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A Study On The Impact Of STAD Cooperative Learning Strategy On Academic Achievement In Biology Among Secondary School Students

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Abstract

This study examines the impact of the Student Teams-Achievement Divisions (STAD) cooperative learning strategy on the academic achievement of secondary school students in Biology. The research aims to determine whether the STAD method enhances students' understanding and performance compared to traditional teaching methods. A quasi-experimental design was employed, involving two groups an experimental group taught using STAD and a control group taught through conventional methods. Data were collected using pre-tests and post-tests, and statistical analysis was conducted to measure the effectiveness of STAD in improving academic achievement. The findings indicate a significant improvement in the performance of students who participated in STAD-based learning, highlighting the effectiveness of cooperative learning in fostering conceptual understanding, teamwork, and engagement in Biology. The study concludes that STAD is an effective instructional strategy for enhancing student achievement and recommends its integration into science education to improve learning outcomes.

Keywords: STAD, Cooperative Learning, Academic Achievement, Biology, Secondary School Students.

Introduction

Education plays a vital role in determining socio-cultural and economic development of a nation. Several countries which have taken strong initiatives towards education have evolved themselves through innovations and showed miracles in their overall development.

The quality of education is highly dependent upon the instructional approach used by the teachers in the classroom. In order to achieve educational excellence the teachers must chose right pedagogy. Traditional method of teaching which is commonly used in school is teacher-centered. It is a chalk and talk method that focuses on rote-learning and memorization. To achieve the goal of holistic development of students, the teachers need to choose effective teaching and learning approach that must be learner-centered.

Cooperative learning is a group learning in which students work together to accomplish shared goals (Johnson, Johnson and Holubec, 1991). In a cooperative learning environment, students collaborate in small groups to accomplish a common learning objective. It is not just to sit students side-by-side at the same table and one student does all the work. In cooperative learning, all learners must be responsible for their own and group member‘s work. They encourage and support each other. Unlike a competitive classroom where students are graded on norm-referenced basis, to work more faster than their classmates, students in cooperative classroom sink or swim together (Johnson, Johnson and Holubec, 1991).

Biology subject occupies a unique position in the school curriculum. It is central to many science related courses such as medicine, pharmacy, agriculture, nursing, microbiology, biotechnology, pathology, morphology, physiology, ecology, anatomy and biochemistry. It is obvious that no student intending to study these disciplines can do without Biology. Instruction in Biology starts at the primary school level. Biology constitutes a significant component of science and is studied by all students till the middle school level. At the secondary school level Biology becomes a part of science textbook. The process of channelization starts at the secondary level with a largely irreversible selection of future choice. These factors have drawn attention of researchers and curriculum planners towards Biology as a subject in the school curriculum (Kareem, 2003).

Cooperative learning is simply the sum of definitions of two words, i.e. cooperative and learning (Tanner et al., 2003). Researchers has been define cooperative learning in different ways. According to Johnson, Johnson and Holubec (1993) “cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other’s learning. . According to Johnson, Johnson and Smith (1998), in cooperative learning, students work in small groups to accomplish shared learning goals. They learn the assigned material and ensure that all other group members also learn it. Davidson and Kroll (1991) opined that cooperative learning takes place in a setting where students share ideas and work collaboratively in small groups to complete academic tasks.

Student Teams Achievement Division is a form of cooperative learning that uses multi-ability learning teams to teach specific forms of content-facts, concepts, generalization, principles, academic rules and skills. Developed by Robert Slavin (1986,1995),it is one of the most popular cooperative learning strategies in use in the schools today.

In STAD, the teacher presents the content or skill in a large group activity in a regular manner with opening, development and guided practice. Then as opposed to individual study, students are provided with learning materials i.e., worksheets developed for STAD that they use in groups to master the content. As students are provided with worksheets that they use in groups to master the content, the teacher circulates around the room to monitor group progress and interaction. When students are ready, they are administered formative test. The teacher scores this test and, uses this information to compute improvement points. These are added up for each team, and teams earning a specific number of improvement points are recognized (e.g., award, free time, or certificate of achievement.

