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Effects of Cooperative Learning on the Academic Achievement and attitude towards cooperative learning: the case of Dilla College of Teacher Education First Year Mathematics Students

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Abstract

The aim of this research was to examine how cooperative learning influences the academic performance and attitudes of first-year mathematics students at Dilla College of Teacher Education in Ethiopia. A quasi-experimental design was adopted for the study. Through random assignment, one class ($n1 = 38$) was designated as the experimental group, while another class ($n2 = 39$) served as the control group. Both groups were given a pre-test prior to the intervention. Following eight weeks of instruction, a post-test was administered to the two groups. The data were analyzed using a paired t-test to compare mean differences at a significance level of $p < 0.05$. The findings revealed a statistically significant difference in mean test scores between the groups ($t = 9.358$, $p < 0.05$), with the experimental group achieving higher results than the control group. This indicates that cooperative learning significantly enhances students' academic performance. Furthermore, the descriptive results on students' attitudes demonstrated that most participants expressed positive perceptions toward cooperative learning, with an overall mean score of 4.3, corresponding to the "Agree" level. This suggests that learners generally hold favorable views and tendencies toward the cooperative learning approach. In conclusion, the findings confirmed that cooperative learning is more effective in improving conceptual understanding compared to traditional teaching practices. Therefore, teachers are encouraged to integrate cooperative learning strategies into their instructional processes.

1 Introduction

1.1 Background of the Study

As noted by Gocer (2010), cited in Odagboyi and Kreni (2017), learners should not be viewed as separate individuals but as members of a wider community. Children's learning experiences are shaped by their families, peers, and the larger society. The goals of individuals are often aligned with common societal objectives, creating a strong interdependence among them (Odagboyi & Kreni, 2017). Odagboyi (2015) further emphasized that classroom groups characterized by supportive peer relationships promote academic success, while classrooms dominated by peer rejection and interpersonal conflict hinder learning. Cooperative learning is an instructional strategy that fulfills several psychological and social needs. A meta-analysis conducted by Johnson, Johnson, Roseth, and Shin (2014) investigated how achievement relates to motivation under three conditions: positive interdependence (students working together toward

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shared goals), negative interdependence (students competing), and no interdependence (students working individually). The study confirmed that positive interdependence environments generate higher levels of both motivation and achievement compared to competitive or individualistic situations.

Slavin, Lake, Hanley, and Thurston (2014) also argued that science teaching methods designed to strengthen classroom instruction—such as cooperative learning, science-reading integration, and the use of technology tools—hold great potential in boosting students' academic performance in science.

According to Johnson and Johnson (2015), cooperative learning cannot be reduced to simply placing students in groups. Its effectiveness relies on certain essential components: (a) positive interdependence, in which group members recognize that their success is linked to one another; (b) the development of interpersonal and small-group skills, as students need to be explicitly taught social skills for effective collaboration; (c) individual accountability, ensuring that each member assumes responsibility for achieving group goals; and (d) group processing, where members reflect on their progress and how well they maintain working relationships. Cooperative learning, when implemented effectively, helps students develop critical thinking, problem-solving, and teamwork skills. It also allows them to build on one another's experiences, leading to more comprehensive outcomes and sustained learning.

A study by Zakaria *et al*. (2010), as cited in Girma (2018), compared cooperative learning with traditional teaching in a school in Miri, Sarawak. Results showed that cooperative learning produced better academic outcomes than conventional methods. Similarly, Antil, Jerkins, Wayne, and Vadasy (1998), cited in Kefale (2015), observed that teacher-centered approaches such as lectures, explanation, questioning, and guided practice often focus on individual goals, encourage competition, and may disadvantage students who learn more slowly. In such traditional models, minority or less-advantaged learners may fall behind their higher-achieving peers (Kefale, 2015).

Tesera and Desta (2006) highlighted that, despite widespread criticism of teacher-centered pedagogy, Ethiopian classrooms remain dominated by lecture-based approaches. Students typically listen passively and copy notes, while interactive strategies such as problem solving, cooperative learning, and group work are rarely applied. Mekonnen (2011) also observed that this teacher-led pedagogy places learners in a passive role, which is educationally undesirable. Hence, research findings indicate that in Ethiopia, cooperative learning is often overlooked, despite being widely advocated. At the same time, institutions like Dilla College of Teacher Education are expected to integrate cooperative learning into their teaching practices in order to align with national educational objectives and to prepare competent teachers.

