

Effectiveness and Transformation in Students' Beliefs: A Case of Collaborative Teaching

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Abstract

Comparison of collaborative and traditional teaching in enhancing mathematics students' scores at 8th grade was the purpose of this study. It also investigated the transformation in the students' beliefs about the teaching of mathematics while studying through the collaboration of teachers. An experimental design was used to conduct the experiment on 118 students. Mathematics achievement test consisting of 32 items were finalized from items pool developed by NEAS. Structured interviews were conducted three times in the study to investigate the transformation in students' beliefs. The interviews were videotaped. Data collected from test was analyzed using average, standard deviation, and 2x2 ANOVA. The qualitative data were first transcribed then analyzed using percentages and line graph. It was found that teaching through collaborative settings improved students scores in mathematics as compared to traditional teaching and a clear positive transformation in students' beliefs about the teaching of mathematics, was noted.

Keywords: Beliefs, collaborative teaching, mathematics

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Introduction

The subject of mathematics is different from other subjects because of its characteristics, for example, language, symbols, and abstraction in its concepts. Difficulty in mathematics learning is being faced by many students. Russell (2006) attributed students' mathematics learning problems to teaching. Generally, a single math teacher cannot cope with all glitches of students in the learning of mathematical concepts. Various researchers have recommended team teaching a better alternative to one teacher's teaching (Wadkins, Wozniak, & Miller, 2004).

Predominantly, Pakistani mathematics teachers are transmitting the mathematics knowledge rather than constructing concepts. They use text books to teach mathematics. In order to solve mathematical exercise questions students need to memorize the formulae dictated by the teachers in the start of lesson. There is a little or no sharing and discussion on mathematics teaching methods or mathematical concepts understanding among mathematics teachers. Consequently, their teaching quality is not improving, and consequently the problem of low achievement persists.

Many approaches like student or teacher centered, focused on content, CT etc. are being used in the world. CT is in practice in countries for example United States, China, United Kingdom, Canada, and Australia. Cook and Friend (1995) described teaching in collaborative setting as "a style of interaction between at least two co-equal parties voluntarily engaged in shared decision making as they work toward a common goal". The various roles of teachers depend on the strengths of teachers. Many research studies conducted by various researchers in these countries for example Jang (2006), McDuffe, Scruggs, and Mastropieri (2007), Olverson and Ritchey (2007), Parker (2010), Rigdon (2010), Almon and Feng (2012) showed positive effects of CT in enhancing academic scores of students in mathematics.

Research studies have shown that beliefs of students about a particular subject significantly affect their achievement and behavior (Krosnick, 2007). Ragland (2011) found strong positive relationship between students' beliefs and their conceptual ability of a particular subject. Students' mathematical beliefs about teaching of mathematics are always been in the focus of mathematics educators.

Beliefs are the personal assumptions of an individual about the nature of any phenomena or reality. Likewise, Kloosterman, Raymond, and Emenaker (1996) stated that beliefs are "the personal assumptions from which individuals make decisions about the actions they will undertake". Beliefs are considered to be those assumptions and suppositions about things, people or concepts which are held by an individual or group as to be true (Anderson & Silva, 2009). In the research, findings of different research studies, one's achievement in mathematics can be affected by one's strong beliefs about learning mathematics (Krosnick, 2007).

The affective domain of McLeod was elaborated and re-conceptualized by Ragland (2011) who investigated students' beliefs in two specific aspects i.e. mathematics and its teaching. He found that majority of the beliefs about mathematics are strongly related with students mathematical learning. Taylor (2009) claimed that beliefs of students can be changed through instruction and particular curricula in a short period of time. Many instructional approaches are used by the mathematics' teachers in the classrooms. Studies on CT all around the world showed its positive effect in improving students scores (Mcduffe, Scruggs, & Mastropieri, 2007). CT may change students' beliefs about mathematics teaching in the context of Pakistan. Research questions of this study were:

- How far collaborative teaching is better in improving mathematics students' scores than one teacher's teaching?
- Do students' beliefs change about mathematics teaching through CT?

