

Comparing Two Method of Cooperative and Traditional Learning and Their Effect on Different Levels of Math Anxiety

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ABSTRACT: The purpose of this study was to evaluate the effectiveness of learning method (Cooperative learning vs. traditional learning) on high school students' math anxiety and academic achievement. Researchers show that students, who are working in small math cooperative groups, can develop productive problem solving. Also many researchers have shown that there is a negative correlation between math anxiety and mathematics performance. The sample comprised 37 (females) first grad of high school students were tested on (1) Test Anxiety Inventory (2) Satisfaction Teaching Test and (3) Math exams. During a year that separated to two semesters, our sample thought their math courses traditionally in the first semester and cooperatively in second one. The result obtained indicated that math performance and Satisfaction teaching of students in second semester was significantly more than first semester ($P < 0.05$). Also results have revealed that student math anxiety in second semester was significantly more than first one ($P < 0.05$).

Keywords: Mathematical performance-Math anxiety-Cooperative learning- Satisfaction teaching Test.

INTRODUCTION

Mathematics anxiety is a feeling of tension and anxiety that interfere with the manipulation of mathematical problems in varied situations in ordinary as well as academic life (Richardson & Suinn, 1972). Mathematics anxiety can be explained as a sense of discomfort observed while working on mathematical problems (Hadfield & Trujillo, 1999; Ma, 2003; Khatoon & Mahmood, 2010) and is associated with fear and apprehension to specific math related situations (D'Ailly & Bergering, 1992). It is found among elementary school students (Jackson & Leffinjingwell, 1999; Steele & Arth, 1998); high school students (Hembree, 1990) and in college students (Tobias, 1990; Bitner et al., 1994). According to Marilyn Burns (1998), nearly two thirds of American adults have a hatred and deep fear of math. The fear of math is deeply rooted and is often initiated by a child's first experience with institutional math.

Math anxiety is often developed as a result of a student's prior negative experience when learning math in the classroom (Rossnan, 2006) and also it's usually develops from a lack of confidence when working in mathematical situations (Perina, 2002). Reported consequences of being anxious toward mathematics include the avoidance of mathematics and the decline in mathematics achievement (Karimi & Venkatesan, 2009). When students are not comfortable with mathematics, it discourages the students from finding the relevance and making sense of the

mathematics. This idea has diminished the importance of mathematics. Many people view it as an abstract and difficult subject reserved for a select few (Turner et al., 2002). This kind of 'anxiety' is first detected in the late 1950s. Researchers noticed undergraduate college students reacting emotionally to arithmetic and mathematics. Although the reaction is appeared to be similar to test anxiety in general, they found that mathematics anxiety is a potential factor prose (Dreger & Aiken, 1957). Math teachers often exacerbate a child's level of anxiety by imposing their personal views about math (e.g. Hoyles, 1981) has reported that students have more bad experiences in mathematics than in other subjects). Each negative experience is transferred into the thoughts of any future math work and ultimately causes a lack of understanding of mathematics (Curtain, 1999) so it effects on students' mathematical problem solving. A negative relationship between math anxiety and math achievement has been found across all grade levels, k-college. In fact, math anxiety is often associated with relatively low performance in mathematical activity (e.g., Betz, 1978; Hembree, 1990; Bessant, 1995; Jackson & Leffinjgwell, 1999; Ma, 2003; Mark & Woodard, 2004, Alamolhodaei, 2009; Daneshamooz & Alamolhodaei, 2011). In this study the effect of math anxiety on mathematical performance according to the learning method (Traditional learning vs. Cooperative learning) will be discussed. It seems to be more beneficial to describe the mathematical problem solving and Cooperative learning (CL) before introducing research framework.

