Parallel Achievement Division as Collaborative Learning Approach for Improved Mathematical Thinking Skills and Engagement of College Students

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Abstract-*An increase in the passing percentage in the Licensure Examination for Teachers (LET) is the main concern of every institution. Mathematics as a general education component in the LET and as perceived by the students as a challenging subject, mathematics educators should create a learning environment that is conducive to increasing the engagement and the mathematical thinking skills of the students. To support, this study introduced the Parallel Achievement Division which assessed its effect in improving the Mathematical Thinking skills and engagement of the students. The use of one group pre-test and post-test experimental research design led in achieving the objectives of the study participated by 40 College of Teacher Education first-year students, non-Mathematics major of the academic year 2018-2019. The result showed a significant difference between the pre-test and post-test scores performance of the student-respondents which imply that the use of the Parallel Achievement Division helped students improve their mathematical thinking skills. This indicates that from poor to low level in remembering, illustrating, analyzing, solving, and applying mathematical concepts they were able to reach a very satisfactory to an outstanding level of performance. Also, the use of the initiated collaborative learning approach encourages students to become more engaged in doing mathematical tasks for they receive points and rewards for every achievement in the group competition. The study suggests that the use of a collaborative learning approach particularly the Parallel Achievement Division in Mathematics classes posts a positive significant increase in student's thinking skills which promotes high engagement in learning.*

Keywords *–Collaborative, Engagement, Mathematical Skills, Parallel Achievement Division*

INTRODUCTION

Preparing the students in the College of Teacher Education in taking board examinations should start on instruction during their academic stay at the university. One of the major concerns of every institution is to ensure that they prepare students who possess the qualities and skills needed, adhering to the standards at the national level. There are plans and initiatives implemented in observance to achieve a high passing percentage to manifest a good quality program being offered. Classroom teachers are responsible for supervising or facilitating learning experiences to support the academic goals of the university [1]. This perspective serves as an initial input to create an innovative learning experience for the students in Mathematics since this is a challenging subject for students to take in the Licensure Examination.

Many educators support that collaborative learning is one of the approaches that would help increase the mathematical achievement of the students. There are claims that the Mathematical thinking skills of the students were enhanced after being exposed to the Collaborative Learning approach [2]-[4]. The involvement of the students in collaborative learning provides an avenue to become cognitively, socially, and emotionally smart. Collaborative Learning (CL) [5] is described as an approach in education toward teaching and learning process that involves groups of students collaboratively work together in solving a problem which will lead to the completion of the task provided and constructed output. Exposure to a designed CL, it is observed that the students are socially and emotionally challenged which are based on the shared perspective they have during group activities. Hence, it is necessary to become articulate in defending and sharing their ideas to arrive at a

consensus. With this, students construct their knowledge frame and not limited to what their teachers have provided only for them to learn. In a CL structure, the students have their chance to deliver and share what they know to their peers, have an exchange knowledge, present and defend ideas based on their collaborative constructs.

Handling academic activity at all levels in the educational field and satisfying the needs of analytic and holistic developments of the 21st-century inventors, creators, and the innovative worker is the main concern of the increasing challenges in education [6]. Today, the speedy change and knowledge availability shows the relevance of the curriculum and instruction not just manifested in memorizing information delivered by classroom facilitators. In making the student more engaged in the classroom, it is beneficial for teachers to innovate their teaching practices. Constructing and introducing a collaborative learning set-up would encourage the full participation of the students and can develop different skills of the students in the class. Besides, CL also encourages other positive behavior in doing classroom tasks [7]-[9]. However, there are cases that students become highly dependent on the fast learner of the group that led them to low mastery of the competencies set in the discipline [10] [11]. Thus, this study hopes to fill that gap by innovating a collaborative learning approach called Parallel Achievement Division and aims to determine its effectiveness in improving the Mathematical skills of the students in remembering, illustrating, analyzing, solving, and applying concepts. This also would like to assess the level of engagement of the students in the subject.

Collaborative Learning is a structure that determines presently tough ground [12], implemented in regular schooling and virtual set-up. There are three merging theories where CL is anchored: socio-cognitive conflict theory, inter subjectivity theory, and distributed cognition theory. Also, the model of strategies developed and constructed that facilitates socio-cognitive collaboration is also considered. This model mixes and strategizes learning groups as techniques and methods within CL areas.

Socio-Constructivism acknowledges the relevance of learning whereas it indicates students' development as a result of members' contact, group-based activity, buddy-based, or small group encounter [13] which emphasized the significance of socio-cognitive conflicts. Interaction among members of the group serves as an avenue to an intellectual discussion which could lead to encouraging and resolving conflicts. In this way, students could reach the optimum development of their social behavior within the members of the group.

