



EFFECTIVENESS OF COOPERATIVE LEARNING ON LEARNERS' PERFORMANCE IN MATHEMATICS

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Abstract : Cooperative learning is one of the student-centered approach use in teaching Mathematics. This study attempted to determine the effectiveness of cooperative learning in teaching selective concepts in Mathematics to Grade 2 Learners. It specifically determined (1) how effective is cooperative learning in teaching Mathematics; (2) is there a significant difference in the performance of Grade 2 learners in the pretest and posttest between the control group and the experimental group; and (3) what are the implications of the findings of the study in teaching Mathematics to Grade 2 learners.

There were 66 learners Grade 2 respondents from Sumilao District, San Vicente Elementary School, Bukidnon. A researcher-made questionnaire was used as an instrument in this study and a thirty (30) items made test based on the Mathematics Learners Material 2 and Modules. The research design utilized in this study is quantitative. Percentage, description, rank, mean, standard deviation, and descriptions were used. Paired T-Test was used as a statistical tool to make difference.

The study found out that cooperative learning has high effects to the learners academic performance in Mathematics and has very positive effects in the learners attitude towards Mathematics. It was also found out that learners who did not use cooperative learning as teaching strategy has negative effect to learners attitude towards Mathematics.

It was concluded that cooperative learning was effective to the academic performance of the learners as well as in developing the attitude of the learners towards learning Mathematics. There is a significant difference between the experimental and controlled group after employing cooperative learning to the Grade 2 learners.

Hence, this study recommends that the basic education offices, school heads, and elementary teachers create further innovations that will encourage the use of cooperative learning to develop high academic performance and positive attitude of learners towards Mathematics.

IndexTerms - Cooperative Learning, Academic Performance, Attitude toward Mathematics.

INTRODUCTION

Academically speaking, Mathematics is a subject that many students either love or hate. It becomes a problem to the teachers as it is hated by learners who do not find figures interesting, especially those students who are more into social sciences and linguistics. Mathematics is considered as one of the boring subjects by some and a difficult one to others. Moreover, researches on teaching and learning constantly endeavour to examine the extent to which different teaching strategies enhance growth in student learning in Mathematics since the academic performance of lots of learners continue to fluctuate (Cardino & Ortega-Dela Cruz, 2020). In the district of Sumilao, Bukidnon the consolidated results of the Curriculum Management Support System (CMSS) for S.Y. 2021-2022 showed that out of 2, 032 students, 1, 317 or 64.81% got grades which did not meet the expected satisfactory performance which could be a great challenge to the teachers.

The 2019 International Mathematics and Science Study (TIMSS) revealed that the Filipino learners scored significantly lower than any other participating countries. TIMSS is an international assessment tool for Mathematics and Science. The Philippines has actually scored the lowest among all 58 participating countries (Magsambol, 2020). PISA 2018 revealed that performance in Mathematics is still a problem (Valderama, 2021). It was found that Mathematics was one of the subjects performed poorly as to the result of the National Assessment Test (NAT). This has already been an existing phenomenon from 2004 to present. Teachers have been grinding to improve the student performance, however, despite the efforts, it remained unresolved throughout the country. The results become depressing and should serve as a wake-up call.

The above results in Mathematics assessments from international, national, and district level are adjacent to the challenges that the classroom elementary teachers are facing when using cooperative learning in their mathematics class. Sherrington, (2018)

pointed out that there is still need to explore the use of several teaching methodologies coherent to cooperative learning and have yet to come to the conclusion of which of the methodologies or activities will most serve the purpose of alleviating the academic performance the learners. In terms of the learners attitude towards learning mathematics, Teachers may not able to release the order and control of a teacher-led exposition and questioning phase to get learners talking because they can't manage all the details as they already have a presumption of how boring mathematics is: not everyone follows the brief; learners can drift, share misconceptions, just fill the time until they're given another task.

