Only those units of textbook are taught that are important to pass the examination.	23	20	10	23	24

From Table 1, many positive features are evident but, in most cases, significant minorities do not share the general views. This is parallel to the findings of Alhmali (2007) where he found marked polarization of views related to mathematics in his study in Libya. Overall, the majority of participants were agreed that they understand their mathematics lessons. They are satisfied with teaching methods used for teaching mathematics and understand the techniques of solving math questions. The data also shows that the majority of participants were agreed that they like the multiple-choice questions in mathematics tests. However, there are areas where students express uneasiness. Inevitably, students do not wish to work too hard and tend to become anxious as examinations approach while they do not enjoy revising in mathematics tests.

Attitude of Students in Mathematics

Table 2 from the 2nd section of the questionnaire presents what is the students' attitude towards their learning in mathematics?

Table 2
Attitude of students in mathematics

Statements	*High*	*Medium*	*Low*
I like Mathematics	43	37	20
I find mathematics beneficial in my daily life	54	31	15
I find mathematics an interesting subject	62	26	12
I wish to study mathematics because I like it	65	22	13
I feel mathematics is easy to understand	61	28	11
Knowing mathematics will help me in my career	63	26	11
Mathematics allows me to create ideas	49	30	21
Understanding mathematics is important to me	64	25	11
Mathematics rules can never be proved wrong	64	25	11

On the whole, it is evident from Table 2 that learners feel confident regarding mathematics learning. The majority of the participants in this study expressed positive views regarding mathematics with most expressing that they feel happy to learn mathematics. Their optimism was slightly over-confident when they consider that mathematics rules can never be proved wrong. Using the method pioneered by Johnstone et al. (1971) and employed by many (Ali & Reid, 2013), students were asked to rate the topics studied in the following way:

Easy	I understand the topic first time
Moderate	I did not understand it first time
Difficult	I have never have understood the topic
Not taught	Topic not studied

Students Difficulties in Learning in Mathematics

Table 3 presents the answer of questions exploring what are the students difficulties in learning of mathematics. The topics about difficulties in mathematics are given in Table 3 and 4.

Table 3
Grade 9th students difficulties in learning in mathematics

Grade 9, N = 375	*Easy*	*Moderate*	*Difficult*	*Not Taught*
Matrices and determinants	50	20	20	10
Real and complex numbers	50	30	10	10
Logarithms	32	30	28	10
Algebraic expressions and algebraic formulas	40	35	15	10
Factorization	50	30	10	10
Algebraic manipulation	40	30	20	10
Linear equations and inequalities	40	30	20	10
Linear graph and its applications	40	30	20	10
Introduction to coordinate geometry	40	25	25	10
Congruent triangles	40	30	20	10
Parallelograms and triangles	35	30	25	10
Line bisectors and angle bisectors	45	35	10	10
Sides and angles of a triangle	50	20	20	10
Average score	42	29	19	10

Table 4
Grade 10th students difficulties in learning mathematics

Grade 10, N = 272	*Easy*	*Moderate*	*Difficult*	*Not Taught*
Quadratic equations	45	30	20	5
Theory of quadratic equations	50	30	10	10
Variations	45	35	15	5
Partial equations	50	35	10	5
Sets and functions	45	40	10	5
Basic statistics	55	15	20	10
Trigonometry	45	30	10	15
Projection of a side of a triangle	45	35	15	5
Chords of a circle	50	20	20	10
Tangent to a circle	45	25	20	10
Chords and arcs	70	20	5	5

Angle in a segment of a circle	60	20	10	10
Practical geometry	55	20	13	12
Average score	51	27	14	8

From the tables above, the student responses appear to find most topics are easy and little difficult. But a logarithm is most difficult for students. In addition, the responses showed that, introduction to coordinate geometry and Parallelograms and triangles are difficult for students. This is similar to the findings of Ali and Reid (2013). Compared to the 9th class, the proportions selecting '*difficult*' are much higher. This pattern is very similar to that obtained by Ali and Reid (2012).

By evaluating the results applying chi-square statistic, data of male and female students was compared. Results are given in Table 5. Data exhibits that majority of participants were agreed that they understand their mathematics lessons. They also expressed that they do not like to do homework because they do not have enough ability to do it on their own. The outcome here reflects the fact that there are limited opportunities to develop increased field independence in the educational culture in Pakistan. In the overall data, two groups appeared to show higher levels of confidence in mathematics learning: boys and those for urban schools. This was checked using chi-square as a contingency test and it was found that the differences were often significant.