Nevertheless, personal observations and prior experiences suggest that many instructors continue to rely on traditional teaching strategies, leaving cooperative learning approaches largely unused. To bridge this gap, the current study examines the effects of cooperative learning on students' academic achievement. Additionally, the study provides valuable insights into students' perceptions of cooperative learning and its impact on their learning experiences.

Thus, this study addressed the following basic research questions:

1. What is the students' attitude towards cooperative learning?
2. Does the cooperative learning approach have statistically significant effects on the academic achievement of students?

1.2 Review of literature

Basic concepts of cooperative learning

Scholars have provided various definitions of cooperative learning (CL), though most share common themes with only slight variations. Cooperative learning should not be confused with simple group work. Rather, it involves structured collaboration where students actively assist one another in achieving shared goals. As Jacobs (1997), cited in Tina (2014), pointed out, CL is more than just grouping students and assigning a task. It is an instruc-

tional tool through which teachers promote mutual assistance and ensure active participation of all members, giving each student the responsibility of supporting their peers.

Wilkinson (1994), as cited in Bolukbas (2011), explained that in cooperative learning, the attainment of individual goals depends on the overall success of the group. Consequently, students who wish to succeed must also support their teammates. This structure enables advanced learners to assist slower ones, ensuring that all members strive to improve both individually and collectively, since group success depends on each person's contribution.

Similarly, Kagan and Kagan (1998), cited in Berhanu (2016), described cooperative learning as a structured peer-interaction process emphasizing collaboration, positive relationships, active engagement, equal participation, and equal status among learners. This method can be applied across subjects, including languages, mathematics, and social sciences. Ogunleye (2011), cited in Berhanu (2016), further defined it as a system where learners pursue shared academic goals collaboratively, rather than competing or working in isolation. Despite differences in wording, these definitions converge on the central principle of working together and helping one another.

Benefits of using Cooperative learning (CL) on academic performance

Beyond its definition, numerous advantages are linked to the application of cooperative learning in classroom instruction across grade levels. Researchers widely argue that CL is more effective than competitive or individualistic learning. Some of the key benefits include:

(A). Students can enhance their social skills:

In real-world settings, individuals often need to collaborate within families, workplaces, and communities for mutual benefit. Yet, schools frequently prepare students to compete rather than cooperate, fostering a mindset where others' failure enhances one's own success. Cooperative learning reverses this by cultivating interpersonal skills and promoting group-based achievements. Freeman (2000), cited in Kefale (2015), emphasized that CL encourages collaboration instead of competition. According to Johnson and Johnson (1990), cited in Odagboyi and Kreni (2017), essential social skills fostered in CL include effective communication, encouraging peers, constructive feedback, critical questioning, and maintaining group focus.

(B). There can be more individualization of instruction:

CL allows for tailored support, as students can receive help not only from teachers but also from their peers. Long and Porter (1985), cited in Kefale (2015), observed that peer assistance benefits both the learner receiving help and the one providing it. Similarly, Farivar and Webb (1994), cited in Kefale (2015), argued that helping others enhances the academic outcomes of the helper as well. Brumfit (1984), cited in Berhanu (2016), also noted that small groups enable learners to progress at their own levels, offering more individualized instruction compared to whole-class setting.

(c). Anxiety can decrease:

Students are often nervous when speaking before an entire class. However, smaller groups provide a less intimidating environment. Representing a group in class discussions can also ease pressure, since responsibility is shared. Long and Porter (1985), cited in Kefale (2015), and Brown (2001), cited in Berhanu (2016), both confirmed that small-group activities create greater security and confidence for students.

(D). Motivation and positive attitude towards class can increase:

Because CL promotes student-centered interaction, it allows communication to occur at a pace suited to group members' understanding. Unlike traditional classes, where the pace may be too fast for some and too slow for others, students in CL groups adjust to one another's needs. McKernan (1996), cited in Kefale (2015), highlighted that this cooperative atmosphere fosters encouragement, emotional bonds, motivation, and a more positive outlook toward learning.

Students' attitude towards Cooperative Learning

Attitude is a critical factor in learning. As Emina (1986), cited in Odagboyi and Kreni (2017), observed, attitudes shape motivation in education, including CL. Teachers must engage learners' interest and ensure that the cultivation of positive attitudes is deliberately planned and integrated into both the curriculum and daily learning activities.

Tina (2014) reported that 75% of students expressed favorable attitudes toward CL, noting that it increased their motivation to participate. Similarly, Burden (2004), cited in Hagose (2012), found that a positive attitude strongly motivates learners to achieve their educational goals. Fahad (2009) also demonstrated that many students view CL as essential in improving retention and that they are generally effective in participating when CL is used. These findings suggest that attitudes toward cooperative learning significantly influence its success in classrooms.