Methodology

The design used in this study was experimental to investigate the effectiveness of CT. A public school was selected for experimentation with Solomon Four Group design. Researcher faced many difficulties mainly because of heads' attitudes towards research, number of enrolled students, and availability of the equal qualification of the teachers involved in the experiment. A sample of 118 students studying at 8th grade was selected for experimentation. Experimental groups students were taught by teachers' collaboration and control groups students were taught mathematics by single teacher teaching method. Three teachers, including one from the researchers i.e. first author of this paper, were participating in the experiment voluntarily and one teacher of the same school was teaching to the control group students alone with traditional mathematics teaching i.e. deductive method of teaching in Pakistan. Two teachers, one first researcher and one math teacher from the selected school, collaboratively developed a module for collaborative teaching of mathematics. It covers algebra and geometry contents of 8th grade mathematics. They developed 20 lesson plans. The role and work of the both teachers in the collaborative groups was defined in the lesson plans according to their mathematical strengths. For example teacher A is explaining the concept of square meanwhile teacher B is holding a chart consisting of some daily life examples of squares. The control group and experimental group teachers were covered the same content. It was 37 days experiment. The class settings of the experimental and control groups are shown in the figures 1 & 2.

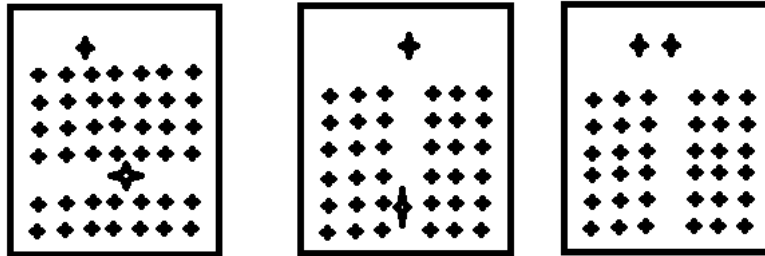


Figure 1. Collaborative teaching settings i.e. alternative teaching, one teach- one assist, and team teaching

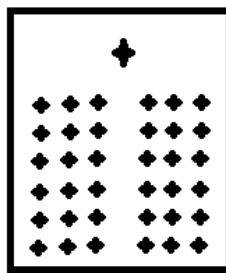


Figure 2. Traditional teaching i.e. single teacher teaching

Table 1

Details of Groups Mean Scores

| Groups | Pre-test given | Without pre-test | Total |
|--------------|----------------|------------------|-------|
| Control | 10.38 | 9.83 | 10.08 |
| Experimental | 12.29 | 13.38 | 12.80 |
| Total | 11.33 | 11.32 | |

Table 2

Difference between Groups Mean Scores

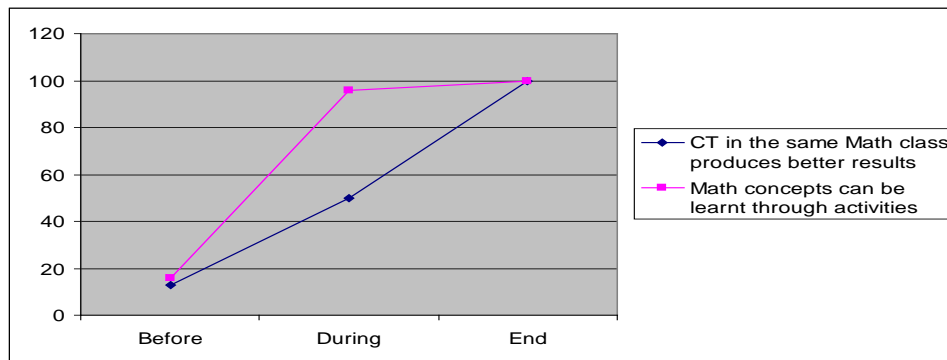
| | Sum of Squares | Df | Mean Square | F | P |
|-------------------------------------|----------------|----|-------------|--------|------|
| Groups (Ex & Co) | 180.86 | 1 | 180.86 | 19.504 | .000 |
| Groups (with and without pre-test) | 1.78 | 1 | 1.78 | .191 | .663 |
| Groups *Conditions | 16.19 | 1 | 16.19 | 1.75 | .190 |

Table 2 showed that significant value $0.000 < 0.05$, hence students' means scores of groups i.e. experimental and control were significantly different. Table 1 shows that scores of students' taught through CT were higher than control groups students' scores i.e. 12.80 and 10.07 respectively. The findings related to transformation of students' beliefs about teaching of mathematics has been presented in table 3.