Table 5
Gender differences in their attitude to school mathematics

Statements	Gender	SD	D	N	A	SA	χ^2	df	p
I understand my lessons completely	Female	0	1	15	129	131	7.3	4	$p < 0.05$
	Male	9	15	20	171	156			
I like the way my teacher explains the methods	Female	5	2	11	88	170	18.3	3	$p < 0.001$
	Male	9	21	21	146	174			
I actually understand the procedures in class	Female	2	4	26	146	97	16.6	4	$p < 0.01$
	Male	17	29	46	166	114			
I think tuition is necessary to get good marks in mathematics	Female	36	55	27	68	90	28.5	4	$p < 0.001$
	Male	21	38	33	109	170			
I tend to panic near the exam	Female	24	52	51	95	53	21.0	4	$p < 0.001$
	Male	78	72	72	98	53			
I think that the allowed time limit is very short in	Female	29	37	45	74	89	19.9	4	$p < 0.001$
	Male	34	84	29	124	102			
If I have a problem in understanding something new, I seek help from my teacher	Female	6	8	16	102	144	19.0	3	$p < 0.001$
	Male	20	36	25	137	153			
I feel difficulty in learning a topic because I did not understand previous ideas	Female	32	75	57	75	37	14.0	4	$p < 0.01$
	Male	36	86	47	130	72			
Teacher question in class helps my understanding	Female	4	7	4	96	165	24.1	2	$p < 0.001$
	Male	24	21	23	121	182			
Only those units of textbook are taught that are important to	Female	91	51	32	44	58	30.3	4	$p < 0.001$
	Male	61	99	31	88	92			
Mathematics rules can never be proved wrong	Female	18	24	37	84	111	19.1	4	$p < 0.001$
	Male	43	55	45	75	155			

In several of the comparisons, the differences between males and females reflect the generally higher male confidence in relation to studies. Thus, the males tend to be more confident when it comes to feeling that they understand and in seeking help.

Table 6
Grade differences in their attitude to the school mathematics learning

Statements	Class	SD	D	N	A	SA	χ^2	df	p
I hate homework because I cannot do it on my own	9th	75	73	64	78	87	31.3	4	p < 0.001
	10th	80	84	35	41	30			
I think tuition is necessary to get good marks in mathematics	9th	24	37	20	123	173	52.1	4	p < 0.001
	10th	33	56	40	54	87			
I do not like short questions because I cannot express all that I know	9th	87	133	44	76	37	21.1	4	p < 0.001
	10th	94	101	24	25	26			
I think that the allowed time limit is very short in mathematics paper	9th	37	83	39	126	91	20.6	4	p < 0.001
	10th	26	39	35	72	100			
I feel difficulty in learning a topic because I did not understand previous ideas	9th	36	86	53	144	58	17.7	4	p < 0.01
	10th	32	75	51	62	50			
Teacher question in class helps my understanding	9th	25	19	13	138	182	11.1	2	p < 0.01
	10th	3	9	14	79	165			
Only those units of textbook are taught that are important to pass the examination	9th	95	98	23	70	91	18.3	4	p < 0.01
	10th	57	52	40	62	59			
I like mathematics	9th	46	35	54	154	88	41.8	4	p < 0.001
	10th	19	23	18	85	125			
I find mathematics an interesting subject	9th	58	63	49	96	111	22.1	4	p < 0.001
	10th	26	24	27	74	119			
I want to learn mathematics because I enjoy it	9th	67	60	49	76	125	15.4	4	p < 0.01
	10th	29	28	32	66	115			
I feel mathematics is easy to understand	9th	62	68	35	100	112	17.4	4	p < 0.01
	10th	27	26	29	84	104			

The data shows that as compared to the 9th class, the proportions selecting "*demanding*" are much higher. The chi square analysis helps in exploring the difference between opinions of male and female students. Also the results show that majority of students from urban areas have positive perceptions. The outcome here may well reflect the fact that there are limited opportunities to develop increased field independence in the educational culture in Pakistan.

