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**RESEARCH PAPER**

**Impact of Cooperative Learning on Academic Achievement in  
Grade 5 Mathematics: A Mixed-Methods Study**

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**ABSTRACT**

*This research aimed to assess the impact of cooperative learning on the academic achievement of grade 5 mathematics students. The study sought to evaluate the effects, score differences, and benefits of the cooperative learning method compared to traditional teaching methods. A sequential explanatory mixed-method research design was employed. The study was experimental in nature and utilized a convenience sampling technique for data collection. Data were gathered from students in both the control and experimental groups. The experimental group received instruction through the cooperative learning method, while the control group was taught using traditional methods. An academic achievement test was administered to both groups post-intervention, and the quantitative data were analyzed using SPSS 21, with an independent sample t-test applied. Additionally, focus group interviews were conducted with participants from the experimental group to explore their perceptions of the cooperative learning approach. The qualitative data were analyzed using thematic analysis. The findings indicate that students taught through cooperative learning performed significantly better than those in the control group. Moreover, the qualitative findings support the quantitative results, with students perceiving the cooperative teaching method as both attractive and efficient for learning.*

**Keywords:** *Academic Achievement, Cooperative Learning, Experimental Study, Traditional Learning.*

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## **Introduction**

Teaching method adopted builds a kind of interaction between the teacher and learner. Learning process is considered as an interaction between the teacher and the student which aims to transfer knowledge and skills to the student in the existing learning environment. An interactive method is a form of a teacher-student interaction which involves both a teacher and the students. In this method of learning, students are not passive listeners any longer but they are active members in the learning process. Because of these benefits, a lot of teachers prefer this method of instruction. (Madona & Marine, 2017). Due to the emphasis on rote learning in our teaching and learning system, students are no longer exposed to conventional instructional methods. (Yasin, Rasool & Azim, 2021). Students have the chance to participate in group projects through cooperative learning, which enriches the learning experience and boosts academic performance. Under the guidance of the teacher, students use the cooperative learning technique to collaborate in small groups to achieve a shared learning objective. (Richard & Rebecca, 2007) It has been noticed that mathematics achievements have been dropped Students' perceptions of mathematics as a challenging and boring subject is one of the factors contributing to the drop in math achievement in schools. To excel in the subject, the students should be provided with the opportunity to communicate and reason mathematically as well as to develop their confidence in their ability to solve mathematical problems. Cooperative learning is one method for achieving this. Students engage in cooperative learning when they work together in small groups to accomplish common objectives. (Zakaria, Chin & Daud, 2010). The poor concept base among the students at the elementary and middle school levels in Pakistan and the inadequate usage of contemporary teaching and learning methodologies are the main causes of the low performance and high dropout rates among secondary math students there. (Majoka, Saeed & Mahmood, 2007) Therefore, it was essential to find out the impact of cooperative learning on the student's academic achievement. This will be an experimental study which aims to investigate the Impact of Cooperative Learning on Academic Achievement of Mathematics Students in Grade 5.

### **Objective of the study**

The objective of the study is to find out the dissimilarity in the academic achievement score of grade five mathematics students when taught by cooperative learning method and by traditional teaching method. Furthermore, the study will investigate the perceptions of students regarding the efficiency of cooperative learning method.

It has been studied that students show low performance in Mathematics and dislike mathematics due to poor base at primary level and less

application of modern methods. Therefore, it is significant to teach mathematics with modern methods. (Majoka, Saeed & Mahmood, 2007). This study focuses to study the impact of cooperative learning method on the academic achievement of mathematics students of grade 5. The findings of the study found cooperative learning a better approach for teaching mathematics, hence the findings help teachers to design effective teaching activities. Further the findings are helpful for school administrator and curriculum designers for designing effective content and teaching strategies for teaching mathematics. Research questions

1. What are the impacts of cooperative learning approach used by mathematics teacher on the academic achievement of students of grade 5?
2. What are the significant differences in academic scores of the grade 5 mathematics students when taught through traditional and cooperative approach?
3. What are the benefits of cooperative method on student's learning?

Hypothesis

**Ho:** There is no significant difference in academic scores of the grade 5 mathematics students when taught by traditional teaching method or cooperative teaching method.

### **Literature Review**

Traditional teaching methods are centred on teachers explaining lesson from textbook, so students are not active members. Nontraditional teaching methods, awaken learner's interest and creativity, and motivate them to contribute in class activities. In the past two decades, numerous authors have proposed a variety of nontraditional teaching methods to maximize learners' successes. Since instructors cannot create a course specifically for each student in a classroom, numerous authors and researchers have worked hard to identify a special teaching strategy that would work well for various learner types. (Safapour, E., Kermanshachi, S. & Taneja, 2019).

