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Efficacy of STAD cooperative learning approach in Mathematics at middle stage

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Abstract:
There has been increasing concern that traditional methods have detrimental effects on students' performance and positive attitudes toward mathematics in the classroom. This study proposes an innovative approach using the cooperative learning technique to improve performance. Specifically, this study investigates the effect of Student Team Achievement Division (STAD) on standard VII students' mathematics performance. A quasi-experimental design was employed, using a non-randomized two-group post-test design. The study was conducted with 44 students in the control group and 44 students in the experimental group. The experimental group was taught using the STAD approach, while the control group was taught using traditional methods. A self-made achievement test and other learning materials were used. The experimental group was taught two chapters of mathematics. Data were collected and analysed using t-tests in Excel. The results indicate a significant difference in academic achievement between the experimental group (STAD) and the control group (traditional method).

Keywords: *STAD, cooperative learning approach, mathematics, learning method*

1. Introduction

In the education system, the basic units are teachers and students. The purpose of education is to achieve the learning outcomes of students. To accomplish this, teachers must employ different classroom processes and activities beyond conventional methods to reach educational goals. In classroom pedagogy, many techniques and methods are available. Teachers must select or find an appropriate method to teach a subject. When selecting a method or technique, teachers must be aware of how to use it effectively to achieve the desired results.

In this context, "Cooperative learning is a methodology that employs a variety of learning activities to improve students' understanding of a subject by using a structured approach, which involves a series of steps, requiring students to create, analyse, and apply concepts" (Kagan, 1990). Cooperative learning is a methodology where students with varying performance levels collaborate to accomplish a common objective (Bruner, 1985). Positive benefits on outcomes, including self-worth, relationships between groups, acceptance of kids with academic disabilities, school attitudes, and cooperative work skills, have been repeatedly observed (Slavin, 1991). Cooperative learning is focused on students by using group processes to enable students to work together and achieve mutual benefits and achievements for groups (T. Rattanatumma, 2016). The cooperative learning approach has long been regarded as a solution to many academic problems, such as enhancing critical thinking skills, improving and enhancing learning, and preparing learners to be collaborative human resources in the future (Slavin, 2010). According to multiple studies, students who complete cooperative learning group exercises typically perform higher on academic tests.

Cooperative learning is a teaching approach that combines group projects with individual interaction at the core of the learning process. These study groups often consist of three to six people, each with a

specific function to perform and thorough learning assignments. Teachers anticipate that by using this approach, pupils will be more motivated to learn and work together, as well as be active and creative in the classroom. To establish an effective teaching-learning environment in the classroom, various approaches to collaborative learning can be implemented. Diverse student groups are used in cooperative learning approaches to achieve intended goals. There are many different cooperative learning approaches that make learners more involved and participatory; some of these include Jigsaw, STAD (Students Teams Achievement Division), Team Games Tournaments (TGT), Team Accelerated Instruction (TAI), and Group Investigation (GI). This study aims to investigate the efficacy of the STAD learning approach in mathematics at the middle stage.

2. Student Teams Achievement Division (STAD)

Robert Slavin designed the Student Team Achievement Division (STAD) at John Hopkins University in the 1970s. Slavin (1982) lists STAD as one of the cooperative learning approaches that involves having students work in diverse groups. These diverse groupings were created according to differences in ethnic background, gender, and academic achievement.

In STAD, the teacher gives a lecture, and then the students work in groups to ensure that every team member has understood the given material. After that, each student completes a separate quiz on the subject topic. During this time, they are not allowed to assist one another. The basic goal of STAD is to inspire students, support one another, and help them perform better. Students must support and encourage their colleagues to study the subject and do their best on the individual quiz if they want their team to receive team prizes (Sharma, 2020).

