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Effects Of Classroom Context On Learner Belief Systems And Heuristic Ability And At Secondary Level

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Abstract

This study makes an effort to explore effects of classroom context on belief systems and heuristic ability of the learners in the subject of mathematics at the secondary level. Study nature was qualitative and the method assumed for obtaining information was a single case study. The site selected for this investigation was Government Girls Higher Secondary School Rustam in District Mardan. Participants of the study were class 10th science students. Tool used for the collection of data was classroom observation for checking their teacher attitude, way of teaching, learner's interest, problem solving ability and their participation as well as classroom environments. Researcher observed four mathematics periods for the collection of data. Data were analyzed through thematic analysis. Results and discussion of the study showed that classroom environment greatly effects learner's belief and heuristic ability of the learners towards in the subject of mathematics.

Keywords: Classroom, Classroom context, Heuristic, Heuristic ability, belief system.

1. Introduction:

Mathematical belief is an individual understanding of the world of mathematics, while identifying shared mathematical tasks. It is not only the field of cognitive, but also affective fields, such as attitudes and beliefs that affect the stages of solving the problems (Hadi, 2017). For Mathematics learning and teaching beliefs play a great role. The knowledge product of learners is powerfully linked to the attitudes and beliefs about mathematics (Furinghetti & Pehkonen, 2000). Smith (2014) quoted the definition of beliefs that —beliefs as the understandings that the person has dealings of mathematics and the globe that the person believes to be corrected. Aksu (2012) argue that the learner's beliefs come from experiences which are gain from classroom environment. Beliefs of learner derived from

his/her liking and disliking of mathematics. An individual view of mathematics is a mixture of knowledge, beliefs, conceptions, attitudes and feelings. (Hannula, 2007).

The ability of students is one of the main factors in mathematics education, because it can be used to determine the success of the implementation and success of students absorbing learning material. Heuristics ability is best used with those students who understand the mathematics concept, but those students have difficulty in remembering the steps in completing a problem are unable to solve the problem in a good manner. The use of heuristics or self-strategies in mathematics can have a deep impact on a student's ability to quickly and accurately solve a math fact or word problem. (Burns, 2011; Snyder, 1988). Farooq and Shah (2008) conducted a study under the title "Students attitude towards Mathematic" they concluded that attitude towards mathematics plays a crucial role in the teaching and learning processes of mathematics. It effects students 'achievement in mathematics.

A research conduct by Woodward et al. (2012), these researcher talk about the bond amongst the students beliefs regarding resolving the problem and their accomplishment in the solution of problems. They concluded that statistically there is a significant relationship amongst the problem-solving, learners 'beliefs and their accomplishment with explaining day to day complications was observed. In Pakistan different researches has done on mathematics education at secondary such as mathematics anxiety, poor performance of students, factor influence the learning of mathematics, mathematics teachers beliefs and its contribution and the relationship between teacher and students beliefs. Work on this particular aspect that is 'affects of classroom context on heuristic ability and belief system at the Secondary level' are rare.

Statement of the Problem

In Pakistan mathematics is a compulsory subject from KG to secondary level because the knowledge of mathematics is very important for the solution of day to day problems along with others conventional subjects (Akhter, 2018).The purpose of mathematics subject in Pakistan at secondary level is imitative in its aim which strain to facilitate learners to obtain understanding of the perceptions of mathematics and its implementation in their real life situation. The gap is here that to what extent classroom context effects belief system and heuristic ability of Secondary school learners in the mathematics.

Objectives of the Study

Objective of the study was:

To investigate to what extant mathematics related classroom context effect learner heuristic ability and belief systems at Secondary level.

Research Questions

Is mathematics related classroom context effect learner heuristic ability and belief systems at Secondary level?

Significance of the Study

Firstly this study was likely to know about classroom environments in the subject of mathematics, teaching methodology, student's interest, their attitude, their participation in the class and problem solving ability. It may be a rich contribution to the teacher that is aware about the learner beliefs related to mathematic and heuristic ability of their students and teacher will know better about problem solving ability in mathematics classroom. In the field of mathematics, mostly this research will proceed for the growth of theory on opinions and problem-solving and in what way students' beliefs about mathematics are connected to the discipline of mathematics academic environment.

