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### FACILITATING TEACHERS IN USING CONSTRUCTIVIST APPROACH IN TEACHING MATHEMATICS AT SECONDARY SCHOOL LEVEL

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**Key Words: Constructivist Approach; Traditional Methods Of Teaching.**

#### **ABSTRACT**

The purpose of this paper is to report the findings of a study which aims to analyze mathematics teachers teaching approaches at secondary level in rural Sindh and to facilitate teachers in using constructivist approaches while teaching geometrical concepts. The research was designed in a qualitative paradigm. Primary source of data included interviews with teachers, classroom observations, and together with secondary school sources such as document analyzes and informal conversations with teachers. The study was conducted in schools situated in the rural areas of District Noushahro Feroze Sindh. Findings suggests that the term "constructivists approach" was a novice for majority of teachers. However, when teachers were told to use this approach while teaching mathematics, they found this new approach useful for learners and students were inclined towards learning mathematics; It did away with their fear about mathematics. Students were found to be interested and motivated during delivery of the lesson. It is therefore recommended that constructivist approach may be used in teaching mathematics. For that purpose, sufficient material may be provided to schools for teaching mathematics concepts. In order to improve repertoire of teachers about constructivist approaches in teaching mathematics, secondary school teachers should be given opportunity for professional development.

#### **INTRODUCTION**

This paper attempts to review existing practices of teaching mathematics and to facilitate teachers in using constructivist approaches in order to improve students' involvement and engagement in learning of mathematics.

Mathematics is one of the core subject in the school curriculum. One of the prime aims of teaching of Mathematics in Pakistan is to develop logical thinking, skills, provides opportunities to explore mathematics in daily life and in inculcate the habit of curiosity among learners about the things around them. Mathematics is compulsory subject from primary level of education to secondary level of education in Pakistan. Since the inception of Pakistan in 1947, the teaching of Mathematics has not been given due attention. The subject was taught as we teach social science. It has been remained a common practice that formulae and algorithms always explain by teachers. There was very little involvement of students in the classroom. As we know, the first Mathematics curriculum of Pakistan was formulated in 1975, second was made in 2002 and the last curriculum was introduced in 2006.

One of the distinguishing aspect that makes 2006 Mathematics curriculum with other two curricula is its focus and nature. The focuses of National 2006 Mathematics curriculum is to develop Mathematics proficiency of the students. The Mathematics proficiency aims to develop relational, procedural, conceptual, strategic, problem solving competence of the child. It also entails to engage students in mathematical discussion and discourse by teaching different concepts of math. These concepts are derived from different strands such as algebra, numbers, measurement and geometry. It is widely acknowledged that school Maths is not useful for children because of its stress on rote memorization and the regurgitation of formulae. (Good, Grows, Ebmeer, 1983; Mustafa, Abro, & Awan, 2021). Various studies have been conducted to see the effect different teaching approaches. Due to importance of mathematics as subject, school mathematics is on top agenda of educational reforms. No doubt, success in Mathematics has contribute greatly in success of other subject.

Although a number of these efforts focus on the professional development of mathematics teaching, yet little is known about the effect of different approaches to teaching in mathematics. John Dewey advocates a novel ideology of teaching and learning process. He recommends that learning is not a passive representation (recording) but a active reconstruction and reinterpretation of experiences. Knowledge is actively built up by learners as they understand learning experience as a constructivist view of learning (Steve Alsop and Keith Hicks). (Piaget 1980.23)