According to Slavin (1982), there are six components of STAD:

1. Content Presentation: The teacher gives a direct lesson, explaining the material and preparing the stage for group work.
2. Team Formation: Students with varying academic backgrounds, genders, and ethnicities work together to form heterogeneous groupings.
3. Role Assignment: Slavin (1982) suggested that each team member have a specific role assigned to them. This involves designating a taskmaster to keep the group focused, a progress chairman to ensure that all questions are answered before the class period ends, a team captain to oversee roles within the group, and a group compiler to gather responses from each member.
4. Individual Quiz: Following one or two rounds of worksheet completion and team practice, students take an individual quiz in which they are not permitted to assist one another.
5. Individual Progress Score: Each student receives a score according to how well they performed on the quiz. Points are given based on how well students performed in relation to their own prior performance, and quiz scores are compared to past averages.
6. Team Recognition: Certificates or a weekly class newsletter are sent to the teams whose average score meets the minimum standard or the result that places the team in first place.

3. Objectives

1. To assess the effect of the STAD cooperative learning approach on standard VII students' academic achievement in mathematics.
2. To examine the effect of the STAD cooperative learning approach between low and high achiever students of standard VII.

4. Variables

- STAD learning approach and traditional method were independent variables.
- Academic achievement in mathematics was the dependent variable.
- Achievement level was a moderating variable.
- Standard, medium, subject, unit, time, and school were control variables.
- Intelligence of students, learning interest, and learning readiness were intervening variables.

5. Hypotheses

H_{o1}: There will be no significant difference between mean scores in academic achievement of control group and experimental group students in mathematics subject of standard VII.

H_{o2}: There will be no significant difference between mean scores in academic achievement of higher achiever students of control group and experimental group in mathematics subject of standard VII.

H_{o3}: There will be no significant difference between mean scores in academic achievement of lower achiever students of control group and experimental group in mathematics subject of standard VII.

6. Design of the Study

The quasi-experimental design was employed in this investigation. The researcher used a two-group, post-test-only design. It involved two groups of standard VII students, one experimental group and one control group.

7. Methods

7.1 Sample

In this study, the sample was taken as purposive sample selection method. Students of standard VII from middle stage were included. There were 88 students studying in standard VII of PM Shri pay center school Thermal of Kheda district in Gujarat. There were 44 students in Experimental group which taught through STAD cooperative learning approach and the other 44 students in control group taught through traditional method. Both group were equivalent as statistically.

7.2 Tool

The tool was developed by researcher. In this tool there were three part like worksheet, quizzer and achievement test. It contains different type of questions from the two units of mathematics on experimental design was based. This tool was made as per STAD learning approach. A mathematics achievement test with 40 multiple choices based questions which was implemented at last as a post test. This tool was checked by an expert for ensuring its validity and for reliability it pilot-tested in other school. After that took some changes and finalized it.

7.3 Procedure of the Study

The researcher gave a permission letters to the selected school principal. The principal of the school gave formal authorization to conduct this study in their school. The researcher made tow group of standard VII students according to statistical method then selected one group for experimental method by randomized method and other were control group. Experimental group were taught by STAD learning approach by using STAD components as discussed early. The control group were taught by traditional method relied on the lecture, demonstration and questions-answer method. By using statistical method, researcher determine the level of achievement of students on the basis of previous term marks in mathematics in two level like lower achiever and higher achiever.

Researcher made 8 group of 5 students of each and one group of 4 students, total 9 group in STAD learning group students were assigned to heterogeneous groups. Then the researcher instructed the group on what to do. The researcher assigned all the role which discussed early in STAD components. They were encouraged to work together, teach each other and help their group members in difficulty.

This was 10 days experimental programme which included 20 teaching periods based on two units of mathematics of standard VII. The two units taught were Factorization and Introduction of graph. First, the researcher gave instruction and then students worked in group on worksheets, they learned in group by helping each other. Following the two instructional periods, students took an individual quiz in which they were not permitted to assist one another. Improvement score of the individual students and team were calculated, the team with highest score awarded by their name was displayed on the bulletin

board.

7.4 Data analysis and Results

To analyze collected data were used various statistical tools. Analyze data using mean, standard deviation and t-value.

Testing of hypothesis Ho_1: There will be no significant difference between mean scores in academic achievement of control group and experimental group students in mathematics subject of standard VII. After a procedure, we tried to identify whether there was a statistically significant difference between the experimental and control group.