In formal education, competencies to be taught to school children are given from the central office (the Department of Education in Philippine setting) which the teachers need to follow in a specific period of time. Teachers put these competencies in a Budget of Work where the competencies are scheduled to be taught in specific days. The problem arises when the teachers cannot proceed to the next lessons as scheduled in the Budget of Work, and in the Teacher's Guide in Mathematics because the learners are stubborn in learning about the lesson, taking also into account the possibilities that the teachers had been having difficulties in teaching the competencies in terms of cooperative learning. In addition, in order to prepare students for examinations and better embed learning, both the learning content and teaching strategies should be considered (Durdin-Myers, 2019)

It has been observed that most of the Grade 2 learners where the researcher is presently working in has below satisfactory, and stubborn in engaging with the lessons, and so the problem is, the teacher cannot proceed to the next lesson, or the teacher proceeds to the lesson even when the learners had low performance of the previous competency. So ideally, this study would like to establish the effectiveness of cooperative learning when used for teaching Mathematics that the teachers conduct in classes in order to help the learners improve their academic performance and attitude towards learning mathematics. The researcher believes that this study would help solve these problem.

I. RESEARCH METHODOLOGY

Due to the nature of the study, the researcher chose to do a quasi-experimental quantitative research design, using descriptive study, since the study seeks to determine the significant difference among the experimental and control group after integrating cooperative learning. Moreover, this chapter presents the research design, research setting, research respondents and data gathering procedure, the research instrument, scoring procedure, and the statistical treatment.

3.1 Population and Sample

The respondents of this study were the Grade 2 learners of San Vicente Elementary School for the second quarter of the school year 2022-2023. The school has 3 sections in Grade 2 and there were 66 learners which were included in this study with a population of 99 and 33 per section. Table A shows the distribution of the learner-respondents of this study.

Table A
Distribution of the Respondents

Group	Section	Population	Total
Control Group	Cinderella	33	33
Experimental Group	Goldilocks	33	33
Total			66

3.2 Data and Sources of Data

The researcher personally administered the answering of survey questionnaire on the attitude of Grade 2 learners towards learning mathematics. Each item in the questionnaire was loudly and clearly explained to the respondents as they answer in unison. The researcher made sure that all of the respondents have already responded to the previous item before proceeding to the next. Clarifications about the survey questions were clearly addressed, as well as translating each item into vernaculars to make sure that everybody understands, hence give the honest responses.

Moreover, the researcher scheduled another day to administer the pretest among the respondents. The researcher explained to the respondents the reason of why the pretest was conducted. This should be done before the teaching innovation is introduced to the participants. After administering the pretest, the researcher personally implemented cooperative learning activities. After the intervention period was over, the researcher personally administered the posttest to all respondents in the study. This should measure the same outcome as the pretest.

To have a clearer view of the data gathering procedure, the researcher made a lesson log to emphasize the phasing of the conduct of classes in the experimental group and control group.

3.3 Theoretical framework

The dependent variables are the performance and the attitude of the learners towards learning Mathematics. The independent variables include the cooperative learning which uses Think-Pair-Share, Jigsaw, Numbered Heads Together, Carousel, and Team Games Tournament in teaching mathematics.

Math teaching in the K-12 curriculum uses the theory of the constructivists. Constructivism is based on the idea that people actively construct or make their own knowledge, and that reality is determined by your experiences as a learner (Thompson, 2020). Basically, learners use their previous knowledge as a foundation and build on it with new things that they learn. So, everyone's individual experiences make their learning unique to them. Constructivism is crucial to understand as an educator because it influences the way all of your students learn. Teachers and instructors that understand the constructivist learning theory understand that their students bring their own unique experiences to the classroom every day. Their background and previous knowledge impacts how they are able to learn. Educators are able to use constructivist learning theory to help their students understand their previous knowledge (Western Governors University, 2020).

Moreover, Constructivism as the theoretical basis of this study states that children learn mathematics are termed as constructivist, and they are founded on the view that learning is not merely the transmission of knowledge from one person to

Group	Equivalent Rating	Description
Control	75.884	Fairly Satisfactory
Experimental	75.581	Fairly Satisfactory

another; it rather posits that students are actually active participants in the construction of their own knowledge, especially from their personal experiences (StudyCorgi, 2020). It has been endorsed, taking into account its strengths as highlighted by scholars such as Vygotsky and Piaget. This is because the approach appreciates the interaction between the learner and his environment and how this crucial matrix helps in the comprehension of patterns, thus, concepts.

Cooperative learning is a unique teaching strategy that emphasizes on the collective performance of learners arranged into 'groups', rather than recognizing the productivity of a single student. S. Kaymak et al. (2021) had concluded in his research journal that cooperative learning can increase the learning outcomes of students in Academic Year 2018/2019. This increase is showed at the average score from the initial condition 83,11% to 86,33% at cycle I to 91,67% at cycle II.