Theoretical model of the study

Although different models of CL exist, the current study employed the Student Teams Achievement Division (STAD) model. STAD is a collaborative learning method developed by Robert Slavin and colleagues at Johns Hopkins University. As explained by Innovative Learning (2009), cited in Monchai and Sanit (2013), STAD groups students of mixed ability, gender, and background into teams of four or five. The teacher presents a lesson, after which team members work together to ensure understanding of the material. Later, students take individual quizzes without group assistance, and their scores are compared to their previous averages. Points are awarded based on individual improvement, thereby motivating students to help each other learn.

Keramati (2009), cited in Monchai and Sanit (2013), conducted a study on physics students and found that those taught using STAD performed significantly better than those taught through conventional methods. This supports the argument that CL, and STAD in particular, enhances academic performance compared to traditional approaches.

2 Objectives of the Study

2.1 General Objective of the Study

The general objective of this study was to investigate the effects of cooperative learning strategies on academic achievement and students' attitudes towards cooperative learning at Dilla College of Teacher Education first-year mathematics department students.

2.2 Specific Objectives of the Study

More specifically, the present study was proposed:

1. to evaluate students' attitude towards cooperative learning strategies
2. to analyze whether or not cooperative learning strategies significantly affect the academic achievement of students

3 Materials and Methods

In this research, a pre-test and post-test quasi-experimental design was employed, aligning with a quantitative approach. Two groups were involved in the experiment. Students were randomly assigned to different teaching methods: the control group was taught using the independent learner (IL) or traditional method, while the experimental group was instructed through the cooperative discussion group (CDG), specifically using the Student Team Achievement Division (STAD) model. In the CDG, one high-achieving student facilitated learning for peers of varying performance levels. As highlighted in a study by Mattingly and VanSickle (1991), cited in Molla and Muche (2018), the cooperative learning achievement division (CLAD) model is among the most effective instructional strategies. In CLAD, students are grouped based on their performance levels (high, medium, and low achievers) and are held individually accountable for their contributions. For the group to succeed, each member must play their role responsibly.

Accordingly, in this study, the experimental group received instruction through cooperative learning for eight weeks, while the control group was taught using the conventional lecture method. The subject matter covered was general biology, specifically

focusing on the central nervous system unit, which was delivered using the cooperative learning approach.

3.1 Population of the Study

The study was conducted at Dilla College of Teacher Education, Dilla, Ethiopia, between March 2009 and May 2010 E.C. The target population consisted of first-year mathematics department students.

According to data from the college registrar's office, the total number of first-year mathematics students was 77, including 66 males and 11 females.

3.2 Sample and Sampling Techniques

The entire population of 77 students participated in the study. Using simple random assignment, students were divided into two groups: one class (n_1 = 38) was assigned as the experimental group, while the other class (n_2 = 39) served as the control group. Both groups were heterogeneous in terms of achievement levels, gender, ethnicity, and language backgrounds, reflecting the diversity of the student body.

3.3 Data Collecting Methods

An achievement test containing 50 items was administered to measure a student's achievement in a general biology course to conduct a post-test after treatment. All questions were objective type items, including true or false items, multiple choice items, and matching items. The time allowed was 50 minutes, and each item was allocated 1 mark. The maximum score for the achievement test was out of 50. The questions were used to assess a student's achievement before treatment and to measure the student's achievement after treatment. The content validity of the test items was checked by the researcher before the examination. To test their validity and reliability, the items were cross-checked and reviewed by biology and measurement and evaluation expert instructors. Thus, the validity of the test item was confirmed as valid as it could measure what it was planned to measure. The questioners, which were adapted from Berhanu (2016) by the current researchers, were also used to evaluate the attitudes of students towards cooperative learning strategies. It contains 14 items, and the validity was measured using Cronbach's coefficient alpha and the result of the test was .83.

3.4 Methods of Data Analysis

Data analysis followed a quantitative approach. Responses were coded numerically and organized for entry into SPSS version 21. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to describe students' attitudes toward cooperative learning.

Inferential statistics, specifically the paired sample $t - test$, were applied to compare the pre-test and post-test mean scores of the experimental and control groups. This allowed for testing whether differences in achievement between the groups were statistically significant.

4 Results

The central purpose of this study was to investigate the investigative effects of cooperative learning strategies on academic achievement and attitudes towards cooperative learning of students at Dilla College of Teacher Education first-year mathematics department students. In doing so, findings secured via quantitative methodologies are presented in table 1.