*Cooperative learning:* The practice of learning through cooperation known as cooperative learning involves students working in small groups to support one another's learning while the teacher monitors them. (Abramczyk & Jurkowski, 2020; Johnson & Johnson, 1999).

### **Types of Cooperative Learning**

*Formal Cooperative learning groups:* Students collaborate to achieve shared learning objectives. It is created with a specific objective in mind and can span anywhere from a day to several weeks.

*Informal cooperative learning groups:* It is used to facilitate the learning of students during direct teaching. It is ad-hoc group that last for weeks to a period.

*Cooperative base group:* The purpose of this group is to allow members to

provide support, encouragement, help and assistance to each other to be successful academically. They are long lasting groups and consist of heterogeneous members. (Johnson et al., 2014).

*Techniques of Learning: Cooperative* There are variety of ways to implement cooperative learning techniques in classrooms for all subjects and grades. Therefore, the teacher should: explain activities and objectives and split students into groups and groups should be diverse which focuses the desirable skills that are needed for achievement of the task. Assign roles to the students and discuss about the assessment criteria and the kinds of skills that will be required. Show an active part in the group work and monitor the work and evaluate individual and group performance. (Johnson, Johnson & Smith, 2014; Pateşan Balagiu & Zechia, 2016).

*Teaching of Mathematics:* As an academic discipline, mathematics provides the necessary foundation for the growth of students' cognitive abilities. It shapes and improves mental processes like synthesis, comparison, and analysis, fosters the capacity to generalize, and establishes the conditions for improving memory, attention, and other mental processes. (Ibrokhimovich & F. J, 2022).

The objective, content, means and methods of instruction and the structuring of instructional activities are some of the distinctive qualities (primary characteristics) of the idea of "lesson." The lesson's educational, developmental, and instructional objectives play the largest role among the key aspects. The development of mathematical knowledge, skills, and talents is one of the educational objectives. However, in order to organize mathematics instruction more logically, it is required to develop general educational knowledge, skills, and talents in addition to mathematical understanding. (Ibrokhimovich & I. F. J. 2022).

If a lesson upholds the greatest standards of integrity, it can be far more powerful. To do this, it must possess systemic, comprehensive qualities. The instructor must carefully consider the educational potential of mathematics and emphasize the educational goal of each lesson in order to increase the educational impact of their instruction. The learning objectives dictate the basic mathematics course's content. Continuity in the study of mathematics throughout middle and high school should be ensured by the mathematics course for younger students. (Ibrokhimovich & I. F. J. 2022)

*Advantages of cooperative learning in mathematics:* Students' attitude toward arithmetic and their quantitative achievement both benefit from cooperative

learning. It has gradually affected how students' attitude toward mathematics have changed for the better. (Zakaria, Chin & Daud, 2010) Cooperative learning enhances performance, long-term memory for

math, self-concept, and social skills, according to studies. Students should be given more chances in class to participate in discussions, come up with ideas, and collaborate with other students. Studies employing cooperative learning were undertaken by many math educators and revealed an improvement in students' math skills. (Brush, 1997; Nichols & Miller, 1994; Tarim & Akdeniz, 2008; Zakaria & Daud, 2010).

Rambe et al. (2020) conducted a study in Indonesia to find the influence of Jigsaw Cooperative Learning Model on Mathematical Representation Ability and Student Learning Motivation at Private Elementary School. The purpose of the study is to ascertain how the cooperative learning paradigm affects students' mathematical aptitude and learning drive. The study was carried out in a private school with 10 samples, 2 classrooms, and a total of 35 students in each class. The jigsaw cooperative learning design has a 9.1% greater effect on the students' mathematical portrayal abilities than the expository dialogue learning model, according to the results of this experimental study. There is also an effect of beginning mathematical ability on pupils' mathematical representation abilities, with high initial mathematical capacity of students having an 11.5% higher effect than low initial mathematical capacity of the students.