2. Literature Review

In all around the world Mathematics is an important part of the curriculum. In Pakistan mathematics is a compulsory subject in schools. The knowledge of mathematics is a vital for most of the subject (Akhter, 2018). The teaching of mathematics means knowledge to resolve problems, both individual as well as day to day problems (Tambunan, 2018). Khan (2012) reputed that mathematics is not frequently a popular subject and it is the subject in which the learners face many difficulties and many challenges.

Beliefs

Beliefs are defined as knowledg building by the person from his or her own point of views. This point of views of one individual are totally different from the other its mean that building knowledge of one person is different from the other (Op'tEynde et al, 2002). Kayander and Lovric (2005) claim that in the formation of beliefs, attitude plays a great role because beliefs are twisted by previous experiences especially in education from classroom experiences.

Yılmaz (2007) described the epistemological beliefs of the learners and categorized these beliefs into two distinct beliefs one is the positive and the second one is the negative belief. Positive beliefs are for their explained into the problem solving process and the try for solving the problems process while negative beliefs may be no motivation of individual towards learning of mathematical problem. The learners'academics achievements clearly showed about their beliefs and attitudes about mathematics (Furinghetti & Pehkonen, 2000). Beliefs relevant to Mathematical concepts has great role for understanding the behavior of the learners in various sessions in the subject of mathematics (Underhill, 1988).

Giovanni and Sangcap's (2010) view that in mathematics education attitude and behavior of the learners has a great role. Student's achievements are strongly related to their beliefs and attitudes towards mathematics. Mutodi (2014) investigated the student's perception on Mathematics performance. Moreau (2010) described that attitude may control the creation of original beliefs this claim also cited by (Moscucci, 2008) that beliefs are developed from the personal experiences through classroom activities and also from their social environment such as from parents, from relatives and from peer group. The researcher also cited that prior knowledge play a great role in the development of new beliefs. Aksu (2012) argue that the learner's beliefs come from experiences which are gain from

classroom environment. The use of heuristics or self-strategies in mathematics can have a deep impact on a student's ability to quickly and accurately solve a math fact or word problem. (Burns, 2011; Snyder, 1988).

Malouf, **(**2011**)** noted that even though a heuristic lead a learner for obtaining a solution in any given problem situation, but the solution is not guaranteed. Callejo and Vila 2009) exposed a composite relationship between belief system and problem solving. As a result,, they could not identify any fundamental relationship between learner belief systems and their problematic nature of approaches. Belief has a importance on general problem solving skill was much hold up by studies in the field of Mathematics and Computer Science. (Westland et al. (2015) states that heuristic solution method relies on spontaneous or simple rules, which applied to the problem and offer more than one solutions for a single problem. Ozturk & Guven (2015) conducted a study on Evaluating Students 'Beliefs in Problem Solving Process.

3. **Methodology**

Tools for Research

Classroom observation was used for the collection of data.

Participant of the study

Class 10th science student.

Classroom context affect learner heuristic ability and belief systems

The researcher use classroom observation for investigating that whether classroom environment affects the heuristic ability and their beliefs about mathematics.

Observation 1

Host School: GGHSS Rusam Name: XYZ

Designation: SST Math & Physics Subject: Mathematics

Day: (Monday) Date &Time: (10:00AM) 20/01/2020

Period: 3rd Class &Section: 10th A

Total strength 94 Present 79

Absent 15

Table 4.6.1 Summary and short description of the classroom observation.

Observation area	**Short Descriptions**
1. Physical Environment of the class	➢ Lighting available ➢ Board present ➢ Students sitting in row
2. Academic environment	➢ Students participation were 7 to 12 ➢ Students were passive

	➢ Teacher was active
3. Knowledge of Subject Matter	➢ Good command ➢ Materials are relevant to the course ➢ No emphasize a conceptual grasp ➢ No incorporation of recent developments in discipline
4. Teacher methodology and her attitude	➢ Lecture method ➢ Direct start lesson ➢ No motivation ➢ Yes gives the task ➢ Rout behavior

5. Teaching Strategies used by the teacher	❖ No, stand on one place ❖ No, just lecture method ❖ Yes board work legible & organized ➢ Yes, sometime ➢ No, no use of other techniques
6. Organization and Clarity of the subject matter	➢ No, on the spot ➢ sequence of content covered logical ➢ present and explain content clearly
7. Presentation and Enthusiasm	➢ The rate of speech too fast ➢ rate of speech not appropriate for note taking ➢ No motion to sustain student interest
8. Teacher and Students Interaction	➢ Direct from text book ➢ Yes, guidelines clear but for few students ➢ Teacher encourage student questions ➢ No use of verbal reinforcement by teacher ➢ No, non-verbal response (smile, nod)
9. Student attitude during the class	➢ Write down what instructor puts on board ➢ Few students listening attentively ➢ Teacher just appreciates step by step procedure.