An approach to inter subjectivity [14] highlights the mentalization as a learning concept which is defined as the ability to comprehend conscious and unconscious cognition personally and with others. Mental states presented are habitually planned like learning goals, emotions, needs, and beliefs that could be recognized for them to describe and forecast their behavior. It is relevant to consider that the concept of mentalization should not only be pointed as the ability to think referred to states of cognition but it also denotes the ability to work with a notch of accuracy.

Distributed Cognition [15] is the educational perspective showing how the prior knowledge of an individual relates to the external physical, cultural, and social contexts in a learning environment they belong to. The human cognition of an individual necessitates various external context to which they react in different ways exposed to different situations.

The structure of CL can be viewed through grouping and pairing of students with established attaining the common educational goal which has been a part of research trends written in the various professional literature. It is defined [16] as an instructional method where students considering different levels of performance work together by pairs or in groups attaining a shared goal. An individual is accountable for their own learning and in one another's educational development. Thus, to become successful, they need to work collaboratively ensuring every person's success.

There are four main elements of Collaborative Learning [17] which noted simultaneous interaction, positive interdependence, individual accountability, and equal participation. Collaborative Learning delivers active involvement of the students who do the talking within the group in contrast to the conventional way where there is only one person who talks, it is only the teacher who discusses the topic. In CL, teachers may facilitate student's roles where each one is designated to warrant the success of the learning process. Discovery and exploratory skills are established where everyone is responsible for achieving a general objective.

Collaborative Learning is a multifaceted situation [18] where researches are being conducted showcasing different mental or cognitive thinking

levels and from different theoretical and methodological viewpoints. Instructors and students need to understand the different group elements like their dynamics processes, and learning situations to effectively impose CL. Teaching and learning sequential delivery should be carefully analyzed on how group interaction could be fully demonstrated to accomplish an understanding of the context in the fulfillment of the learning competencies. As an observation, individual learning necessitates independence in cognitive processes whereas group-based learning highlights the understanding of the collaborative learning concepts. Lastly, the use of CL and different techniques or approaches within can promote good retention of knowledge, the academic achievement of the students, and even their attitude towards the subject they are taking.

Teamwork engagement has a positive significant relationship to personal success learning of the student [19]. Likewise, the engagement of the students and their groupmates has a positive significant relationship to success-work satisfaction. As discussed further, the teamwork engagement of the students helps them to attain their personal success. Learning in a collaborative set-up highlights the cognitive gain of an individual like the manipulation of different media, gaining new knowledge, and being more acquainted with learning methods exposed in group-based situations where everyone is accountable for their learning.

Results in the study [20] emphasized that students perform better when exposed to collaborative set-up, only if the important factors for the success of CL are highly evident such as positive interdependence, individual accountability, team, and social skills, and group processing. This means that the correct way of implantation of CLemploying the right procedures may lead teachers to effectively execute at an inexpensive method of teaching that may ensure the success of teaching and learning processes.

OBJECTIVES OF THE STUDY

This study assessed the effect of an introduced collaborative learning approach called Parallel Achievement Division to the Mathematical Skills and engagement of the students. Specifically, this aimed to: determine the pretest and posttest score performance of the student-respondents on Mathematical thinking skills assessment in terms of: remembering; analyzing; illustrating; solving; and applying; determine the level of engagement of the student-respondents in doing Mathematical tasks; find out if there is a significant difference between the pretest and posttest scores of the student-respondents on Mathematical thinking skills assessment; and find out if there is a significant relationship between students' engagement in the class and their Mathematical thinking skills level.

MATERIALS AND METHODS

Research Design

In creating a collaborative learning experience, this study introduced the Parallel Achievement Division which assessed its effect in improving the Mathematical skills and engagement of the students. The use of one group pretest and posttest experimental and descriptive research design-led in achieving the objectives of the study.

Participants

This study was participated by 40 College of Teacher Education first-year students. They were non-mathematics major, during the second semester of the academic year 2018-2019.The respondents were chosen through convenient sampling. These students were directly handled by the researcher as their Mathematics teacher.

Instrumentation

There were two sets of instruments utilized in the study. The first sets were the pretest and posttest which were described containing a 40-item examination, composed of a multiple-choice type of questions with the following divisions 25% for remembering, 17.50% for illustrating and analyzing, and 20% for solving and applying. Both pretest and posttest materials were subjected to face validation of Mathematics experts in the university. Three professors were asked to check the validity, accuracy, and appropriateness of the tests given to the respondents. The second set is a 15-item survey questionnaire prepared to assess the academic engagement of the students. This measured how they actively involve themselves during Mathematical tasks to be given and how they enjoy working with their group mates in the accomplishment of the activities. The survey instrument used by the researcher was first administered to another group of students who were not subjected to the study. The data were analyzed through Cronbach's alpha testing its reliability and internal consistency which resulted in a value of 0.826 showing that the indicators tested in the

survey instrument posted a high level of internal consistency. After this, the survey instrument was refined before it was administered to the students.