Significantly, cooperative learning is also anchored on the theory of Lyv Vygotsky's Social Learning Theory. According to this theory, a child's learning is determined by the social interaction he has with the peers, family, and groups. Social interactions are one of the ways to learn things best. The classroom methodology of getting along with others to make the work done plays a critical role in understanding mathematical concepts and learners' performance in Mathematics (Foster, 2020).

3.4 Statistical Treatment

This study used mean, frequency, percentage, and rank to determined the effectiveness of cooperative learning and the learners attitude towards mathematics.

Moreover, the t-test was used to determined the difference in the academic performance of Grade 2 learners in the pretest and posttest between the control group and the experimental group. The P-value was determined through Mann-Whitney U test since there was no normal distribution of data.

Scoring Procedure

For the academic performance of the learners, the pretest and posttest in math during the 2nd Quarter of the sample population were utilized. The scaling of grades is based on the CMSS. The following was used as the scoring procedure:

A. Academic Performance

Equivalent Rating	Description	Interpretation
90-100	Outstanding	Very High
86-89	Very Satisfactory	High
80-85	Satisfactory	Moderate
75-79	Fairly satisfactory	Low
0-74	Needs Improvement	Very Low

For the scale of the test questionnaire on attitude towards Mathematics of the learners, the following were used as the scoring procedure:

B. Attitude of the Learners in Mathematics

Scale	Range	Description	Interpretation
4	3.26 – 4.00	Strongly Agree	Very Positive
3	2.51 – 3.25	Agree	Positive
2	1.76 – 2.50	Disagree	Negative
1	1.00 – 1.75	Strongly Disagree	Very Negative

IV. RESULTS AND DISCUSSION

Problem 1: How effective is Cooperative Learning in terms of the following:

1.1 Academic Performance

1.1.1 Pretest (Experimental & Control Group)

1.1.2 Posttest (Experimental & Control Group)

1.2 Attitudes Towards Mathematics

1.2.1 Control Group; and

1.2.2 Experimental Group

Table 1

Distribution of Respondents in terms of their Performance in the Pretest

Legend:

90-100- Outstanding/Very High

86-89 -Very Satisfactory/ High

80-85 -Satisfactory/Moderate

75-79 -Fairly Satisfactory/Low

0-74 -Needs Improvement

Table 1 shows that in the pretest result. The pretest result showed that the control group had an Equivalent Rating of **75.884** which is described as **Fairly Satisfactory**. The experimental group on the other hand had an Equivalent Rating of **75.581** which is also described as **Fairly Satisfactory**. This means that before cooperative learning strategies were implemented to the experimental group, both groups had a fair level of performance.

Having a fair level of pretest results from both the control group and the experimental group is important before conducting an innovation because it establishes a baseline for comparison. A pretest measures the initial level of the variable being tested in both the control and experimental groups before any cooperative learning activities was given. This allowed the researcher to determine if the cooperative learning activities had a significant effect on the experimental group compared to the control group. Without a fair level of pretest results, it is difficult to establish a valid comparison and draw accurate conclusions about how effective cooperative learning is to the academic performance of the young learners.

Research has shown that a fair pretest is essential for the validity and reliability of an experiment. According to Henson (2017), a pretest is necessary to ensure that the groups are equivalent at the start of the study, and any differences observed between the groups after the intervention can be attributed to the treatment, rather than preexisting differences. Additionally, a fair pretest can reduce the risk of confounding variables that may affect the results of the experiment. Having a fair level of pretest results from both the control and experimental groups is important before conducting an innovation because it establishes a baseline for comparison, reduces the risk of confounding variables, and helps to establish the validity of the experiment.

The above result indicates that before the cooperative learning was used in learning Mathematics, majority of the Grade 2 learners had a Fairly Satisfactory level of academic performance. This implies that the learners only had a very few backgrounds of what is to be taught to them. Because a pretest is given before the lesson is discussed, a low score is usually expected. This is supported by Kuehn (2023) as he stated that pre assessment tools are used for measuring the preparedness and performance of learners.