Results

The researcher observes class of mathematics. First she noticed the physical environment of the class and noted the facility of lighting which was satisfactory and the seating arrangement was focused in rows rather than towards group seating. The writing board facility was also available in front of the class. Next, the researcher examine academic environment of the class and noticed that the class environment was teacher center the teacher was active while the students were passive. The student's participation was round about 7 to 12 out of 79 students.

The observer also observe the teacher competency and mastery over the subject. Researcher noted down that the teacher was competent and has good command over the subject but she has no incorporation of recent developments in discipline. She used lecture method for teaching and started the lesson directly from the text book; she used writing board for writing and not uses any motivational techniques for learning the new concept. During lecture her behavior was route. She was just appreciating the competent students and ignores the slow learner. During presentation the researcher monitor the organization and clarity of subject matter. She observed that the teacher not prepare the lesson in advance because the teacher was study some rules on the same time when she faced difficulties in solving the problem. The teacher rate of speech too fast which was not appropriate for note taking. The teacher was just stood on one place and no motion to sustain the student's interest.

The researcher examines the teacher entrance in the class. The teacher entre into the class the students say to " teacher Assalamu alikum" the teacher said Walikum salam, pickup book and start direct from the text book on board the teacher was encourage the students but no use of verbal reinforcement were occurred for motivation during teaching There was no nonverbal response such as smile, nod etc. was occurred. The observer watched for student's attitude and interaction. She said that the students were just writing down what the teacher puts on board. Few students were listing attentively and the teacher just appreciates step by step procedure. At last she gave the whole exercise for home work. The researcher analyzed from the whole class observation that the teacher was only focused on the text book problem and not used motivational techniques for creating their interest and to hold positive attitude and beliefs toward the subject of mathematics.

Observation 2

Host School: GGHSS Rustam	Name: XYZ
Designation: SST Math & Physics	Subject: Mathematics
Day: (Wednesday)	Date &Time: (10:AM) 22/01/2020
Period: 3rd	Class &Section 10th A
Total strength 94	Present 82
Absent 12	

Table 4.6.2 Summary and short description of the classroom observation.

Observation area	Short Descriptions
1. Physical Environment of the class	➢ Lighting available ➢ Board present ➢ Student sitting in row
2. Academic environment	➢ Students participation were 8 to 10 ➢ Students were little bit active ➢ Teacher was active
3. Knowledge of Subject Matter	➢ Good command ➢ Materials are taken from the course ➢ No, only focused on course materials ➢ A little incorporation of recent developments in discipline ➢ Yes, important content discussed
4. Teacher methodology and her attitude	➢ Traditional method ➢ Direct method motivation ➢ No, gives the challenges task ➢ Attitude was harsh
5. Teaching Strategies used by the teacher	➢ Yes, a little bit ➢ No, stand on one place ➢ No, just lecture method ➢ Yes board work legible & organized ➢ Yes, sometime ➢ Yes , question answer techniques
6. Organization and Clarity of the subject matter	➢ Yes prepare the lesson ➢ Yes, but little bit ➢ sequence of content covered logical ➢ present and explain content clearly
7. Presentation and Enthusiasm	➢ Use text book materials ➢ The rate of speech too fast ➢ Guide line clear just for few students ➢ Due to fast speech students are unable to take note ➢ The teacher is sticky on one place

8. Teacher and Students Interaction	➢ Yes, guidelines clear to few students ➢ Teacher encourage student questions ➢ No use of verbal reinforcement by teacher ➢ No, non-verbal response (smile, nod)
9. Student attitude during the class	➢ Write down what instructor puts on board ➢ Few students listening attentively ➢ Teacher adopt the rules of algorithm

Results

From the second mathematics classroom observation the researcher observes physical environment of the class and was noted the facility of lighting was satisfactory and the seating arrangement was in rows. The writing board facility was also available in front of the class. Along with physical environment the researcher also examine the academic environment of the class. She sight that the class environment was a little bit teacher center the teacher was more active while the students were less than the teacher. The student's participation was round about 8 to 10 out of 82 students. Next the researcher notice the knowledge of subject teacher and concluded that the teacher of this class have enough knowledge regarding to this course because she was SST Math & physics teacher. The teacher of this class was focused on course materials and a little incorporation of recent developments in discipline.