Data Collection Procedure

Tests and Survey Administration. Before the conduct of the study, the researchers administered a pretest to determine the level of Mathematical thinking skills on remembering, analyzing, illustrating, solving, and applying. The scores obtained serve as a baseline. After the assessment, their Mathematics teacher used the teaching routine on Parallel achievement division to Mathematics concepts introduced. After one-month of instruction which covered the topics on functions and relations, the teacher administered the posttest which determines the ending level of Mathematical thinking skills. After a week, the students answered the survey instrument given by the researcher measuring their level of engagement of the student-respondents in doing Mathematical tasks.

Instruction. The parallel achievement division was done by introducing the concepts then set the students in collaborative experience with a structured system of achieving points in group competition. The researchers innovated a CL approach that was implemented in Mathematics class. 5-minute classroom management was done by the teacher which includes attendance, and other preliminary activities. The lecture of the teachers was shared with the active participation of the learners. After a 15 minute-lesson presentation, an activity was given to the students where they have applied what they have learned in the discussion given by the teacher. The 5-minute activity was intended for a group collaboration approach where members of the group need to accomplish the task which guarantees individual accountability to understand the concepts and its application, analyze the details of the problem and its solution. Students were set in a parallel competition where each group competed with another group in parallel formation. Each member competes with another member of another group. Students' task is to write their answers in a card and show it after the allotted time for each question. If the two competing students from two groups got the answer correctly, no point is to be given however if one of the two is correct and the other is wrong, then a point is to be credited to the parallel group. This activity is to be done within 15 minutes. After the group competition, the points are to be summarized and to be added to the achievement of the group. After a week, the group with the highest points was given a reward. After the parallel competition, group coaching was done, each parallel group needs to ensure that each student mastered the competency set in the session. This group coaching was done within 5 minutes only. The individual assessment was given to students to confirm if students are already independent learners and a 10-minute generalization and closing activities followed.

Ethical Considerations

Prior to the conduct of the study, the researchers sought permission from the Research Office and College Dean to implement the study during instruction. They also asked consent from the students to participate in the study specifically the test administration. Moreover, the researchers guaranteed the safety of each participant by securing the venue conducive for collaborative learning set-up.Furthermore, information dissemination on the results of the study was done by the researchers tothe students and teachers of the university.

Data Analyses

The researcher utilized different statistical measures to ensure that the objectives of the study were answered quantitatively. In response to the first objective in determining the pretest and posttest score performance of the student-respondents on Mathematical thinking skills assessment, frequency, and percentage were used. In presenting the level of engagement of the student-respondents in doing Mathematical tasks as to the second objective, mean and standard deviation were utilized. Moreover, the paired t-test was calculated by the researchers to find out if there is a significant difference between the pretest and posttest scores of the student-respondents on Mathematical thinking skills assessment. Lastly, Pearson's product-moment correlation is intended to show if there is a significant relationship between students' engagement in the class and their Mathematical thinking skills level.

RESULTS AND DISCUSSION

The tables below show the levels of mathematical thinking skills of the students in their pre-test and post-test. Table 1 presents the pre-test and post-test Scores of student-respondents using the Parallel Achievement Division in mathematical thinking skills in terms of remembering.

Table 1. Pre-test and Post-test Scores of Student-Respondents using Parallel Achievement Division in Mathematical Thinking Skills in terms of Remembering

Rating	Pre-test		Post-test		Interpretation
	f	%	f	%	
90 and above	2	5.00	25	62.50	Outstanding
85-89	1	2.50	9	22.50	Very Satisfactory
80-84	3	7.50	4	10.00	Satisfactory
75-79	4	10.00	1	2.50	Low
74 and below	30	75.00	1	2.50	Poor
Total	40	100.00	40	100.00	

During the conduct of the pre-test, most of the students have poor to a low level of Mathematical thinking skills in terms of remembering, most of the students did not remember the terminologies in functions and relations which imply that they do not recognize and process the working definitions of it. Although some of the students have prior knowledge since basic concepts on functions and relations were already tackled when they were in their junior high school.