The cooperative learning strategy may prove a suitable pedagogy to tackle these challenges. Hence Scholars such as Slavin (1998), Okebukola (1989) and Esiogbu (2011) recommended the use of the CLS in teaching science subjects. The use of cooperative learning in classrooms helps to achieve not only the cognitive goals, but also in realizing and developing social and psychological aspect of education.

Statement of the Problem

The study is titled as **"A Study on the Impact of STAD Cooperative Learning Strategy on Academic Achievement in Biology among Secondary School Students."**

Objectives of the Study

The following objectives have been formulated for the present study.

1. To study the impact of the STAD cooperative learning strategies on the academic achievement in Biology among secondary school students
2. To study the difference in cognitive domain levels in Biology between the Control and Experimental (STAD) groups on the pre-test.
3. To study the difference in cognitive domain levels in Biology between the Control and Experimental (STAD) groups on the post-test.
4. To study the difference in performance levels in Biology between the Control and Experimental (STAD) groups on the post-test.

Hypotheses of the Study

The following Hypotheses have been formulated for the present study.

1. There is no significant difference between the mean achievement scores in Biology of the Experimental group (STAD) on the pretest and posttest.
2. There is no significant difference between the Control group and the Experimental (STAD) group students in their mean scores in Biology on the posttest.
3. There is no significance difference between the Mean Achievement Scores in Biology on the Pre-test of the Control Group and Experimental (STAD) Group with respect to Cognitive domains levels
4. There is no significance difference between the Mean Achievement Scores in Biology on the Post-test of the Control Group and Experimental (STAD) Group with respect to Cognitive domains levels
5. There is no significance difference between the Mean Achievement Scores in Biology on the Post-test of the Control Group and Experimental (STAD) Group with respect to Performance Levels

Design of the study

The present Research is Experimental in nature involving Pretest Posttest Design. The goal of this Research was to find out the "Impact of co-operative learning strategy on achievement in Biology among Secondary school Students". The study employs a pre-test and post-test design for the experimental group, while the control group uses a pre-test and post-test design. Biology ability tests were performed on participants from both the experimental group and the control group. The conventional teaching method was used to teach the control group, whereas the co-operative learning strategy was employed to teach experimental groups. The posttest was administered to all the groups.

Sample of the Study

Purposive sampling technique was employed in selecting the schools four sections was selected, The initial student sample comprised of 96 students chosen from four sections of class 9th of Mahatma Jyotiba Phule Telangana Backward Classes Welfare Residential school, keesara, Medchal- Malkajgiri district located in the state of Telangana. Sample consisted of 96 students studying in standard IX during the academic year 2022-2023.

Tools of the Study

1. An Achievement test of Biology for IX Class was developed by researcher herself.
2. Cooperative Learning Lesson Plans was developed by researcher herself.

Statistical methods adopted

The objective of the study was to determine whether the cooperative learning strategy is more effective than the conventional approach to teaching. Descriptive statistics and the 't' test were used to summarize the data, with the goal of assessing whether there is a statistically significant difference between the two groups.

Analysis and interpretation of data

Hypothesis1: "There is no significant difference between the mean achievement scores in Biology of the Experimental group (STAD) on the pretest and posttest."

Table 1: Comparison of Pretest and Posttest Mean Achievement Scores in Biology of the Experimental Group (STAD)

Group	N	Mean	SD	't' Value	Sig.(p value)	Remarks
Experimental (Pretest)	48	32.06	4.12	9.08	0.0003	S
Experimental (Posttest)	48	46.18	7.95			

The data in Table 1 presents the comparison of the pretest and posttest means achievement scores in Biology of the Experimental group (STAD). The group had 48 participants; with a pretest mean score of 32.06 and a posttest mean score of 46.18. The standard deviation (SD) for the pretest was 4.12, while the posttest SD was 7.95.

The calculated 't' value of 9.08 and the p-value of 0.0003 indicate a statistically significant difference between the pretest and posttest scores at the 0.05 level of significance. Since the p-value is much lower than 0.05, this result is highly significant, meaning the null hypothesis which states that "there is no significant difference between the mean achievement scores in Biology of the Experimental group (STAD) on the pretest and posttest" is rejected. In simpler terms, the Experimental group (STAD) demonstrated a significant improvement in their Biology achievement scores from the pretest to the posttest.

Hypothesis 2: There is no significant difference between the Control group and the Experimental (STAD) group students in their mean scores in Biology on the posttest.