Mathematical problem solving (Mathematical performance)

Problem solving has a special importance in the study of mathematics. A primary goal of mathematics teaching and learning is to develop the ability to solve a wide variety of complex mathematics problems (Wilson et al., 1993). It is through teaching via problem solving that students acquire various methods of solving mathematical problems. Teaching via problem solving is where students move from "the concrete (a real-world problem...) to the abstract (a symbolic representation...)" (Schroeder & Lester, 1989) To many mathematically literate people, mathematics is synonymous with solving problems -doing word problems, creating patterns, interpreting figures, developing geometric constructions, proving theorems, etc. On the other hand, persons not enthralled with mathematics may describe any mathematics activity as problem solving (Wilson et al., 1993). Problem solving is an integral part of all mathematics learning. In everyday life and in the workplace, being able to solve problems can lead to great advantages (Akinsola, 2008). However, solving problems is not only a goal of learning mathematics but also a major means of doing so. Problem solving means engaging in a task for which the solution is not known in advance.

Learning Method (Traditional and Cooperative Learning)

Cooperative learning (CL) has been a popular topic in educational circles for more than a decade. Researchers and practitioners have found that students working in small cooperative groups can develop the type of intellectual exchange that fosters creative thinking and productive problem solving. In addition to intellectual growth, cooperative learning enhances students' social and personal development. Research has found that specific instructional strategies produce more anxiety in students (Curtis, 2006). In traditional math class, students have been taught to memorize mathematical concepts without actually working through problems and comprehending the reason behind the math skill. This along with being unprepared greatly contributes to a child's increased level of math anxiety (Rossnan, 2006). Students were satisfied when they perceived themselves successful at their work. They blamed their dissatisfaction on their teachers. The dissatisfaction was a result of not being able to complete tasks successfully or failure to understand math. These bad experiences contributed to the students' anxiety, feelings of inadequacy.

A review of the literature on CL shows that students benefit academically and socially from cooperative, small group teaching (Gillies & Ashman, 2000). For example, Stuart (2000) implemented various teaching methods into her fifth-grade class to reduce math anxiety. Over the year, she distributed surveys to see how the students felt about the different strategies. She found that when she used CL, her students felt more comfortable discussing problems with their peers. CL can produce positive effects on student achievement (Cohen, 1986; Davidson, 1989; Devries & Slavin, 1995; Johnson & Johnson, 1989; Okebukola, 1985; Reid, 1992; Slavin, 1990). Academic benefits include higher attainments in reading comprehension (Mathes et al., 1997) and mathematics (Ross, 1995; Whicker et al., 1997). Social benefits include more on-task behaviors and helping interactions with group members (Burron et al., 1993; Gillies & Ashman, 1998; McManus & Gettinger, 1996), higher self -esteem, more friends, more involvement in classroom activities, and improved attitudes toward learning (Lazarowitz et al., 1996; Lararowitz et al., 1994).

CL gives students a common goal where the group will be rewarded for its efforts (Johnson & Johnson, 1988). Students work together on a given task while still being held accountable on an individual basis and they will learn

to share in the group's successes and accomplishments. These successes will contribute to the students overall (positive) feeling about the work. During group activities, it is the teacher's responsibility to promote the groups successes, by praising even the smallest accomplishments. A study examining the effects of cooperative learning on mathematics achievement of a group of seventh grade minority students found that students involved in cooperative learning performed significantly better than students who were not exposed to cooperative learning (Reid, 1992). In a study comparing the effects of cooperative learning to individualistic learning in a racially integrated classroom, Johnson and Johnson (1983) found that cooperative learning experiences resulted in higher academic achievement for minority students.

Research Framework

The main aim of the present study is to investigate the effect between learning method (Traditional learning vs. CL), math anxiety and mathematical performance of High school students. Thus the main question addressed here is: Can learning method improves the negative effect of high math anxiety on mathematical performance? In an attempt to answer this question the following objectives were sought:

The first objective of the study was to discover whether in which group of learning method (Traditional learning or CL); students have the lower math anxiety.

The second objective of the study was to find whether in which group of learning method (traditional or CL), students have the highest mathematical performance.

The last objective was to find in which groups of learning method, students have more satisfaction.

MATERIALS AND METHODS

Participants

The sample group of the present study comprises 37 high school students who were selected from Ramiyan of Golestan Province. For this purpose, our sample was selected, through census method.

A 'census' is the process of obtaining information about every member of a population. In contrast to sampling where information is only obtained from a subset of a population.