The onlooker looks for her methodology which was traditional method and direct method. The teacher was given challenges task from the text book for their homework. Her attitude was very harsh. From today observation the researcher observes that the teacher prepare her lesson and use logical sequence for solving questions. The teacher present and explain content clearly but the speed of speech was too fast that every students cannot pickup early. The teacher did not use any alternative method such a, l media, lab and discussion. She delivers her lecture from the one place. The teacher gave guidelines which was not clear for an all students in the class although the teacher encourage the students questions during the lesson but no use of verbal reinforcement by teacher and no, non-verbal response (smile, dip) were used by her. The researcher see in this lecture that the teacher motivation towards the learning of mathematics. She said that the teacher just delivers the lecture and no motivational techniques used for developing the students beliefs about mathematics. The eyewitness noted that the teacher was mostly focused on the step by step procedure and used the board for this purpose while the students work were just to note the lecture from the board in the same way which was the teacher has written on the board. Only few students were attentive towards the lesson the

other learners were mentally not in the class. The teacher only solve example and gave the whole exercise for home work for the next day.

Observation 3

Host School: GGHSS Rusam Name XYZ
Designation: SST Math & Physics Subject: Mathematics
Day: (Friday) Date &Time: (10 AM) 24/01/2020
Period: 3rd Class &Section 10th A
Total strength 94 Present 74
Absent 20

Table 4.6.3 Summary and short description of the classroom observation.

Observation area	Short Descriptions
1. Physical Environment of the class	➢ Lighting available ➢ Board present ➢ Student sitting in row
2. Academic environment	➢ Students participation were 9 to 11 ➢ Students were passive ➢ Teacher was active
3. Knowledge of Subject Matter	➢ Good command ➢ Materials are relevant to the course ➢ No emphasize a conceptual grasp ➢ No incorporation of recent developments in discipline ➢ Yes, important
4. Teacher methodology and her attitude	➢ Lecture method ➢ Direct start lesson ➢ No motivation ➢ Yes gives the task ➢ Rout behavior
5. Teaching Strategies used by the teacher	➢ No, stand on one place ➢ No, just lecture method ➢ Yes board work legible &organized ➢ Yes, sometime ➢ No, no use of other techniques
10. Organization and Clarity of the subject matter	➢ No, on the spot ➢ Yes, but little bit ➢ sequence of content covered logical

	➢ present and explain content clearly
11. Presentation and Enthusiasm	➢ The rate of speech too fast ➢ rate of speech not appropriate for note taking ➢ No motion to sustain student interest
12. Teacher and Students Interaction	➢ Direct from text book ➢ Yes, guidelines clear to few students ➢ Teacher encourage student questions ➢ No use of verbal reinforcement by teacher ➢ No, non-verbal response (smile, nod)
13. Student attitude during the class	➢ Write down what instructor puts on board ➢ Few students listening attentively ➢ Teacher just appreciates step by step procedure.

Results

From this observation the researcher observes the class of mathematics. First she noticed the physical environment of the class. She was noted the facility of lighting was satisfactory and the seating arrangement was focused in rows rather than towards group seating. The writing board facility was also available in front of the class. Further the researcher examine academic environment of the class. She view that the class environment was teacher center the teacher was active while the students were passive. The student's participation was round about 9 to 11 out of 74 students.

The observer also observe the teacher competency and mastery over the subject she noted down that the teacher was competent and have good command over the subject but she have no incorporation of recent developments in discipline. She used lecture method for teaching and starts the lesson direct from the text book, use writing board for writing and not use any motivational techniques for learning the new concept. During lecture her behavior was route. She was just appreciating the competent students and ignores the slow learner.

During presentation the researcher monitor the organization and clarity of subject matter. She observed that the teacher not prepare the lesson in advance because the teacher was study some rules on the same time when she face difficult in solving the problem. The teacher rate of speech too fast which was not appropriate for note taking. The teacher was just stood on one place and no motion to sustain the student's interest. The researcher examines the teacher entrance in the class. The teacher

entre into the class the students say to " teacher Assalamu alikum" the teacher said Walikum salam, pickup book and start direct from the text book on board the teacher was encourage the students but no use of verbal reinforcement for motivation during teaching were occurred. There was no nonverbal response such as smile, nod etc. was occurred. The observer watched for student's attitude and interaction. She said that the students were just writing down what the teacher puts on board. Few students were listing attentively and the teacher jus appreciate step by step procedure. At last she gave the whole exercise for home work. The researcher analyzed from the whole class observation that the teacher was only focused on the text book problem and not used motivational techniques for creating their interest and to hold positive attitude and beliefs toward the subject of mathematics.