Table 2
Distribution of Respondents in terms of their Performance in the Posttest

Legend:

- 90-100- Outstanding/Very High
- 86-89 -Very Satisfactory/ High
- 80-85 -Satisfactory/Moderate
- 75-79 -Fairly Satisfactory/Low
- 0-74 -Needs Improvement

Table 2 in this paper lays down Posttest result of the academic performance of the control group and experimental group. The experimental group obtained an equivalent rating of **86.207** which is described as **Very Satisfactory**. This indicates that learners performed pretty well after learning their Mathematics lessons while employing Cooperative Learning. This is probably because cooperative learning also helps the retention of lessons among young learners. The general process of learning from others and by doing in cooperative learning helps the learners remember the important concepts and procedures in learning

Group	Equivalent Rating	Description
Control	80.291	Satisfactory
Experimental	86.207	Very Satisfactory

Mathematics. This is supported by Appiah-Twumasi and Kwabena Osei (2021) when she found out in her study that students who were instructed using cooperative learning achieved significantly higher scores on the achievement and knowledge retention posttests than did students who were instructed using lecture-based teaching. This further suggests that cooperative learning may be a more effective teaching method for promoting learners engagement, critical thinking, and collaborative skills. However, the effectiveness of cooperative learning may depend on a variety of factors, and teachers may need to invest more time and effort in planning and preparation compared to traditional lecture-based teaching methods.

This implies that the use of cooperative learning is very effective to improve the academic performance of the learners. Groups collaborate on open-ended problem-solving with members sharing different approaches, strategies, and solutions. Students expand their perspectives as they get to test one another's conjectures and identify what seems valid or invalid.

On the other hand, the control group, which did not experience cooperative learning, had an **Equivalent Rating of 80.291** which is described as **Satisfactory**. The lecture type of instruction was made in the delivery of lesson. This indicates that lecture-type of learning mathematics is not as good as that of employing cooperative learning.

The above-mentioned results imply that the learners in control group still learned their Mathematics accordingly even when cooperative learning was not used in conducting classes. However, the range would tell that there were still a large number of learners who got **Satisfactory**. This is probably because these learners are not suitable to lecture-type teaching. Lecture method is not well suited to the development of high-level intellectual skills and attitudes. The method does not appear to focus on Conceptual learning as much as factual or perceptual learning. Hence, placing students in a passive (rather than an active) role, encouraging one-way communication, requiring significant out-of-class time for students to engage with the material, and requiring the speaker to possess effective speaking skills (Sage-Answers, 2019).

This result may imply that most of the students did not master the content and context of the lessons delivered to them in Mathematics. This is because cooperative learning was not used in this group of students. These learners had a hard time achieving excellence as one of the many advantages of cooperative learning. Cooperative learning helps you achieve excellence because you acknowledge your improvement areas. Trying your best to be the best is what cooperative learning does for you (Harappa, 2021). The implication of cooperative learning suggests that cooperative learning can help young learners strive to

achieve their best and reach their full potential. This implication can have several positive effects on young learners. Cooperative learning encourages students to work together and support each other in their learning, which can foster a sense of community and promote positive social interactions among young learners, and can help young learners develop a growth mindset, which is the belief that intelligence and abilities can be developed through effort and hard work.

Table 3

Distribution of Respondents in terms of their Attitude Towards Mathematics of the Control Group

Indicator	Mean	SD	Description
This subject is of great value to me.	3.21	0.88	Agree
I love studying Mathematics subject.	1.78	0.52	Disagree
Mathematics has an irresistible attraction to me.	1.61	0.90	Disagree
I really enjoy learning Mathematics	1.55	0.60	Disagree
This subject develop my reasoning ability.	2.65	0.94	Agree
I love Mathematics because it is very practical.	3.02	0.91	Agree
This subject teaches me to become accurate.	3.37	0.73	Strongly Agree
This subject relates to my real-life situation.	2.13	1.09	Disagree
This subject is very realistic.	2.15	1.09	Disagree
This subject needs time to learn.	2.97	1.40	Agree
Overall	2.44	0.91	Disagree

Legend:

3.26-4.00-Strongly Agree/Very Positive

2.51-3.25 -Agree/Positive

1.76-2.50 -Disagree/ Negative

1.00-1.75 -Strongly Disagree/Very Negative

Table 3 presents the attitude that the learners have shown towards Mathematics among the Grade 2 learners in the **control group**. The overall result obtained a mean of **2.44 (SD=0.91)** described as **Disagree/Negative**. This result indicates that the Grade 2 learners had a negative attitude towards learning Mathematics.

The above result indicates that negative attitudes towards mathematics can have significant implications for young learners' academic success, career aspirations, and overall well-being. Research has shown that negative attitudes towards mathematics can lead to reduced motivation, decreased confidence, and lower academic achievement in mathematics.