Different studies show that the state of mathematics teaching in the province of Sindh is not upto the mark. The Standardized achievement Test (SAT) results tells that mathematics results of students are very poor. According to SAT (2016) the mean provincial score of class 8<sup>th</sup> in mathematics was remained around 12%, which is frightening situation for policy makers, teacher educators, district management as well as parents. Government schools has been criticized for this poor performance of students in maths and other subject. There are different reasons of low performance of students in mathematics. We can categorized these factors into, environment led-factors, head teacher led factors and teacher-led factors. Among teacher led factors teachers qualification, teachers background, training, level of motivation and teaching strategies playas important role in students learning. It is noted that in

government secondary schools of Sindh province most of the teachers adopt teacher-centered approach. These approaches include lecture method prominently. While teaching maths concepts teachers only resource is chalk and talk method. In most cases teachers themselves solve problems on the blackboard. Rarely teachers use constructivist teaching approaches. There is lack of conceptual clarity among government secondary school teachers about innovative teaching approaches. Constructivist approach in teaching of mathematics has far reaching implications for learning of students. By using these approaches such as brainstorming help teachers to activate prior knowledge and ideas of students. As a result, students become motivated and engaging.

### **RESEARCH OBJECTIVES**

1. To study mathematics teachers' perceptions about the use of constructivist approach in teaching mathematical concepts at secondary level
2. To facilitate teachers in improving students involvement in learning mathematics through implementation of constructivist approach.

### **METHODOLOGY**

The presents study is qualitative in nature. There is strong rationale to choose this design because of the nature of the topic. The researchers needs in-depth understandings of the issues investigated. Rossman and Rallies (1998) signifies my point of view that qualitative study helps in understand the process of research as well as detailed data helps in making connection among different phenomenon. Within the qualitative paradigm action research was identified suitable for this research study. The combination of action and research render that action is a form of disciplined inquiry, in which a personal attempt is made to understand, improve and reform practice (Morison& Col 2002). There are numerous definitions of action research (AR). Action research can be defined s trying out ideas in practice.AR is an action to improve teaching – leaning situation, this action is undertaken in some social settings. Self -reflection is one of the key feature of AR. The social basis of action research is involvement, and the educational basis is improvement. On this basis, therefore, my aim of using action research in this study is to bring about improvement in the mathematics teacher's style of teaching math topics.

### **THE RESEARCH DESIGN**

The researcher followed the cycle of Retalick (2003) which includes planning the action, implementing it, observing and then reflecting. Therefore, the first step in the conduct of this study was to know what was happening and way it was happening. This called the pre intervention stage. At this stage, efforts were made to know the perceptions and research participant about teaching of mathematics. In addition, through interviews and classroom observations, the next step was the implementation stage. At this stage, the various aspects of lesson taught were analyzed. On the basis of this reflection, planning for further action was also made.

***Setting and research location***

This study was conducted in a typical Government in a rural district of Sindh. The research participants were teachers teaching maths to 10<sup>th</sup> class students of a high school situated in the District Naushahro Feroze.

***Sampling and sampling procedure***

As the paradigm of the study was qualitative, I selected my research participant with certain purposes and criteria in mind. It was purposive sampling. The criteria of selections for research participant were the following:

- The teacher should be willing to work with me.
- The teacher should be a mathematics teacher.
- The teacher should be an experienced teacher, who has been teaching mathematics at secondary level for at least five years.
- Teacher should be trained. He must have pedagogical skills.

***Phases of data collection***

During this research study, a variety of tools and sources were used to collect data, such as class room observation, planning sessions, interviews informal discussions, teacher's maintaining reflective journals, researcher maintaining diary use of audiotape, and analyzing curriculum of mathematics. The phases of data collection are divided into three stages:

Phase One: Pre-Intervention Stage

Phase Two: Intervention Stage

Phase Three: Post Intervention Stage

The detail of each phase is provided in the table below:

**Table 1:** Phases of Data Collection

<b>Phase#</b>	<b>Data Collection Strategy</b>	<b>Technique</b>	<b>Activity</b>
One Pre- Intervention	<ul style="list-style-type: none"> <li>• Discussion with research participant</li> <li>• Classroom observation</li> <li>• Unstructured Interview</li> </ul>	<ul style="list-style-type: none"> <li>• Document Analysis</li> <li>• Semi-Structured Interview</li> <li>• Classroom Observation,</li> </ul>	<ul style="list-style-type: none"> <li>• Analysis of mathematics curriculum</li> <li>• Notes on teacher's beliefs, conceptions about teaching mathematics</li> <li>• Field notes on teacher's approaches of teaching</li> <li>• Researcher's</li> </ul>