During the year that separated to two semesters, our selected sample learned its math courses with two learning method:

- At first semester traditionally
- At second semester cooperatively

In first semester the traditional instruction received primarily lecture-based classroom instruction, while In second semester our sample was divided into some subgroups and students was taught based on explained guide plan in teaching books, the class was divided into cooperative learning groups and students that remained together for the semester which helped to improve communication skills and strengthen positive interdependence among the group members. Since heterogeneous groups promote student learning, students in the cooperative learning groups were heterogeneously arranged so no group was overly weighted with all academically strong or weak students and those with health care experience were evenly distributed.

Procedures

The research instruments were Test Anxiety Inventory (TAI), Satisfaction Teaching Test (STT) and score of two final math exams at the end of each team.

Test Anxiety Inventory (TAI)

This questionnaire has been made by Abolghasemi et al (1996). It consists of 25 items, and each item presented an anxiety arousing situation. The students decided the degree of anxiety and abstraction anxiety aroused using a four rating scale ranging from most of the time to not at all (4-1). Psychometric properties of this scale are computed by researchers. Cronbach's alpha, the degree of internal consistency of mathematics attention test items for this study was estimated to be 0.94. Concern to learning style method, Students who scored above the sample mean were

labeled as high math anxiety and those who scored less than the sample mean, as low math anxiety one. Table 1 shows this distribution.

Table1. Kolmogorov-Smirnov test.

		N	Mean	SD	Kolmogorov-Smirnov Test	P-Value
Math Performance	Traditional Learning	37	12.89	4.47	.155	P<.05
	Cooperative Learning	37	10.09	4.29	.201	P<.001
Satisfaction Teaching	Traditional Learning	37	10.05	3.89	.328	P<.001
	Cooperative Learning	37	13.50	4.18	.245	P<.001
Math Anxiety	Traditional Learning	37	80.59	14.16	.152	P<.05
	Cooperative Learning	37	62.58	17.59	.104	P>.05

Satisfaction Teaching Test (ST Test)

At the end of the year ask the participant to grade each learning method which has been thought them during two semesters from 1 to 10 to each learning method which has been thought them during two semesters. Grade 10 mean completely satisfied from Learning method and number 1 mean completely dissatisfied. Sum of the participants' grades use as satisfaction Teaching.

Mathematics Performance

For measuring students' math performance in traditional and cooperative learning method in each semester, final semester math exam was count. Some examples of the math exam in first semester and second semester are presented below:

- a) Consider the function

$$f(x) = \begin{cases} a + bx, & \text{if } x > 2 \\ 3, & \text{if } x = 2 \\ b - ax^2, & \text{if } x < 2 . \end{cases}$$

Determine the values of constants *a* and *b* so that $\lim_{x \rightarrow 2} f(x)$ exists and is equal to *f* (2)

- b) Integrate.

$$\int (\ln x)^3 dx$$

- c) Differentiate.

$$y = 7x(\cos x)^{x/2}$$

RESULTS

Table 2.P-values of Math Anxiety Group, Learning Method Group & Mathematical Performance.

			Mean	SD	P-Value
Math Performance	Learning Method	Traditional (Group1)	8.82	6.78	P<.001
		Cooperative (Group2)	10.17	6.55	
Satisfaction Teaching	Learning Method	Traditional (Group1)	6.11	1.39	P<.001
		Cooperative (Group2)	8.70	1.71	
Math Anxiety	Learning Method	Traditional (Group1)	63.35	20.62	P<.001
		Cooperative (Group2)	50.92	21.06	

According to table 2 and Kolmogorov-Smirnov test, normality assumption for learning method satisfaction and math performance in two groups of learning method (traditional learning and CL) has been rejected. Also normality assumption for math anxiety in traditional learning group has been rejected. Moreover in table 2, mean and standard division of all Groups of learning method has been showed.

According to Kolmogorov-Smirnov test and rejecting normality, non-parametric Wilcoxon Signed Rank Test was showed that there is a significant difference between mathematical performances and teach method groups (traditional learning and CL). Also significant difference between math anxiety and teach method groups (traditional learning and CL) was obtained. Moreover a significantly difference between learning method satisfaction and learning method (traditional learning and CL) was obtained. The results listed in Table 3.