Low motivation and confidence in mathematics can lead to a cycle of avoidance and disengagement, where students actively avoid mathematics-related activities and opportunities, leading to further negative experiences and attitudes (Hannula-Sormunen, Ketonen, & Pehkonen, 2020). This can be particularly detrimental for students who may need to develop mathematical skills for their future careers.

Moreover, negative attitudes towards mathematics can also impact young learners' mental health and overall well-being. Research has shown that negative attitudes towards mathematics can be associated with increased anxiety and stress, which can further exacerbate performance issues (Szűcs, 2019).

In order to address negative attitudes towards mathematics, educators and parents need to create a positive learning environment that emphasizes the importance and relevance of mathematics in everyday life. Strategies such as using real-world examples, providing opportunities for collaborative learning, and emphasizing the process of problem-solving rather than just the final answer can all help to promote a positive attitude towards mathematics among young learners (Hannula-Sormunen, Ketonen, & Pehkonen, 2020).

Therefore, negative attitudes towards mathematics can have significant implications for young learners' academic success, career aspirations, and overall well-being. Therefore, it is essential for educators and parents to create a positive learning environment that promotes a love for mathematics and helps young learners build confidence in their mathematical abilities.

Table 4

Distribution of Respondents in terms of their Attitude Towards Mathematics of the Experimental Group

Indicator	Mean	SD	Description
This subject is of great value to me.	4.00	0.00	Strongly Agree
I love studying Mathematics subject.	3.97	0.17	Strongly Agree
Mathematics has an irresistible attraction to me.	3.88	0.33	Strongly Agree

I really enjoy learning Mathematics	4.00	0.00	Strongly Agree
This subject develop my reasoning ability.	3.97	0.17	Strongly Agree
I love Mathematics because it is very practical.	3.82	0.46	Strongly Agree /Very Positive
This subject teaches me to become accurate.	3.82	0.58	Strongly Agree
This subject relates to my real-life situation.	3.85	0.57	Strongly Agree
This subject is very realistic.	3.91	0.29	Strongly Agree
This subject needs time to learn.	3.42	1.09	Strongly Agree
Overall	3.86	0.37	Strongly Agree

Legend: 3.26-4.00- Strongly Agree /Very Positive
 2.51-3.25 -Agree/Positive
 1.76-2.50 -Disagree/ Negative
 1.00-1.75 -Strongly Disagree/Very Negative

Table 4 of this paper shows the distribution of respondents in terms of their attitude towards Mathematics among the **experimental group**. The overall mean obtained is **3.86 (SD=0.37)** which is described and interpreted as **Strongly Agree /Very Positive**. This result is higher than the control group, which obtained a mean of **3.55 (SD=0.91)**. This result indicates that the learners even developed a more positive attitude towards learning Mathematics after cooperative learning was used in conducting their Mathematics classes. Grade 2 learners have already developed a positive outlook towards learning Mathematics at a young age.

The indicators, **This subject is in of great value** and **I really enjoy this subject** obtained the highest mean of **4.00 (SD=0.00)** which is described and interpreted as **Strongly Agree /Very Positive**. Obtaining the highest mean possible which stated that the learners found Mathematics is in of great value indicates that young learners have a very positive attitude towards Mathematics and recognize its importance in their lives. This attitude can have several positive implications for their academic success and future career opportunities.

Firstly, a positive attitude towards Mathematics can contribute to greater engagement and motivation to learn the subject. Research has shown that students who have a positive attitude towards Mathematics are more likely to persist in their studies, take advanced Mathematics courses, and achieve higher academic performance (Schukajlow et al., 2020).

Secondly, Mathematics is an essential subject for many careers in science, technology, engineering, and mathematics (STEM) fields. A positive attitude towards Mathematics can lead young learners to pursue further studies in these fields and increase their career opportunities in the future.

Moreover, a positive attitude towards Mathematics can also contribute to the development of problem-solving skills and critical thinking abilities. These skills are essential for success in many areas of life, including academic and career pursuits.

Therefore, having young learners who finds Mathematics with great value can have positive implications for young learners' academic success and future career opportunities. Teachers can support this attitude by providing engaging and challenging Mathematics tasks, emphasizing the practical applications of Mathematics in everyday life and careers, and promoting the development of problem-solving and critical thinking skills.