As presented in Table 1, students' attitudes toward cooperative learning were examined using 14 items. The findings indicate that learners generally expressed positive views about cooperative learning, with 74% strongly agreeing and 22.1% agreeing that it is beneficial (overall mean = 4.7). A large proportion of respondents also emphasized that cooperative learning groups should be composed of students with varied abilities, as 50.6% strongly agreed and 35.1% agreed with this statement (mean = 4.3). Furthermore, the majority of students believed that cooperative learning contributes to enhancing self-esteem, with 45.5% strongly agreeing and 39% agreeing (mean = 4.2).

Table 1: Results on students' attitude towards cooperative learning

No	Items on Attitude towards CL	F &%	5	4	3	2	1	Total	Mean
1	I think cooperative learning is advantageous for students' learning.	F	57	17	2	0	1	77	4.7
		%	74	22.1	2.6	0	1.3	100	
2	I think group members in cooperative learning should be heterogeneous in ability	F	39	27	8	3	0	77	4.3
		%	50.6	35.1	10.4	3.9	0	100	
3	Cooperative learning improves students self esteem.	F	35	30	6	4	2	77	4.2
		%	45.5	39	7.8	5.2	2.6	100	
4	Cooperative learning increases students' productivity	F	42	26	6	3	0	77	4.4
		%	54.5	33.8	7.8	3.9	0	100	
5	Cooperative learning improves respect of others opinions among students.	F	28	41	7	0	1	77	4.2
		%	36.4	53.2	9.1	0	1.3	100	
6	Cooperative learning affects students' academic achievement positively	F	37	11	10	13	6	77	3.8
		%	48.1	14.3	13	16.9	7.8	100	
7	Cooperative learning facilitates students to use higher level thinking strategies.	F	41	25	9	0	2	77	4.3
		%	53.2	32.5	11.7	0	2.6	100	
8	Cooperative learning encourages students to create new ideas	F	35	33	6	2	1	77	4.4
		%	45.5	42.9	7.8	2.6	1.3	100	
9	In cooperative learning, group members should not be formed based on friendship.	F	34	28	4	6	5	77	4.1
		%	44.2	36.4	5.2	7.8	6.5	100	
10	Cooperative learning is important both for students and teachers.	F	37	26	5	6	3	77	4.1
		%	48.1	33.8	6.5	7.8	3.9	100	
11	I think students should know the essential elements of cooperative learning for successful learning.	F	34	33	7	2	1	77	4.3
		%	44.2	42.9	9.1	2.6	1.3	100	
12	Cooperative learning is a valuable instructional approach.	F	34	33	7	2	1	77	4.3
		%	44.2	42.9	9.1	2.6	1.3	100	
13	In cooperative learning positive interdependence among group members ensures effective learning.	F	32	29	9	5	2	77	4.1
		%	41.6	37.7	11.7	6.5	2.6	100	
14	I think cooperative learning makes students responsible for their learning	F	48	20	4	3	2	77	4.4
		%	62.3	26	5.2	3.9	2.6	100	
	Total Mean								4.3

Similarly, many participants highlighted that cooperative learning boosts productivity, with 54.5% strongly agreeing and 33.8% agreeing (mean = 4.4). Slightly more than half of the respondents indicated that cooperative learning positively influences academic achievement, with 48.1% strongly agreeing and 14.3% agreeing (mean = 3.8). In addition, 53.2% strongly agreed and 32.5% agreed that cooperative learning enables students to apply higher-order thinking strategies (mean = 4.3).

The data also reveal that most respondents considered cooperative learning important for both students and teachers, with 48.1% strongly agreeing and 33.8% agreeing (mean = 4.1). A significant number of students also believed that teachers should be knowledgeable about the essential elements of cooperative learning in order to ensure its successful application, with 44.2% strongly agreeing and 42.9% agreeing (mean = 4.3). Likewise, a majority of participants perceived cooperative learning as a valuable instructional method, with 44.2% strongly agreeing and 42.9% agreeing (mean = 4.3). Finally, most respondents affirmed that cooperative learning promotes student responsibility for their own learning, with 62.3% strongly agreeing and 26% agreeing (mean = 4.4).

Taken together, the responses suggest that students generally maintain a favorable attitude toward cooperative learning. The overall mean score of 4.3, which approximates the "Agree" category, reinforces the conclusion that learners have positive perspectives, inclinations, and tendencies toward cooperative learning.

The paired t test shows that there was no significant difference in general biology pre-test scores (P =.31) between the experimental group (M = 28.51, SD = 8.1) and the control group (M = 26.44, SD = 9.7). The magnitude of the difference in the means (mean difference = 2.07). This implied that the academic status of the learners in both groups was highly comparable before exposing them to different teaching methods (Table 2).