Table 3
Transformation in Beliefs of Students about Mathematics Teaching

| Beliefs | Start | middle | End |
|--|-------------------|--------|-----|
| | Yes In Percentage | | |
| 1. CT is better teaching approach than single teacher's mathematics teaching | 13 | 50 | 100 |
| 2. Activities in learning mathematical concepts are useful | 16 | 96 | 100 |

Table 3 shows that the students' belief changed with the progression of the CT experiment. The beliefs about using activities for learning mathematical concepts changed sharply at the middle of CT intervention i.e. 96%. The detail of the table 3 was presented in figure 3.



1. CT Produces Better Results

CT changed students' beliefs about teaching in collaborative settings. In the start of experiment students i.e.13% were viewed CT as a useful teaching method. In the middle, 50% students were favored CT and this number went to 100% at the end. Before the experiment, one of the students believed that "I like single teacher's teaching. It is better than CT as I may get confused when two or more teachers are teaching at the same time. I have been taught by single teacher's teaching throughout my study." the views of the same student changed in the middle, "I first time experienced CT and I feel good. Both the teachers deal students very nicely. They do not go harsh on us or unethical behavior. Both are very polite." At the end he said, "I learnt a lot because of CT. I enjoyed it a lot. I will such sort of teaching methods while studying mathematics. The experience of CT was wonderful."

Another student shared his views as “I am satisfied with single teacher’s teaching and I think we will get confused with two different methods of teaching of CTs in the same class.” In the middle he told that “working with two teachers was interesting. At the same time one teacher is writing on the black board the other teacher is helping students to copy the content correctly. In this way, they also control the classroom discipline.” At the end, he expressed his feelings in these words, “I understood the concepts of mathematics very well in the presence of two teachers. I asked the questions related to exercise questions to second teacher when I can’t understand the first one.”

Another student was believed that “We do not need of two teachers in the class for teaching if single teacher teaches with honesty.” In the mid of intervention he said, “I think the idea of two teachers in the same class is not bad. We are large number of students in one class and due to which cannot understand mathematics very well. But these teachers teach us very well. They come up with helping material, charts, and work sheets. I did not face any problem or hazard in CT settings.” At the end of intervention, the student was of the view that “both teachers are doing hard work to teach us well. They performed different activities while teaching mathematical concepts. They also check the homework and give feedback properly.”

Use of Activities in Learning of Mathematics

In the start of the experiment only few i.e. 16% students believed in using activities in learning of mathematics. The study found a transformation in the belief and jumped the number to 96% in the mid of intervention. At the end, it went up to 100%.

Students told that activities might be used in learning of mathematics but we do not know. One student shared that “I always learn mathematics by practicing and my teacher came in the class and asked us to memorize mathematical formulae before solving the exercise questions. After memorization we note the answers of some exercise question from black board. After it we practice exercise questions.” At the end he shared his experience of CT as “I did many activities for the first time to learn and understand mathematical concepts. It was good experience to learn concepts by actively performing activities. Both the teachers helped us a lot in doing so.” Another student was of the opinion at the end of experiment that, “I learned mathematics through activities. I am so happy to be part of this study. Thanks for this experiment. Now at least I know some activities which can help me in mathematical conceptual learning.” He further said, “mathematics teacher should use activities to teach conceptual mathematical learning.” Transformation in the students’ beliefs about teaching of mathematics is shown in using line graph in figure .The steeper lines in the graph show rapid transformation in the students’ beliefs.

Recommendations

This study recommends the following points:

1. In Pakistan, mathematics is being taught by general to specific method of teaching practiced by one teacher. The study found that CT is better in enhancing students' academic achievement than one teacher teaching. So, CT may be practiced in some schools on experimental basis.
2. Students' beliefs about teaching of mathematics had transformation through collaborative teaching. Therefore, teachers may practice CT in order to modify students' attitude towards teaching of mathematics which results in reducing boredom, more opportunities for students to ask questions and their active participation in learning process.
3. Further researcher may be conducted on different grads, include all contents of mathematics, include female students, and apply more CT settings, for example, alternative teaching, station teaching, parallel teaching.

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