I really enjoy this subject also obtained the highest mean of **4.00 (SD=0.00)** which is described and interpreted as **Strongly Agree /Very Positive**. This result indicates that young learners like it more when completing the tasks with their classmates because it enables them to communicate and not get bored in their learning experience. This is supported by Foster (2020) as she claims that when done well, cooperative learning involves planning with clear directions, student work roles, and outcomes and measures for learning goals. Teachers who use this method see the value in cooperation, teamwork, and collaboration as a major part of their classrooms. Students who learn how to collaborate through cooperative learning can become adults who work together more effectively in the work place.

This result indicates that young learners really enjoy a learning experience when they are tasked in groups and when they seem just playing while learning. This implies that these learners have already known how it is to work and learn in a group, as well as how fun it is to learn in school while having games. Hence, the learners have exercised their interpersonal skills and collaborative abilities while learning Mathematics. This is supported by Nguyen (2021) as he states that using games in teaching can help increase student participation, foster social and emotional learning, and motivate students to take risks.

Therefore, cooperative learning is effective as to developing positive attitude among learners towards learning Mathematics. This implies that the execution of cooperative learning was very well executed, hence the desired outcome was achieved. The desired outcome of the use of cooperative learning was to develop a positive attitude among the Grade 2 learners while learning Mathematics. Learners enjoy cooperating with others while performing fun learning in Mathematics. Team Games Tournament, for instance as one of the activities in cooperative learning, the learners developed an attitude of cooperation and having fun on the journey. This also means that the learners realized the value of humility and clean game as they did not think of winning but the fun of learning. Team Games Tournament, if incorporated intelligently, has the potential to reap great rewards for your students and enable them to emerge into a powerhouse of knowledge (MyPrivateTutor, 2022).

On the other hand, **"This subject takes time"** obtained the lowest of **3.42 (SD=1.09)** which is described as **Strongly Agree /Very Positive**. Though it is the lowest mean among other indicators, it is also a very positive level of effectiveness of

cooperative learning towards Mathematics, hence a good result. This result indicates that young learners were able to feel dominated with the other positive effects of cooperative learning on their attitude towards Mathematics.

Through cooperative learning, young learners realized that learning mathematics takes time, especially that learning it requires collaboration with others, though dominated with fun as having fun obtained the highest mean. Realizing that mathematics takes time implies that cooperative learning can help them develop a growth mindset towards the subject, which can lead to greater engagement, motivation, and achievement.

One implication is that young learners may be more likely to engage in deliberate practice. Deliberate practice involves consistent, focused, and intentional effort to improve specific skills or knowledge. The realization that Mathematics takes time can help young learners understand the importance of deliberate practice and motivate them to put in the effort required to improve their skills.

Moreover, the realization that Mathematics takes time can help young learners develop patience and persistence, which are essential qualities for success in any field. Mathematics can be challenging and complex, and it often takes time to fully understand concepts and solve problems. Young learners who realize that Mathematics takes time are more likely to persevere through difficult tasks and overcome obstacles.

Finally, the realization that Mathematics takes time can help young learners develop a more positive attitude towards the subject. When young learners understand that Mathematics requires effort and persistence, they may feel more accomplished and proud of their achievements. This positive attitude can further motivate them to continue their studies and achieve success in Mathematics through cooperative learning.

Problem 2: Is there a significant difference in the performance of Grade 2 learners in the pretest and posttest between the control group and the experimental group?

Table 5
Test Statistics on the Comparison of Grade 2 Learners Academic Performance in Pretest and Posttest in Mathematics

Group N	Academic Performance in Mathematics		SD	df	T-test Value	Interpretation
	Pretest	Posttest				
Control	75.884	79.291	2.79	85	12.11	Not Significant
Experimental	75.581	82.907	3.30	87	22.74	Significant

Table 5 in this paper shows the summary of the significant difference in the academic performance of Grade 2 learners in the pretest and posttest between the control group and the experimental group. This result rejects the null hypothesis of this study that states, "There is no significant difference in the performance of Grade 2 learners in the pretest and posttest between the control group and the experimental group." This study rejects the stated null hypothesis because as shown in Table 5, there is a significant difference in the performance of Grade 2 learners in the pretest and posttest between the control group and the experimental. This implies that the use of cooperative learning makes a major effect in the academic achievement of the learners. The said strategy helps the learners grasp the lessons better than learning through lecture-type of teaching.