After the teacher exposed the students in Parallel Achievement Division, most students reached a very satisfactory to an outstanding level of Mathematical thinking. With this, most of the students recall the working definitions of the terminologies presented by the teacher. The role of group discussion before setting them to compete in parallel competition helps them to be familiarized with the learning contents.

The success of the students in remembering concepts relies on the cognitive load of working definitions available to implement mathematical thinking. It is proven that if the students have loaded in their minds the correct mathematical definitions of the concepts, it is easy for them to understand situations or problems that could lead them to an accurate manner of giving solutions [21]. The students must capture the shreds of evidence of their stored knowledge on the topic as manifested by the remembered mathematical definitions.

It is noted that before the students were exposed in Parallel Achievement Division as revealed by table 2 which presents the pre-test and post-test Scores of student-respondents using Parallel Achievement Division in mathematical thinking skills in terms of analyzing, the pre-test results of the students posted that most of them reached a poor to a low level in analyzing Mathematical concepts.

Table 2. Pre-test and Post-test Scores of Student-Respondents using Parallel Achievement Division in Mathematical Thinking Skills in terms of Analyzing

Rating	Pre-test		Post-test		Interpretation
	f	%	f	%	
90 and above	5	12.50	23	57.50	Outstanding
85-89	2	5.00	10	25.00	Very Satisfactory
80-84	0	0.00	0	0.00	Satisfactory
75-79	8	20.00	3	7.50	Low
74 and below	25	62.50	4	10.00	Poor
Total	40	100.00	40	100.00	

Most of the students failed to examine strategically the questions for they did not focus on the details on how function and relations were determined. Further, students did not check if the rules are elicited. However, the use of the collaborative approach helped students obtained a very satisfactory to outstanding performance in mathematical thinking when they were assessed through the post-test. This only shows that students at this level have clearly and properly scrutinized the evidence in determining whether a given Mathematical statement shows a relation or a function through the use of input and output analysis. Moreover, these students had strategically observed and processed every single detail of the problem so that errors could have been avoided.

Based on the observation of the teacher, Parallel competitions encourage them to think deeply and carefully in analyzing Mathematical questions. Most of the students exhibited a remarkable attitude by helping each member of the group to fully examine the concepts. Students were vocal during the activity that the failure of one means the failure of the group. They were motivated to analyze the problems carefully so that the group would earn the point. [22] Competition becomes a contributing factor to motivate the students to participate actively and engage themselves in the activity.

However, some students had difficulty in analyzing and solving the problems consistently. They committed mistakes in their solutions for they failed to understand completely the context they were reading. Apparently, they struggled in depicting the full details of the problem and in translating correctly the worded facts to numerical representations. [23] This kind of student should be subjected to proper

guidance and remedial session for them to improve their analysis of the problem. Exposure to remedial lessons and innovative practices initiated by the teachers are gravely important in aiding the students to properly analyze the problem and eventually yield an accurate answer.

Table 3. Pre-test and Post-test Scores of Student-Respondents using Parallel Achievement Division in Mathematical Thinking Skills in terms of Illustrating

Rating	Pre-test		Post-test		Interpretation
	f	%	f	%	
90 and above	0	0.00	25	62.50	Outstanding
85-89	2	5.00	8	20.00	Very Satisfactory
80-84	0	0.00	0	0.00	Satisfactory
75-79	6	15.00	4	10.00	Low
74 and below	32	80.00	3	7.50	Poor
Total	40	100.00	40	100.00	

Table 3 on the pre-test and post-test Scores of student-respondents using the Parallel Achievement Division in mathematical thinking skills in terms of illustrating indicates that students before being exposed to the Parallel Achievement Division posted poor to low Mathematical thinking in functions and relations which is based on the pre-test results. This connotes that students forgot the concepts and rules that a function should only take one and a unique sample of the input. They did not illustrate appropriately the figures of one-to-one, one to many, many to one and many to many relationships.

After being exposed to the collaborative approach, the students showed improvement in their performance as they reached a very satisfactory to an outstanding level in Mathematical thinking skills assessment in the post-test. Students have displayed the proper presentation of the figures. Moreover, they have successfully shown whether the illustration is a function or not. This implies that the rule is clearly established which leads the students to illustrate accurately the task given to them.

Making proper representation like illustration helps to better understand problems in Mathematics before the execution of the planned solution. This concept is shared in a study Ramanujam et al. [24] that proper illustration of concepts leads to clarification and reasoning of essential concepts needed in the problem. A good illustration of concepts at first creates an avenue to understand, organize, and imagine well the details of the problem that need to be emphasized. This creates an opportunity to convince the Mathematical audience on the well-organized reasoning of the problem.