Table 7
Area of school differences in the school mathematics learning

Items	Area	SD	D	N	A	SA	χ^2	df	p
I understand my lessons completely	Urban	8	14	27	207	162	18.5	2	p < 0.001
	Rural	1	2	8	93	125			
I do not like short questions because I cannot express all that I	Urban	130	159	45	47	37	20.7	4	p < 0.001
	Rural	51	75	23	54	26			
Teacher question in class helps my understanding	Urban	21	17	24	153	203	12.7	2	p < 0.01
	Rural	7	11	3	64	144			

Chi square results of mathematics learning regarding area difference show that majority of students from urban areas have positive perceptions. The majority of students from urban areas expressed that they understand their lessons of mathematics completely.

Table 8
School type differences in the school mathematics

Statements	School	SD	D	N	A	SA	χ^2	df	p
I do not like doing too much class work daily	Public	37	60	16	69	42	47.6	4	p < 0.001
	Private	40	52	78	115	138			
I think that the allowed time limit is very short in mathematics paper	Public	12	45	21	95	51	22.9	3	p < 0.001
	Private	51	73	53	106	140			
When the mathematics marks of student improve, it is due to his own hard work	Public	16	14	18	87	89	85.4	3	p < 0.001
	Private	26	27	39	97	234			
Only those units of textbook are taught that are important to pass the examination	Public	24	64	13	72	51	56.7	4	p < 0.001
	Private	128	86	50	60	99			
I like mathematics	Public	13	10	35	93	73	21.2	4	p < 0.001
	Private	52	46	37	146	142			
I find mathematics useful in my daily life	Public	9	10	32	86	87	16.5	3	p < 0.001
	Private	46	34	66	115	162			
I find mathematics an interesting subject	Public	24	23	38	68	71	15.5	4	p < 0.001
	Private	60	64	38	102	159			

The table 8 showed that the Public and private schools draw very different student populations and, therefore, large differences are to be expected. The proportion of girls exceeded that of boys, mainly because of the current patterns in education at the moment. In one other study, there was a marked development of independency with age over the range from 12-17 (Onwumere & Reid, 2014). Indeed, there is considerable circumstantial evidence that the extent of field independence can grow with age but this seems to depend of experiences and has cultural implications. The outcome reflects the fact that there are the limited opportunities to develop increased field independence in the educational culture in Pakistan. When the results for the measured field dependency were correlated with mathematics marks, significant correlation values were obtained. This is in accordance with the literature. The positive correlation values (0.3 at 0.05 level of significance) between field dependency and age of students show that field dependency makes an effect on learners' performance as well as achievement in relation to age. The students who are field independent perform better in mathematics than the others who are field dependent.

Discussions

This study was intended to explore students' perceptions of the mathematic learning and difficulties. The finding shows that the students belonging to the private sector and urban areas differ in their views as compared to the public schools and rural areas. This is the pattern of education system Pakistan, especially in the public schools. The students in the public schools of Pakistan are generally belonging to the middle or the lower class of the society, with lesser incomes. They do not have several modern facilities and they have to learn with old and traditional limited resources. In Pakistani schools, there is a recommended textbook of mathematics for all classes. The examination is totally based on this prescribed textbook. In the current teaching methodology, much of the focus is given on just to solve these exercises instead of instilling in the pupils a perfect knowledge of the basic concepts of mathematics. Thus, at present the teaching practices of the subject mathematics make students the rote learners of textbooks.

This study shows that the majority expressed positive views regarding mathematics; with most expressing that they feel happy to learn mathematics. The students well perceived their learning in mathematics. Students generally find mathematics a boring and difficult course and this finding is little contrasting to (Brown et al, 2008). The majority of the students showed that they seem a little importance of using student centered approaches mathematics curriculum as curriculum do not stress to solve problems in classroom. Simply, the students are not encouraged and rewarded in their mathematics performance. The deficiency of programs of development and resources causes problems to the students as well as teachers (Memon, 2007; Halai, 1998). Particularly from the rural areas schools, the students pointed out the difficulties

in their mathematics learning experiences because of inexperienced staff and insufficient resources (Memon, 2007; Anderson et al., 2005). Overall correlation of mathematics marks (standardized) and extent of field dependency is moderate. Likewise, Onwumere (2009) showed that extent of field dependency was highly correlated with mathematics performance for each age group. Moreover, these results were consistent with the findings of Al-Enezi (2006) and (Onwumere, 2009). Thus, the standardized mathematics examination scores reflect that there is a general ability in students in mathematics, and then this ability correlates with the measured extent of field dependency.