DISCUSSION AND CONCLUSION

The results of this study have revealed significant difference between students' math performance with high mathematics anxiety and low mathematic anxiety. It means that students who have high mathematics anxiety tended to perform lower score in mathematics performance (Baloglu & Koçak, 2006; Jain & Dowson, 2009; Alamolhodaei, 2009; Daneshamooz & Alamolhodaei, 2010). However, students who have low mathematics anxiety tended to perform high score in mathematics. The findings confirm the pervious findings, which report significant difference between high and low mathematics anxiety with mathematics performance (Clute 1984; Hembree 1990; Lee, 1996; Ashcraft & Kirk, 2001). Math more than any other subject, math engenders anxiety and avoidance in students (Shore, 2005). Unless math anxiety is confronted, it can turn into a permanent road block. A person’s attitude towards mathematics influences how often they use mathematics, their willingness to pursue advanced work in mathematics, and even their choice of prospective career paths (Dutton & Dutton, 1991). It is imperative that parents and teachers work together to increase a child’s level of confidence, offer individualized academic support, utilize a real life approach to math, and dispel any preconceived math myths (Rossnan, 2006). Sadly, math anxiety is very common. Marilyn Curtain-Phillips (1999) believed that much of this anxiety happens in the classroom due to the lack of consideration of different learning styles of students. Today, the needs of society require a greater need for mathematics. Math must be looked upon in a positive light in order to reduce math anxiety. Therefore, teachers must re-examine traditional teaching methods which often do not match the students’ learning styles and skills needed to be productive in society. Lessons must be presented in a variety of ways. Parents should also maintain an active role when encouraging their children to incorporate math into their daily routine. It is essential that educators and parents work together to assure that every child is learning that math is important, relevant, and fun so that they can learn the math skills that they need to succeed. Also researchers should note that the group of students which have better performance in mathematical task and its anxiety may be different in other learning method.

Central to the goals of cooperative learning in science and mathematics education is the enhancement of achievement, problem solving skills, attitudes and inculcate values. How cooperative learning affects student achievement and problem solving skills was investigated by Effandi (2003). In this study, In first semester participants was instructed using traditional lecture method and in second semester participants was instructed using the cooperative learning methods and after that students' mathematics achievement and problem solving skills

compares in two semester. Participants in second semester showed significantly better results in mathematics achievement and problem solving skills. This finding supports the previous finding that students with traditional learning have lower mathematical performance than students with cooperative learning (Slavin, 1995; Ross, 1995; Whicker et al., 1997). Effandi (2003) found that students in the cooperative learning group had a favorable response towards group work. He concluded that the utilization of cooperative learning methods is a preferable alternative to traditional instructional method. Another study by Lee Guak Eam (1999), found that students who were taught with a cooperative structure outperformed the students in individualistic goal structure in mathematics problem solving. Other researchers have reported similar findings that point to the achievement benefits of using cooperative learning (Yee, 1995). Therefore cooperative learning is helpful teaching method for teachers to help their students. So teachers may encourage their students to study together and make cooperative group in their class in which group members share their knowledge with each other's.

By analyzing the data, in accordance with the satisfaction, appeared significant difference between students' satisfaction with cooperative learning method and traditional learning method. The findings confirm the previous findings, For example a study by Lord et al (2000) found that student satisfaction with the course increased in a student-centered learning environment when they were able to interact with other students.

The students found more satisfaction in the courses which were less packed with drill and practice assignments and allowed time for analytic, problem solving, and interactive learning opportunities. The challenge in education is to effectively teach students of diverse ability and differing rates of learning. Teachers are expected to teach in a way that enables pupils to learn science and mathematics concepts while acquiring process skills, positive attitudes and values and problem solving skills. A variety of teaching strategies have been advocated for use in science and mathematics classroom, ranging from teacher-centered approach to more students-centered ones. In the last decade, there is a vast amount of research done on cooperative learning in science and mathematics. Cooperative learning is grounded in the belief that learning is most effective when students are actively involved in sharing ideas and work cooperatively to complete academic tasks. Cooperative learning has been used as both an instructional method and as a learning tool at various levels of education and in various subject areas.

Conflict of Interest

The authors declare no conflict of interest.

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