Table 2: Comparison of Mean Achievement Scores on the posttest in Biology between the Control Group and the Experimental (STAD) Group

Group	N	Mean	SD	't' Value	Sig.(p value)	Remarks
Control	48	35.08	6.54	9.05	0.000	S
Experimental	48	46.18	7.95			

The data in Table 2 compares the mean achievement scores in Biology on the posttest between the Control group and the Experimental group (STAD). Both groups consisted of 48 students. The Control group had a mean posttest score of 35.08 with a standard deviation (SD) of 6.54.The Experimental group (STAD) had a higher mean posttest score of 46.18 with an SD of 7.95.

The calculated 't' value is 9.05, with a p-value of 0.000. Since the p-value is much lower than the 0.05 significance level, this result is statistically significant. Thus, the null hypothesis "There is no significant difference between the Control group and the Experimental (STAD) group students in their mean scores in Biology on the posttest" is rejected the Experimental group (STAD) showed significantly higher achievement in Biology compared to the Control group on the posttest.

The findings showed that students taught Biology through teaching and learning program based on co-operative learning (STAD) strategy performed better than those taught using the conventional method. The co-operative learning (STAD) strategy teaching and learning program allowed students to apply Biological concepts in a practical and interactive manner, leading to a deeper understanding of the subject. These results suggest that incorporating hands-on activities in Biology education could be beneficial for student achievement.

Hypothesis 3: "There is no significance difference between the Mean Achievement Scores in Biology on the Pre-test of the Control Group and Experimental (STAD) Group with respect to Cognitive domains levels"

Table 3: Control group's and the experimental (STAD) group's mean achievement scores in Biology onthe pre-test in relation to Cognitive domains levels

Cognitive domains Levels	Group	N	Mean	SD	t value	p- value	Remarks
Knowledge	Control	48	12.04	5.32	0.751	.483	NS
	Experimental	48	11.98	4.58			
Understanding	Control	48	10.23	6.25	0.816	.518	NS
	Experimental	48	10.07	6.27			
Application	Control	48	6.83	2.52	0.983	.687	NS
	Experimental	48	6.98	2.61			

The table presents a comparison of the pretest mean achievement scores in Biology between the Control group and the Experimental (STAD) group based on different Cognitive domains levels that is Knowledge, Understanding, and Application.

Knowledge domain the Control group (N = 48) had a mean score of 12.04 with a standard deviation (SD) of 5.32. The Experimental group (N = 48) had a mean score of 11.98 with an standard deviation (SD) of 4.58. The calculated 't' value is 0.751, with a p-value of 0.483, indicating a statistically not significant difference.

The difference in mean achievement scores between the Control and Experimental groups in the Knowledge domain is not statistically significant, as the p-value (.483) is greater than the common significance level of 0.05. This indicates that the STAD method does not lead to a significant difference compared to the traditional method in terms of the Knowledge domain on the pre-test.

Understanding Domain the Control group (N = 48) had a mean score of 10.23 with an standard deviation (SD) of 6.25.The Experimental group (N = 48) had a mean score of 10.07 with an standard deviation (SD) of 6.27.The 't' value is .816, with a p-value of .518, indicating not a significant difference. The difference in mean achievement scores between the two groups in the Understanding domain is not statistically significant, with a p-value of .518, which is also greater than 0.05. This suggests that there is no significant difference in students' understanding of Biology between the two groups at the pre-test stage.

Application Domain, the Control group (N = 48) had a mean score of 6.83 with a standard deviation (SD) of 2.52. The Experimental group (N = 48) had a mean score of 6.98 with an standard deviation of 2.61. The 't' value is 0.983, with a p-value of 0.687, indicating a statistically not significant difference. The mean scores for the Application domain between the two groups are not significantly different, as indicated by the p-value (.687). This shows that there is no significant difference in the application of knowledge in Biology between the groups before the intervention.

For all three cognitive domains (Knowledge, Understanding, Application), the p-values are greater than 0.05, indicating that there is no significant difference in mean achievement scores between the Control and Experimental (STAD) groups on the pre-test. This suggests that any observed differences in pre-test scores are likely due to chance rather than the teaching method, and both groups were similar in their baseline knowledge and skills before the intervention. Therefore stated null hypothesis there is no significance difference between the Mean Achievement Scores in Biology on the Pre-test of the Control Group and Experimental (STAD) Group with respect to Cognitive domains levels is accepted.