Table 1: Mean score difference between control group and experimental group

Teaching Learning Method	N	Mean	Var	SED	Mean Diff.	t-value (C. R.)	Significance
Traditional	44	24.659	38.649	1.1995	3.0909	2.5769	significant at 0.05
STAD	44	27.75	24.657				

In table 1, the calculated t-value for the mean difference in the achievement test scores between control group and experimental test was 2.5769 which was significant at 0.05 level. It was determined that the academic performance of the students in the STAD cooperative learning group differs significantly from that the students in the traditional group. Therefore, hypothesis Ho_1 of the study was rejected.

Testing of hypothesis Ho_2: There will be no significant difference between mean scores in academic achievement of higher achiever students of control group and experimental group in mathematics subject of standard VII.

After a procedure, we tried to identify whether there was a statistically significant difference of high score students between the experimental and control group.

Table 2: Mean score difference of high score students between control group and experimental group

High Score Students	N	Mean	Var	SED	Mean Diff.	t-value (C. R.)	Significance
Traditional	22	29.091	14.753	1.0757	2.2273	2.0705	significant at 0.05
STAD	22	31.318	10.703				

According to table 2, the calculated t-value for the mean difference in the achievement test of high score students between control group and experimental test was 2.0705 which was significant at 0.05 level. It was determined that the academic performance of high score students in the STAD cooperative learning group differs significantly from that the high score students in the traditional group. Therefore, hypothesis Ho_2 of the study was rejected.

Testing of hypothesis Ho_3: There will be no significant difference between mean scores in academic achievement of lower achiever students of control group and experimental group in mathematics subject of standard VII.

After a procedure, we tried to identify whether there was a statistically significant difference of low score students between the experimental and control group

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Table 3: Mean score difference of low score students between control group and experimental group

Low Score Students	N	Mean	Var	SED	Mean Diff.	t-value (C. R.)	Significance
Traditional	22	20.227	23.232	1.2852	3.9545	3.0769	significant at 0.05
STAD	22	24.182	13.108				

According to table 3, the calculated t-value for the mean difference in the achievement test of low score students between control group and experimental test was 3.0769 which was significant at 0.05 level. It was determined that the academic performance of low score students in the STAD cooperative learning group differs significantly from that the low score students in the traditional group. Therefore, hypothesis Ho_3 of the study was rejected.

8. Discussion

The outcome of this study can be attributed to the fact that the STAD cooperative learning approach incorporates group goals and individual accountability (Slavin, 1986). This study presents new insights into the impact of the STAD cooperative learning approach on standard VII students in mathematics. The cooperative learning approach, like STAD, employed by the teacher in this study, seemed to engage learners in the teaching and learning process and help them understand the teacher's offered content.

The results showed that students' mathematics achievement was significantly impacted by cooperative learning. Indeed, students benefit from the implementation of cooperative learning to raise their mathematics performance (Ndebil, Matthew & Ali, Clement, 2024). The results of Tables 1, 2, and 3 are in line with the findings of Wyman (2018), Sharma (2020), and Ndebil, Matthew & Ali, Clement (2024) on the use of heterogeneous groups in cooperative learning approaches. In the quasi-experimental groups, statistics on paired and independent sample t-tests showed statistically significant differences between the groups.

Findings from the analysis of the first hypothesis indicated that cooperative learning significantly affects students' performance in mathematics. Students in the experimental group had more achievement than control group students, showing that the STAD approach affects students' learning performance. The analysis of the second hypothesis showed that high-achieving students in the STAD group performed better in mathematics than students in the traditional method group. The analysis of the third hypothesis showed that low-achieving students in the STAD group performed better in mathematics than students in the traditional method group.

9. Conclusion

In conclusion, it can be stated that the STAD cooperative learning approach is an effective approach to enhancing the learning outcomes of students. The findings of the study showed that students who were taught using the cooperative learning approach performed better than those taught through traditional methods.

Therefore, to achieve the objectives of education, it is recommended to implement the STAD learning approach in schools. However, before implementing it, it is suggested that teachers be familiar with this approach. Students should also be trained on social and communication skills necessary to work in groups.

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