Yasin et al. (2021) conducted research in Pakistan, Jhang city. The study was about effect of Cooperative Learning Strategies on Student's Learning in the subject of Biology. This study was experimental and data were composed of control and experimental group students. The 10th-grade learners were placed into two groups of 20 individuals each at random. While the control group's pupils were taught using the standard approach, the experimental group's students were taught using cooperative learning strategies. Data were gathered from both groups and analysed using descriptive statistics and covariance analysis (ANCOVA). Results of the study showed a notable difference, and students who were taught utilizing cooperative learning methodologies were able to perform noticeably better than students in the control group. Hashmi et al. (2020) conducted a study to discover the influence of cooperative learning on learners' achievement and motivation to computer science at secondary level. A quasi-experimental design with a non-equivalent control group was used. Thirty students each from two complete groups served as the study's sample. The experimental group received instruction using the Students Group Activities Division (STAD) cooperative learning technique, while the control group received instruction using the traditional way. A teacher-made computer science test was used to guide the pre-test and post-test, respectively. To ascertain students' motivation for computer science, the Students' Attitude toward Computer Science Significant Progress was modified.

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This study clearly demonstrates that students' post - test motivation and accomplishment scores for learning computer science were higher than their pretest motivation and success scores. The study supports a cooperative approach to teaching computer science, and disruption should be provided over a significant amount of time.

### **Research Methodology**

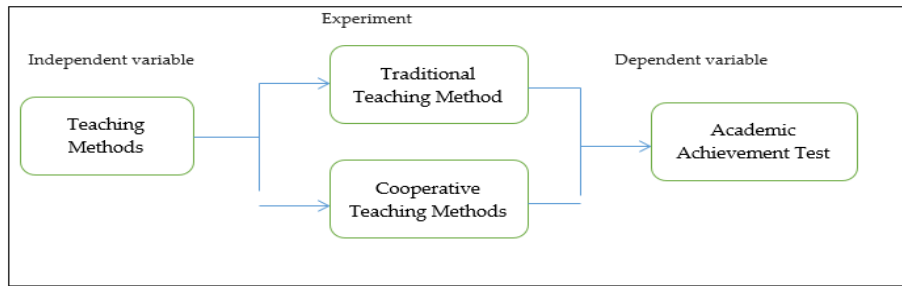
It has been studied that students show low performance in Mathematics and dislike mathematics due to poor base at primary level and less application of modern methods. Therefore, it is significant to teach mathematics with modern methods (Majoka et al., 2007). The current study focused on sequential explanatory mixed method research design. It is a type of research in which data is collected and analyzed, Qualitative Data Collection and Analysis Larger focus on quantitative data (Ashiq & Habib, 2020; Tashakkori & Teddlie, 2010). In order to address research difficulties, mixed methods design combines strategies from quantitative and qualitative methods. A wide range of methodological options, including purpose, overall design, procedures, sampling, data entry and data, analysis, and interpretation, are available for mixed methods social investigations at any number of different stages of the inquiry process. Quantitative data were used in this research to support the qualitative research (Byrne & Humble, 2007).

According to Clark (2011) the explanatory sequential design requires first obtaining quantitative data and then qualitative information to prove justify or elaborate upon those quantitative conclusions. In quantitative part of study, experimental research plan is used to examine the research questions and to compare the two different types of teaching methods. Experimentation allows the researcher to set up research setting and generates data, according to Sprinkle (2003) changing the independent variable and using the randomization principle, experiments allow the researcher to control the study environment and isolate the effects of factors that are masked in the natural environment.

The participants of the current study were divided into two groups, control and experimental. The experimental group students were taught mathematics through cooperative learning approach and experimental group students were taught through traditional teaching approach. The research instrument also contains a lesson plan, an assessment, and a focused group interview. Lesson plans are created to ensure a seamless teaching and learning process for both the controlled group and the experimental group.



Figure 1  
Variables of the Study



The above *figure 1*, displays the teaching methods which are independent variable. Two different types of teaching methods are used in experiment for two different groups. The dependent variable of the current study is the academic achievement test scores, which were affected by the independent variables.

*Sample:* This experimental study was conducted to find out the Impacts of Cooperative Learning on the Academic Achievement of Mathematics Students of grade 5 in Star school Karachi, which is officially a registered secondary school.

Convenient sampling technique was adapted to select research participants of the study. The data were collected from a co-educational private school of Karachi; both male and female students took part in the study. The experimental study was conducted in grade five, the average age of students at this level is 10 years. Altogether 20 students took part in the study. 10 students in control group and 10 in experimental group. Structured lesson plan was integrated. Lesson plan rich with cooperative learning strategies to motivate the interaction of students with each other during team work. Students worked in small groups to contribute their learning and to produce healthier learning environment. Individual learning tasks were provided to students to ensure the engagement of each and every group member. Extensive group activities were involved like think pair and share activity and jigsaw which further engaged students in group work. Rewards and appreciation were provided for good team work. Assessment was taken from both controlled group and cooperative learning integrated classroom to find the difference in scores. Focused group interview was conducted to analyze the benefits of cooperative learning.