Hypothesis 4: "There is no significance difference between the Mean Achievement Scores in Biology on the Post-test of the Control Group and Experimental (STAD) Group with respect to Cognitive domains levels"

Table 4: Control group's and the experimental (STAD) group's mean achievement scores in Biology onthe post-test in relation to Cognitive domains levels

Cognitive domains Levels	Group	N	Mean	SD	t value	p- value	Remarks
Knowledge	Control	48	14.91	4.25	4.61	.000	S
	Experimental	48	18.02	3.91			
Understanding	Control	48	12.86	5.18	5.28	.000	S
	Experimental	48	18.93	4.96			
Application	Control	48	8.69	2.08	4.12	.000	S
	Experimental	48	12.88	1.94			

The table presents a comparison of the post-test mean achievement scores in Biology between the Control group and the Experimental (STAD) group based on different Cognitive domains levels that is Knowledge, Understanding, and Application.

Knowledge domain the Control group (N = 48) had a mean score of 14.91 with a standard deviation (SD) of 4.25. The Experimental group (N = 48) had a significantly higher mean score of 18.02 with an standard deviation (SD) of 3.92. The calculated 't' value is 4.61, with a p-value of 0.000, indicating a statistically significant difference.

The p-value is much lower than 0.05, indicating a statistically significant difference in knowledge levels between the groups. The higher mean score for the Experimental group suggests that students taught using the STAD cooperative learning strategy significantly outperformed those taught using traditional methods in terms of knowledge acquisition.

Understanding domain the Control group (N = 48) had a mean score of 12.86 with an standard deviation (SD) of 5.18.The Experimental group (N = 48) had a higher mean score of 18.93 with an standard deviation (SD) of 4.96.The 't' value is 5.28, with a p-value of 0.000, indicating a significant difference.

The p-value indicates a significant difference, with the Experimental group achieving better understanding of Biology concepts than the Control group. This suggests that the STAD method helped students achieve a deeper understanding compared to traditional methods.

Application domain, the Control group (N = 48) had a mean score of 8.69 with a standard deviation (SD) of 2.08. The Experimental group (N = 48) had a much higher mean score of 12.88 with an standard deviation of 1.94. The 't' value is 4.12, with a p-value of 0.000, indicating a statistically significant difference. The significant p-value indicates that the Experimental group had a significantly better ability to apply the knowledge they learned compared to the Control group. This highlights the effectiveness of the STAD strategy in helping students apply concepts practically.

For all three cognitive domains (Knowledge, Understanding, and Application), the p-values are less than 0.05, showing that there is a significant difference between the mean achievement scores of the Control and Experimental (STAD) groups. The Experimental group consistently outperformed the Control group, demonstrating that the STAD cooperative learning strategy was more effective than traditional teaching methods in enhancing students' knowledge, understanding, and ability to apply Biology concepts. Therefore stated null hypothesis there is no significance difference between the Mean Achievement Scores in Biology on the Post-test of the Control Group and Experimental (STAD) Group with respect to Cognitive domains levels is rejected.

Hypothesis 5: "There is no significance difference between the Mean Achievement Scores in Biology on the Post-test of the Control Group and Experimental (STAD) Group with respect to Performance Levels"

Table 5: Control group's and the experimental (STAD) group's mean achievement scores in Biology onthe post-test in relation to performance levels

Performance Levels	Group	N	Mean	SD	t value	p- value	Remarks
High	Control	14	32.78	7.32	6.83	.000	S
	Experimental	12	48.26	2.58			
Average	Control	26	29.26	6.20	6.39	.000	S
	Experimental	24	42.96	3.27			
Low	Control	8	26.42	2.12	6.01	.000	S
	Experimental	12	40.08	2.57			

The table presents a comparison of the post-test mean achievement scores in Biology between the Control group and the Experimental (STAD) group based on different performance levels: High, Average, and Low.