Table 2: Paired t-test result on pre-test achievement means scores for the experimental and control group

Study Group	N	Mean	SD	Std. Error	t-value	df	p-value
Experimental	38	28.51	8.1	1.38	7.358	37.5	.31
Control	39	26.44	9.7	1.52			

Sig. level p< 0.05

A paired t-test was employed to compare the mean post-test scores of the control and experimental groups after eight weeks of treatments (Table 3). There was a significant difference in mean test scores between the two groups of participants, i.e., the t statistic, t = 9.358 and p =.003 at the p 0.05 level of significance, two-tailed with the experimental group (Mean = 37.26, SD = 6.2) scoring higher than the control group (Mean = 26.13, SD = 4.1). The magnitude of the differences in the means (mean difference = 11.13) The results confirmed that the experimental group who had engaged in learning through cooperative learning produced a higher overall improvement in academic scores on the general biology post-test. This means that working cooperatively has significant effects on academic achievement scores in general and test scores in general biology courses in particular.

Table 3: Paired t-test result on post-test achievement means scores of the experimental and control group

Study Group	N	Mean	SD	Std. Error	t-Value	df	p-value
Experimental	38	37.26	6.2	1.00474	9.358	37	.003
Control	39	26.13	4.1	0.64907			

Sig. level p< 0.05

5 Discussions

The findings of this study indicate that students hold a generally positive attitude toward cooperative learning. Specifically, the overall mean score for attitude-related items was 4.3, reflecting a favorable perception. As outlined in the analysis section, this high mean value demonstrates that participants view cooperative learning in a positive light. Consequently, it can be concluded that the respondents' overall attitude toward cooperative learning was encouraging in this context.

These results align with the studies of Mekonnen (2011) and Hagose (2012), which revealed that both teachers' and students' perceptions and attitudes significantly influence the successful adoption of new instructional approaches.

Moreover, the results showed that students who were taught using cooperative learning strategies achieved significantly higher post-test scores compared to those taught through the conventional lecture-based method. This suggests that cooperative learning was more effective than the traditional approach in enhancing students' academic performance in biology.

For students who provided help to their peers, the cooperative learning environment also created opportunities to strengthen their own academic skills. This observation is consistent with Farivar and Webb (1994), cited in Kefale (2015), who argued that peer assistance benefits not only the learners being supported but also those offering the support. Similarly, Brumfit (1984), cited in Berhanu (2016), emphasized that organizing students into small groups allows for greater individualization of instruction. Each group can work at its own capacity and pace, unlike a whole-class approach where instruction is delivered uniformly.

The present findings also reinforce the results of Slavin, Lake, Hanley, and Thurston (2014), who found that classroom strategies such as cooperative learning, science-reading integration, and the use of technological tools significantly improve science teaching and learning outcomes.

Overall, the results of this study confirm that students with no prior knowledge of biology content performed better when taught through cooperative learning compared to those taught using traditional lecture methods. The statistically significant difference ($p < 0.05$) in post-test scores between the groups highlights the effectiveness of cooperative learning in improving academic performance. These results are consistent with earlier research findings that have demonstrated the superiority of cooperative learning over conventional teaching methods.

6 Conclusion

The study demonstrated that the majority of students developed a positive attitude toward the use of cooperative learning in their educational experiences. In addition, the findings revealed that cooperative learning significantly enhanced academic achievement in general biology compared to the traditional lecture-based method. This confirms that cooperative learning fosters a deeper conceptual understanding and is more effective than conventional approaches. The results further showed a clear difference in academic performance between students taught through cooperative learning and those taught through traditional methods, indicating that cooperative learning is a suitable strategy for improving student outcomes in higher education institutions.

7 Recommendation

Given that cooperative learning was found to improve students' academic performance, it is strongly recommended as an alternative instructional method within the current educational reform efforts in Ethiopia. To ensure effective implementation, both instructors and students should receive appropriate training on how to apply cooperative learning strategies in classroom practice. Teachers are encouraged to recognize the value of cooperative learning and integrate it into their teaching-learning processes.

While the present study supports the effectiveness of cooperative learning, it is important to note that the sample size was limited to 77 participants. Future studies should therefore involve larger groups of students to provide more comprehensive insights into the impact of cooperative learning, both within

the institution studied and in schools across its catchment area.

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Conflict of Interests

The authors declare that there is no conflict of interest.

Ethical approval

Consent was sought form the research participants. Confidentiality was maintained in reporting information.

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