The researcher applied cooperative method in the teaching of mathematics only for one week. It could not be extended because of limited time. This study was limited to grade 5 mathematics students. To determine whether interference is effective, it should be used for a considerable amount of time.

*Research Instruments:* Academic achievement test of mathematics was used to collect the quantitative data. This instrument was design to

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measure the academic achievement test results for both control and experimental group. Academic achievement test was designed to check student's test scores in the subject of mathematics in grade 5. A test of 25 marks was designed from the geometry chapter of Countdown Book 5 text book of mathematics. Achievement test was checked by experienced teacher before implementation to ensure validity. The same test was used for experimental and control groups.

Focused group interview was conducted to examine the student's perceptions regarding integration of cooperative learning method. During the interview the researcher maintained healthy environment of interaction to make sure that the discussion was on point. The researcher took notes when needed. According to Stewart and Shamdasani (2014), "the main methods of data collection during a focus group discussion include audio and tape recording, note-taking and participant observation" (p.101) A focus group meeting's time duration must be carefully considered in addition to choosing the appropriate data collection methods, so that participants do not become fatigued. (Ashiq & Habib, 2020; Nyumba, 2018). The sitting was 30 minutes' period and a total of 5 students took part in these sessions.

#### **Ethical consideration**

Ethical guidelines were observed throughout the entire research process. The principal and the head of the primary section were involved in the discussion about the data collection process. The principal signed the consent form on behalf of the pupils. It was ensured in the consent form that that the information collected will be used for research purpose only and the source of information shall remain confidential. It was ensured that the name of school and the names of participants of focus group will be kept confidential. Pseudo names of school and participants were used.

#### **Findings**

The core objective of the study was to investigate the impact of cooperative learning on students of academic achievements in mathematics and to explore their perceptions regarding the cooperative learning approach. A mixed method style was adopted, hence both quantitative and qualitative data were collected and different data analysis approaches were used to analyze the data. The description of both qualitative and quantitative findings is given below.

*Quantitative Data Analysis & findings:* Mathematics academic achievement test was designed and administrated to check students' scores; the test was conducted after the intervention given to experimental students. The experimental students were taught through cooperative teaching techniques for a month and control group were taught through traditional teaching method. The results of the academic achievement test helped in testing the hypothesis of the study.



### *Testing of hypothesis*

In order to find the answers of the research questions, hypothesis was formulated and tools were designed to test the hypothesis.

**Ho:** There is no significant difference in academic scores of the grade 5 mathematics students when taught by traditional teaching method or cooperative teaching method.

To check students' academic achievement scores a mathematic test was designed for both control and experimental group students. The test was conducted after the intervention of cooperative teaching technique to experimental group students. The results obtained from the test were analyzed through descriptive and inferential statistics via using SPSS-21. Independent sample T Test were applied to compare the mean scores of both groups. The findings from the data were given below.

Table 1

Group Statistics					
		N	Mean	Std. Deviation	Std. Error Mean
Scores	students control group	10	15.2000	4.08384	1.29142
	experimental	10	20.2500	2.70031	.85391

Table 1 shows the descriptive statistics of the students test results, total marks of the test was 25 and the means score of control group students is 15.2 which is 60.8 %, with a standard deviation of 4.08. Whereas the mean score of experimental group students is 20.25, which is 81% with a standard deviation of 2.7. The difference in the means scores is quite visible, the result shows that students of experimental group performed better than the control group.

For better understanding and comparison of the means inferential statistics was used, independent sample T test was applied to compare the mean of the two groups. the table 2 given below shows the result of T-test.

Table 2

Independent Samples Test										
		Levene's Test for Equality of Variances				t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
Scores									Lower	Upper
Equal variances assumed		1.479	.240	-3.262	18	.004	-5.05000	1.54821	-8.30266	1.79734
Equal variances not assumed				-3.262	15.607	.005	-5.05000	1.54821	-8.33878	1.76122

Table 2 above illustrates the results of the independent sample t-test. The sig value of Levene's Test for Equality of Variances is .240 which is greater than .05 hence equal variance assumed. The test showed a significant difference in the grand total scores of experimental and control group students,  $t(18) = -2.62$ ,  $p < .005$ , two-tailed with experimental (students taught through cooperative strategy) ( $M = 20.25$ ,  $SD = 2.7$ ) scoring higher than traditional ( $M = 15.2$ ,  $SD = 4.08$ ) and the magnitude of difference in the means (mean difference = 5.05).

The results of independent sample test clearly shows that the students taught through cooperative learning approach scored better than the students taught through traditional learning approach. Hence the hypothesis of the study was rejected, as there is a significant difference in the academic achievement test scores of the students taught cooperative teaching approach and students taught through traditional teaching approach.