Conclusions and Recommendations

It is found from the study that the students are enthusiastic in their learning in mathematics. They found mathematics interesting and valuable. Although very few found studying mathematics boring and tough. The students of the 9^{th} and 10^{th} class in this study were of the view that mathematics is an interesting, useful and analytical power generating subject. The Figure 2was generated on the basis of Findings, the key problems and recommendations from the study which were detailed below the figure. .

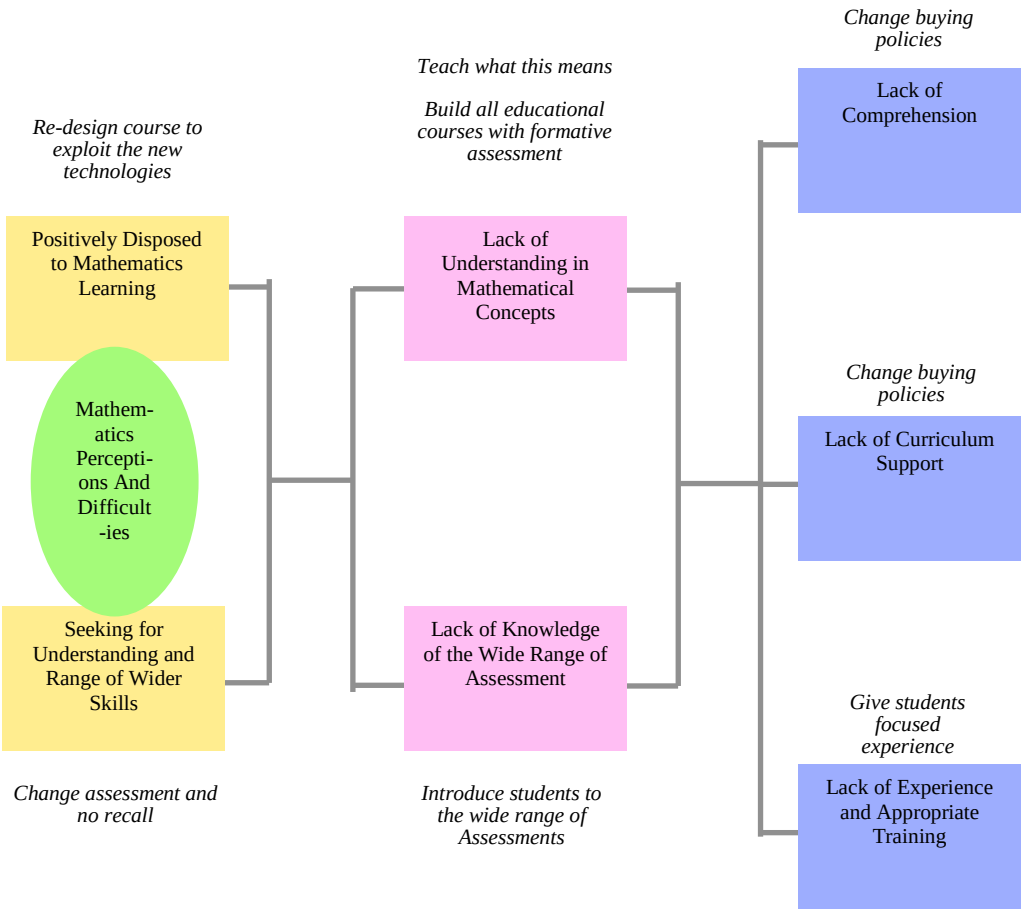

Figure 1. *The key problems and recommendations from the study*

In the figure above, the boxes and circles show the findings and key problems and outer text shows the recommendations from the study. The above figure 2summarizes the key findings as there were some problems identified by the students, particularly, difficult with large classes, demanding in time in preparing lessons. Furthermore, they perceived that their learning in mathematics is not matched properly with curriculum that gives more focus recalling skills and relies more on book and the current assessment system is over-loaded and its focus on just more and more formal examinations. Moreover, the correlation values between field dependency and age of students show that field dependency makes an effect on learners' performance as well as achievement in relation to age. Furthermore, the above diagram shows that the important implications for understanding of the realities that exist in secondary

mathematics classrooms in Pakistan. This is recommended from this study that the teachers should be supported and given the time and resources to develop better ways for the future. Moreover, there should be a broader opportunity to develop increased field independence in the educational culture in Pakistan.