			Reflection
Two Intervention	<ul style="list-style-type: none"> <li>• Classroom Observation</li> <li>• Researcher's and Participant's observation</li> </ul>	<ul style="list-style-type: none"> <li>• Co-plan the lesson, Pre and Post Conferences,</li> <li>• Sharing the material, Lesson observation,</li> <li>• Teacher's own lesson planning and delivering the lesson about geometrical concepts</li> </ul>	<ul style="list-style-type: none"> <li>• Field notes on using the new approach,</li> <li>• Reflection of researcher,</li> <li>• Reflection of participants, researcher and participant maintaining diaries</li> </ul>
Three Post-Intervention	<ul style="list-style-type: none"> <li>• Classroom observation</li> <li>• Discussion</li> <li>• Reflection</li> </ul>	<ul style="list-style-type: none"> <li>• Un-structured Interview, Informal discussion with class participants.</li> <li>• Observing a lesson other than the planned one to see the impact of skills acquired during the intervention stage</li> </ul>	<ul style="list-style-type: none"> <li>• Teacher's views about new strategies/ approaches,</li> <li>• Reflection comments of participant on the process of facilitation,</li> </ul>

**Data collection tools**

**Field Notebook**

The researcher used field notebook to record the immediate situation. Hopkins (2002) is of the view that field notes help the researcher to report the observation and to reflect on classroom problems. During my research study, I noted mathematics teacher's interaction patterns (i.e. his interaction with his students. interaction between the students), the, his teaching methodology, and resources used during the lesson. I even noted the bodily expressions, accent, and reactions of my research participant

**Maintaining Reflective Journals**

During the research study, I and my research participant maintained reflective journals. Journal writing helped me to reflect on my experiences while it helped my participant to improve his reflective writing skills. The following

questions helped me, as well as my research participant, to reflect on the research process:

- What happened?
- How do I feel about it?
- What did I learn?

### **ANALYSIS OF DATA**

Data analysis in this study was an ongoing process. It did not occur at the end of the study. We make sense in the process of data analysis. It is tedious but an exhilarating process. In AR data collection, interpretation and analysis go side by side. To analyze the data I decided to go through the following process:

#### ***Coding***

Coding is defined as marking the segments of data with symbols, or category descriptive words names. Before analyzing the raw data, i.e. daily reflections, interview transcriptions, classroom observations, I coded them. During categorization of data researcher did two activities. The first one was to organize themes in order to make the text meaningful, I read and re-read my text to identity coherent categories. Coding helped me in labeling the data. The exercises of data coding have facilitated the categorization of data into a more manageable chunk, which can be classified into broader themes and issues. After going through the above-mentioned stage, I wrote memos.

#### ***Memo Writing***

Analytic memos are long reflections that focus on reflections (Bogdan & Biklen, 1992) my research study, I wrote analytical memos weekly. These helped me to guide the research process strengthen my analysis. The memos were used to write my personal record of insights, ideas, thoughts, concerns and discussions, which I come across during my research.

### **DISCUSSION**

#### ***Pre-Intervention Stage***

The findings from this stage are based on the research participant's interview, and on his classroom lesson observation. Analysis showed that the mathematics teacher understanding about constructivist teaching approaches was limited to certain approaches. Mathematics Teacher only used lecture method while teaching mathematical concepts. While observing the classes, I found that the mathematics teacher did not involve the students in any kind of activity. He was the only person, who was talking in the class. I also found that the teacher did not bring any material in order to enrich his mathematics lesson.