High performance level the Control group (N = 14) had a mean score of 32.78 with a standard deviation (SD) of 7.32. The Experimental group (N = 12) had a significantly higher mean score of 48.26 with an standard deviation (SD) of 2.58. The calculated 't' value is 6.83, with a p-value of 0.000, indicating a statistically significant difference. Students in the Experimental group (STAD) with high performance level showed significantly higher achievement in Biology compared to the Control group.

Average performance level the Control group (N = 26) had a mean score of 29.26 with an standard deviation (SD) of 6.20.The Experimental group (N = 24) had a higher mean score of 42.96 with an standard deviation (SD) of 3.27.The 't' value is 6.39, with a p-value of 0.000, indicating a significant difference. Students with average performance level in the Experimental group (STAD) performed significantly better in Biology than those in the Control group.

Low performance level, the Control group (N = 8) had a mean score of 26.42 with a standard deviation (SD) of 2.12. The Experimental group (N = 12) had a much higher mean score of 40.08 with an standard deviation of 2.57. The 't' value is 6.01, with a p-value of 0.000, indicating a statistically significant difference. Even students in the low-performance level category of the Experimental group (STAD) outperformed their counterparts in the Control group, showing a significant improvement in Biology scores.

Across all performance levels (High, Average, and Low), the Experimental group (STAD) significantly outperformed the Control group in their post-test Biology achievement. The null hypothesis "There is no significant difference between the mean achievement scores in Biology on the post-test of the Control group and Experimental (STAD) group with respect to performance levels" is rejected for all performance categories.

This indicates that the Experimental group performed significantly better than the Control group. This demonstrates that the Experimental group accomplished a much higher level of success than the Control group. The findings suggest that the achievement in Biology of students who belong to High, Average, and Low levels has improved after being exposed to Teaching Learning Programme Biology Based on Co-operative learning STAD strategy, when compared to the achievement of students who were exposed to the Conventional Method.

Conclusion

The present study was undertaken to study the effect of Co-operative learning strategy based teaching learning programme on the Achievement, of IX students in Biology. The Co-operative learning strategy Based Teaching Learning Programme was found to be effective in improving the Achievement in Biology of the students and also the students belonging to the above High, Average and Low categories. The use of concrete material and manipulatives in the teaching learning of Biology has helped in improving the achievement of the students in Biology and it has also helped in retention of the concepts in Biology for a longer period of time

cooperative learning strategies were found to be effective in improving students' academic achievement in Biology.

Educational Implications

- The study revealed that the students exposed to Co-operative learning strategy based teaching learning programme performed better than the students exposed to the Conventional Method with respect to the Achievement in Biology. So Co-operative learning strategy should become an inevitable part of teaching and learning of Biology.
- The existing teaching- learning pedagogy needs to incorporate the Cooperative learning strategy since; co-operative learning strategy helps the students in the enhancement of their achievement at higher levels of cognitive domain. This is seem possible with incorporating innovative pedagogical approach like co-operative learning strategy which can enhances students' cognitive abilities at higher levels and develops reflective skill in them.
- Teachers can enhance student engagement and academic performance by incorporating cooperative learning strategies
- Development of higher order cognition required use of innovative pedagogy like CLS by trained and qualified teacher. Hence, teachers should have a positive attitude towards cooperative learning approach and the students should be given chances to do group works, discussions, and presentations and peer learning in the regular teaching- learning process.
- Parents can support the use of cooperative learning strategies by encouraging their children to engage in group activities and collaborative tasks at home.
- Policymakers should consider promoting cooperative learning strategies, such as STAD and Jigsaw, within the national or regional educational curricula.
- Educational institutions can foster a more collaborative and supportive learning environment by integrating cooperative learning methods into their curriculum.

Suggestions for further Research

1 Studies may be undertaken for other classes involving Biology Co-operative learning strategy.

2 Studies on Biology Co-operative learning strategy Based Teaching Learning Programme can be extended to Central Government Schools.

3 The present research was confined to Biology only, but the principles of cooperative learning strategies should apply to all subjects too. Hence investigation in the future may include areas such as language, arts, mathematics and science, etc

4 A survey of teachers' attitude towards using Biology Co-operative learning strategy Based Teaching

Learning Programme can be undertaken.

5 More research is required to determine how cooperative learning affects special groups of children, such as gifted, learning disabled and other mildly handicapped students

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