References

Al-Enezi, D. (2006). *Difficulties Associated with Teaching and Learning Mathematics: A Study of Psychological Factors Affecting Pupils' Performance* (Unpublished MSc thesis). Glasgow, University of Glasgow.

Alenezi, D. (2008). *A Study of Learning Mathematics related to Some Cognitive Factors and to Attitudes* (Unpublished PhD Dissertation). Glasgow, University of Glasgow. [URL: http:// theses. gla. ac.uk/333/).

Alhmali, R. (2007). *Student Attitudes in the Context of the Curriculum in Libyan Education in Middle and High Schools* (Unpublished PhD Dissertation). Glasgow, University of Glasgow. [URL: http://theses.gla.ac.uk/61/]

Ali, A.A., & Reid, N. (2012). Understanding mathematics some key factors. *European Journal of Educational Research, 1*(3), (283-299).

Ali, T. (2011). Exploring students' learning difficulties in secondary mathematics classroom in Gilgit-Baltistan and teachers' effort to help students overcome these difficulties. *Bulletin of Education and Research, 33*(1), 47-69.

Amirali, M. (2007). *Exploring students' conception of nature of mathematics*. A quantitative Research study Report - Unpublished assignment of the PhD study. Aga Khan University Institute for Educational Development, Karachi, Pakistan.

Amirali, M., & Halai, A. (2010). *Teachers' knowledge about the nature of mathematics*: A Survey of secondary school teachers in Karachi, Pakistan. *Bulletin of Education and Research, 32*(2), 45-61.

Anderson, J., White, P., & Sullivan, P. (2005). Using a schematic model to represent influences on, and relationships between, teacher's beliefs and practices. *Mathematics Education Research Journal, 17*(2), 9-39.

Brown, M., Brown, P., & Bibby, T. (2008), *I would rather die: Reasons given by 16-years-olds for not continuing their study of mathematics*. *Research in Mathematics Education, 10*(1), 3-18.

Halai, A. (1998). Mentor, mentee, and mathematics: A story of professional development. *Journal of Mathematics Teacher Education, 1*(3), 295- 315.

Harries, T., & Barmby, P. (2007). Representing and understanding multiplication. *Research in Mathematics Education, 9,* 33-45.

Harries, T., & Patrick, J. (2006). Exploring links across representations of numbers with young children. *International Journal for Technology in Mathematics Education, 13*(2), 53-64.

Johnstone, A.H. (1997). Chemistry teaching, science or alchemy. *Journal of Chemical Education, 74*(3), 262-268.

Khan, S. (2012). *The rise of the tech-powered teacher*. Education Week.

Matthews, A., & Pepper, D. (2005) *Evaluation of participation in A level mathematics: Interim Report*. London: Qualifications and Curriculum Agency.

Memon, G.R. (2007). Education in Pakistan: The key issues, problems and the new challenges. *Journal of Management and Social Sciences, 3*(1), 47-55.

Mohammad, R.F. (2002). *From theory to practice: An understanding of the implementation of in-Service mathematics teachers' learning from university into the classroom in Pakistan* (Unpublished M.Phil. Thesis). University of Oxford, UK.

Nardi, E., & Steward, S. (2003). Is mathematics T.I.R.E.D? A profile of quiet disaffection in the Secondary mathematics classroom. *British Educational Research Journal, 29*(3), 345-367.

Onwumere, O. (2009). *Difficulties Understanding Mathematics: An Approach related to Working Memory and Field Dependenc*y (Unpublished Ph.D Dissertation). University of Glasgow http:/thesis gla.ac.uk/I278.

Reid, N. (2000). The Presentation of Chemistry: Logically Driven or Applications Led? *Chemistry Education: Research and Practice, 1*(3), 381-392.

Reid, N. (2009b). Working memory and science education, *Research in Science and Technological Education, 27*(2), 245-250.

Reid, N., & Skryabina, E. (2002). Attitudes towards Physics, R*esearch in Science and Technological Education, 20*(1), 67-81.

Tinajero, C., & Paramo, M. (1998). Field dependence-independence, cognition style and academic achievement: A review of research and theory. *European Journal of Psychology of Education, 13*(2), 227-251.