### *Intervention Stage*

Analysis showed that teaching material such as articles on understanding different aspects of constructivist teaching, different pictures showing different situations, helped research participant in discussing the significance of brain storming ice breaking activity, up work mind mapping: use of question and answer technique in the class. According to research participant,- It was my first time that I taught mathematics in such a way, I have no previous experience of using constructivist approaches. I was scared but teaching material and researcher helped me. For me it was a good lesson. (Field notes, classroom observation, February 10, 2018). Analysis showed that using constructivist's approaches in the mathematics class was challenging for the research participant. It was difficult to cater the needs of diverse learners.

### *Post-Intervention Stage*

Analysis showed that mathematics teachers pedagogical know edge bout approaches of constructivism has increased during the research study. The research participant said, "Constructivist approaches are interesting in order to motivate your students. I really enjoyed my teaching when I used these approaches. Whenever l involves my students in mathematical discussion it really helped me to make my classroom an ideal place for learning mathematics." (Interview, March 2.2018)

Analysis of data also indicated that research participant's classroom activates improved during this research study. Data also showed that the mathematics teacher was using only the lecture method. The teaching of geometrical concepts requires discussion, role-play, debates, and mind mapping of the concepts. The research study helped the research participant to shift from the teacher-centered to student centered approach.

In the beginning of research study, the research participant was rarely using teaching material. The study helped him to use a variety material quite e in his teaching data confirms that of the research participant faced difficulties in using mathematical manipulative and other material effectively in a way that it created interest among student. It is challenging to use resources in order to shape a learning program that works for desired making use of the talents and interests of situation, students.

During this research, I found that the teacher was only textbook dependent; the data showed his willingness to use a variety of material in his lessons but the required material was not available in the school library. The teacher, most of time, relied on the material that I provided him.

The data confirms that teachers have rare opportunities of attending any training program regarding mathematical pedagogy. Teaching mathematical concepts are difficult and complex; building sufficient knowledge of teachers is very essential. The data confirms that while discussing mathematical concepts in the class several new dimensions regarding it came under discussion. The point is that while teaching about mathematical concepts,

knowledge always has to be constructed with the help of all the participants, and, for that, teachers have to allow participation by all students. In this situation a teacher's role becomes different, i.e. from that of being a sole provider of knowledge so the role of facilitator, helping construction of knowledge about issues and their solutions.

The data also revealed that using constructivist approaches in mathematics is not easy for teachers; it was time consuming and required a lot of energy. Research participant admitted that, "you need lot of time and energy when you use these approaches in teaching geometry". Interview, March 2018).

Analysis showed that research participant was satisfied with the Process of research. This process helped him in understanding and applying constructivist approaches in mathematics.

### **FINDINGS**

- The mathematics teachers were frequently using lecture method in teaching mathematical concepts
- The term "constructivist approach" was a novice term for mathematics teacher.
- Researchers' intervention helped mathematics teachers to get deep understanding about constructivist teaching approaches such as brain-storming and mind mapping.
- The use of constructivist approaches inclined learners towards learning of mathematics: it did away with their fear about mathematics. Students became interested and motivated during delivery of the lesson.
- Mathematics teachers had limited opportunities for professional development.
- Mathematics Teachers were textbook dependent. The researcher did not find supporting material other than the textbook with teacher.

### **SUGGESTIONS**

The following recommendations are made for different stakeholders:

- In order to teach Mathematics in line with constructivist approach, there is need to develop mathematical kit for government schools in the province of Sindh. This kit should contain items such as geometry box, worksheets, CDs and calculators. Teachers should be oriented in using this kit in classroom
- For the improvement of Mathematical content knowledge of teachers, regular workshops for teachers should be conducted by eminent teacher training institutions.



- The Education Department, Government of Sindh, should encourage and finance teachers for participation in Maths trainings
- The Education Department, Government of Sindh, should formulate a policy for the improvement of Mathematics teaching and learning in government schools of the province.

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