Observation 4

Host School: GGHSS Rusam Name: XYZ
Designation: SST Math & Physics Subject: Mathematics
Day: (Monday) Date &Time: (10 AM) 27/01/2020
Period: 3rd Class &Section 10th A
Total strength 94 Present 80
Absent 14

Table 4.6.4 Summary and short description of the classroom observation.

Observation area	Short Descriptions
1. Physical Environment of the class	➢ Lighting available ➢ Board present ➢ In row
2. Academic environment	➢ Students participation were 5 to 7 ➢ Students were passive ➢ Teacher was active
3. Knowledge of Subject Matter	➢ Good command ➢ Materials are relevant to the course ➢ Emphasize a conceptual grasp ➢ In corporation of recent developments in discipline ➢ Yes, important contents
4. Teacher methodology and her attitude	➢ Discussion method + lecture ➢ In Direct start lesson ➢ No motivation ➢ Yes gives the task ➢ Flexible behavior
5. Teaching Strategies used by the teacher	➢ Yes, a little bit ➢ Move towards the learner

	➢ Lecture method and discussion ➢ Yes board work legible & organized ➢ Yes, sometime ➢ Yes, use of question-answer session
6. Organization and Clarity of the subject matter	➢ Not , not prepare ➢ Yes, but little bit ➢ sequence of content covered logical ➢ present and explain content clearly
7. Presentation and Enthusiasm	➢ The rate of speech moderate ➢ rate of speech appropriate for note taking ➢ No Motion to sustain student interest
8. Teacher and Students Interaction	➢ Direct from text book ➢ Yes, guidelines clear to few students ➢ Teacher encourage student questions ➢ No use of verbal reinforcement by teacher ➢ No, non-verbal response (smile, nod)
9. Student attitude during the class	➢ Write down what instructor puts on board ➢ Few students listening attentively ➢ Teacher appreciated other strategy

Results

From this observation the researcher observes the class of mathematics. First she noticed the physical environment of the class. She was noted the facility of lighting was satisfactory and the seating arrangement in rows. The writing board facility was also available in front of the class. Further the researcher examine academic environment of the class. The observer also observe the teacher

competency and mastery over the subject she noted down that the teacher was competent and have good command over the subject and have good incorporation of recent developments in discipline.

Teacher used lecture method and discussion method for today lesson and start the lesson from the discussion of theorem and its parts from the text book. Use writing board during lecture her behavior was flexible not very polite and not very rigid but she were not appreciate those students who were more engage in their work. During presentation the researcher monitor the organization and clarity of subject matter. She observed that the teacher was not prepared her lesson in advance. The teacher rate of speech was moderate which was appropriate for note taking. The teacher was sustained motion for the student's interest. She was go to those students whose are talking the teacher was stand behind them and check their work silently. Later on, she guided the students for their encouragement.

The researcher examines the teacher entrance in the class. The teacher entre into the class the students say to "teacher Assalamu alikum" the teacher said Walikum Salam. There was no non verbal response was occurred. The observer watched for student's attitude and interaction with teacher and to one another. She said that the students were busy in their work and very excited in group work. Majority of the students were wants to excel from their fellows in drawing diagram for the theorem. At last she evaluates the students work and asked to them to prepare it for test on next day.

Data Analysis

Data were analyzed through thematic analysis.

Result and Discussion

The researcher conducted four classroom observations for the study for the purpose to know about the sample students' attitudes, interest, behavior, teacher students' interaction, students- students' interaction and the strategies used by them during their mathematics classroom. The researcher analyzed that teacher – students as well as students- students' interactions were weak. The teacher was used traditional method for delivering lecture and used harsh attitude during lecture and not used. Hence above half of the students possessed positive believes towards mathematics but they were not very satisfied from the teacher. So it was concluded by the researcher that for interest of the learners' teacher methodology has a great role further lack of interest become the negative beliefs. The researcher observed that the excited students for learning mathematics were hold positive belief.

4. Conclusion

It was concluded from the result that classroom environment highly effects problem solving ability. Teacher attitude and methodology also influence learner's beliefs as well as their heuristic ability.

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