### Qualitative Data Analysis & findings

Thematic analysis was employed in this study to examine qualitative data. A qualitative research approach is known as thematic analysis. It is a procedure for classifying, analysing, organising, describing, and reporting themes found in the data. (Braun & Clarke, 2006) It enables the researcher to link frequency analysis of a theme to a particular piece of text. Accuracy and intricacy will be balanced in this way, improving the overall meaning of the research. (Alhojailan & Muhammad, 2012) Similar codes were identified from the answers of respondents and themes were made from those similar codes.

### Teaching with cooperative method

Students were in favor of learning in group with their peers not only for mathematics but also for another subject as well. Students look forward to seek changes in teaching learning process. A respondent F1 said that

*“Group learning helps to solve sums more quickly with the help of my peers. If teachers integrate cooperative learning in the teaching learning process, it would help to achieve good grades”.*

Another respondent F2 said that

*“Teacher should make groups so that every individual is accountable of their peers work.”*

### **Team building**

Students feel drastic changes in the behaviour of their peers. They help each other and incorporate good learning environment.

One the respondents F3 said *“Cooperative learning groups allow for more social interaction and can enhance students’ social skills.”*

Another student respondent F2 said that

*“Students help their group members irrespective of friendships. They are willingly focused that their group members complete their task within the provided time.”*

### **Communication**

Students were asked what changes they felt while learning in groups. Respondent F5 said that *“Discussion and communication help to open up ideas and share thoughts without fearing judgments.”*

Respondent F4 shared that *“It became easier for us to clear concepts through discussion. We were free to communicate our ideas.”*

*Leadership:* Researcher asked participants to comment on the leader work in the group. How they help their members in their group work. Participants commented on the cooperative settings leadership. Participant F4 said that *“Leaders ensured that every member of the group complete their task successfully.”*

Participant F2 responded that *“Group Leaders maintain effective relationship among members”*

Overall students like learning in cooperative settings in mathematics subject. They considered it an effective method of learning which helps them to achieve good learning in better setting. They were in favour of applying cooperative settings in other subjects as well.

### **Discussion**

Even though the majority of studies were carried out at the undergraduate, graduate, and master’s level and in global contexts, the results of the present study are consistent with previous research in the existing academic literature. Since there is a research shortage at the elementary level of education, the current study’s main goal was to integrate cooperative learning into Pakistan’s primary school mathematics curriculum.

Quantitative analysis shows that teaching with cooperative method improves the learning achievements of students in the subject of mathematics. The scores of academic achievement test were improved

after integrating cooperative method in the teaching of mathematics for one week as compared to the scores of the controlled group. Research article of Rambe and Elvi, 2020 indicates that treatments provide to cooperative learning group based on cooperative learning strategies during teaching helped the students to achieve relatively better and noticeably different from the participants in the control group of learners. The results of the present study corroborate those of a study on the impact of cooperative learning practices on students' learning conducted by Yasin et al. in 2021. Students who received instruction that included cooperative learning techniques performed noticeably better than those in the control group.

The focus group participants who were instructed through cooperative learning responded favourably to it. They supported implementing cooperative learning techniques in the classroom. The study of Hashmi et al., 2020 on the impact of the cooperative learning strategy on students' academic achievement and motivation there at secondary level is supported by the findings of this study. Their findings show that mathematics achievement can be improved via cooperative learning. Additionally, cooperative learning enhances comprehension and self-assurance.

### **Conclusion**

There were significant differences in the academic scores of grade five mathematics students when taught through traditional versus cooperative methods. Teaching with cooperative methods improves students' learning achievements in mathematics. The scores on academic achievement tests improved after integrating cooperative methods into mathematics teaching for one week, compared to the scores of students in the control group. Students showed increased interest in the subject when taught with cooperative strategies. They developed team-building skills, gained the confidence to solve problems individually, and communicated effectively with their team members. Group leaders were held accountable for all group members, ensuring that everyone completed tasks successfully and maintained effective relationships, which supported a positive learning environment.

### **Recommendations**

Teachers should implement a cooperative learning strategy to help students improve their communication skills. In order to strengthen student's Mathematics skills, it is also advised that teachers implement innovative cooperative learning activities in the classroom. These kinds of lessons should be planned by teachers to help students build their self-confidence, get over their shyness, and improve their social learning abilities. At the primary level, teachers should receive training in cooperative learning techniques. It is advised to use the cooperative

learning method to help students to improve their academic achievements, engagement, motivation, and self-reliance.

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