Table 5 shows a clear remark of "**Significant**" in the **Experimental Group**, while "**Not Significant**" remark in the **Control Group**. This result indicates that integrating cooperative learning in teaching Mathematics among the Grade 2 learners has a high effect and significance to achieving a better academic achievement. Especially integrating Team Games Tournament, Numbered Heads Together, and Jigsaw are found to be bringing great and high effects to the academic performance and positive attitude of the Grade 2 learners. A research concluded from results that cooperative learning activities had a positive effect on academic achievement of students (Gull & Shehzad, 2016). This means that When students work together in groups, they are able to share their knowledge, skills, and ideas, which can lead to a deeper understanding of the subject matter. By engaging in discussions, problem-solving, and other collaborative activities, students are able to develop critical thinking and communication skills that are essential for success in any field. Additionally, cooperative learning can help students develop social and emotional skills, such as empathy, teamwork, and leadership, which are important for success in school and beyond.

This result on the significant effectiveness of cooperative learning in Mathematics has several implications for the academic success of young learners. These young learners will be able to attain an improved problem-solving skills. By working collaboratively, young learners can learn from each other's strategies and approaches to problem-solving. This can lead to a deeper understanding of mathematical concepts and the development of more effective problem-solving skills.

In addition, young learners will also have an increased motivation and engagement. Cooperative learning can help to create a positive learning environment where young learners feel supported and encouraged to take risks and try new things. This can increase their motivation and engagement in Mathematics and lead to greater academic success.

Moreover, development of social and emotional skills is another implication of the effectiveness of cooperative learning on the academic performance of young learners. Cooperative learning requires young learners to work together, communicate effectively, and take on different roles within their groups. This can help them develop social and emotional skills such as empathy, teamwork, and leadership, which are important for academic success and for their future lives. More often than not, young learners also reduce achievement gaps. Cooperative learning can help to reduce achievement gaps between high- and low-performing students. By working collaboratively, students are able to support and learn from each other regardless of their initial level of knowledge or skills.

Overall, the implications of cooperative learning in Mathematics on the academic performance of young learners are positive. By promoting critical thinking, communication, social and emotional skills, and motivation to learn, cooperative learning can help young learners to achieve academic success and develop skills that are important for their future lives.

Problem 3: What are the implications of the findings of the study in teaching Mathematics to Grade 2 learners?

The findings of this study imply that learners develop critical thinking and other that comes along with the cognitive domain when learning cooperatively with others. Cooperatively taught students tend to exhibit higher academic achievement, greater persistence through graduation, better high-level reasoning and critical thinking skills, deeper understanding of learned materials, greater time on task and less disruptive behavior in class, lower levels of anxiety and stress, greater intrinsic motivation to learn and achieve, greater ability to view situations from others' perspectives, more positive and supportive relationships with peers, more positive attitudes toward subject areas, and higher self-esteem. Students should be encouraged to take active part in cooperative learning so as to promote better high-level reasoning and critical thinking skills (Nwabueze & Igbinedion, 2018).

Moreover, cooperative learning helps the teachers design activities in the classroom wherein the learners develop very positive attitude towards learning Mathematics. This enables the learners to prepare themselves on self-directed instructions. This is very important especially nowadays that module distribution in place of in-person classes is advised in case of the absence of the teacher or when there are disruptions of classes. Teacher training programmes should equip teachers so that they can support learners to be lifelong, self-directed learners. Self-directed learning can be described as a process in which students gradually accept more responsibility for their own learning by taking initiative, with or without the assistance of others, in identifying their own learning needs; formulating their own learning goals and outcomes; identifying own resources for learning; choosing and implementing learning strategies suitable for their own learning; and assessing their achievements of set learning outcomes (Mentz & van Zyl, 2016).

Furthermore, experience of group works in cooperative learning revealed learning gains and eradicated reluctance to work in groups. When considering motivation and deep approach to learning and their sub-dimensions, reflective approach to learning was found to be the main factor determining the perceived learning gains. These results suggest two avenues for teaching based on cooperative learning: discuss and clarify with students the mechanisms of cooperative learning, and structure the teaching to engage them in discussions to collectively self-regulate their activities (Bächtold et al., 2022).

The above-mentioned implications are supported by the first-hand observations of the researcher while implementing cooperative learning. The researcher had observed that learners are motivated to learn, class discussions are fun and engaging, most of the learners are participative, learners are happy if they have group activity, and learners are enjoying specially if we have game activities.

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