It is clearly shown in table 4, presented the pre-test and post-test Scores of student-respondents using the Parallel Achievement Division in mathematical thinking skills in terms of solving, that students performed poorly to a low level of Mathematical thinking skills in terms of solving during their pre-test. Students failed to evaluate and show the proper solution of evaluating function notation and substituting values to define a function.

Table 4. Pre-test and Post-test Scores of Student-Respondents using Parallel Achievement Division in Mathematical Thinking Skills in terms of Solving

Rating	Pre-test		Post-test		Interpretation
	f	%	f	%	
90 and above	2	5.00	15	37.50	Outstanding
85-89	3	7.50	11	27.50	Very Satisfactory
80-84	5	12.50	7	17.50	Satisfactory
75-79	14	35.00	2	5.00	Low
74 and below	16	40.00	5	12.50	Poor
Total	40	100.00	40	100.00	

This suggests that they did not master well the competency or forget the steps to consider in doing so. The use of the Parallel Achievement Division helped the students to become competitive in solving function notation and its substitution quantities for they obtained ratings that are interpreted as very satisfactory to an outstanding level in their post-test. This asserts that they performed well in showcasing the proper solutions and followed the correct procedure in evaluating function notations and proper substitution of values to satisfy the functions.

The attainment of the students on giving appropriate solution is a manifestation that they executed well the problem-solving process formulated by Polya shared in one study [25]. The process works on understanding the main concern, viewed how details are interconnected leading to plans in solving, carrying out the plan and checking the solutions if it obtained a correct response. One of the factors that led them to work well in solving Mathematical problems is due to the effective understanding of Mathematical terminologies or concepts. Mathematical vocabulary is strong enough to be processed even better with the details and questions being asked. It supported by the idea of Vula et al. [26] that Mathematical vocabulary stimulates understanding of the lesson, tasks, and word problems. It also pointed out that the lack of

understanding of Mathematical vocabulary influences the ability in solving problems.

Table 5 depicts the pre-test and post-test Scores of student-respondents using the Parallel Achievement Division in mathematical thinking skills in terms of applying whereas the pre-test scores show that most of the students with regards to applying as Mathematical thinking skills obtained ratings showing poor performance.

Table 5. Pre-test and Post-test Scores of Student-Respondents using Parallel Achievement Division in Mathematical Thinking Skills in terms of Applying

Rating	Pre-test		Post-test		Interpretation
	f	%	f	%	
90 and above	1	2.50	21	52.50	Outstanding
85-89	0	0.00	9	22.50	Very Satisfactory
80-84	3	7.50	5	12.50	Satisfactory
75-79	0	0.00	1	2.50	Low
74 and below	36	90.00	4	10.00	Poor
Total	40	100.00	40	100.00	

This only reveals that students fail to see the relevance of the Mathematical concepts presented by functions and relations into real-life situations. They did not process well the given in the problem which resulted in their inability to solve for what is being asked. However, based on their obtained scores in the post-test, it can be gleaned from the table that the respondents were able to score a very satisfactory to an outstanding level which indicates that they manipulated the given details in the word problems well that led them to obtain the correct response. This means that they were able to manifest applying competency to a great extent.

Applying concepts in Mathematics specifies the interconnectedness of the discipline to real-life problems. The skill of the students manifested in the study shows the intellectual process that requires daily life utilization of the concepts needed to be learned. This is inconsonant to the findings of [27] that if teachers exposed students to be equipped with literacy in mathematics with the inclusion of several media such as technological and other thinking skills mandated to practice in daily life and effective use of Mathematical concepts then the maximum development of such skill could be achieved.

Evidently, group collaboration and group coaching imposed for 5 minutes have greatly impacted the students to improve their mathematical thinking skills. Students had the chance to exchange ideas and clarify several concepts and processes to their groupmates. Misconceptions and flaws in the solutions were immediately clarified and addressed through group discussion. Besides, parallel competition has influenced them to have individual accountability for their learning and for the success of the group. Teachers should note that in doing a group activity, they must ensure that each student contributes to the construction of learning. Thus, group activity that produces too much reliance on the smartest member of the group to accomplish an output must be evaded. This affirms the study of [20] that for collaborative learning to be effective, factors such as positive interdependence, individual accountability, team and social skills, and group processingmust be present. Furthermore, [28] working collaboratively is more advantageous than individual learning.

Table 6. Level of Engagement of the Student-Respondents in doing Mathematical Tasks using Parallel Achievement Division

Statement	Mean	SD	VI
In Parallel Achievement Division, I…			
1. actively involved myself in classroom discussions.	3.30	.72	SA
2. had fun in the class receiving points and rewards.	3.53	.60	SA
3. contributed meaningfully to class discussions.	3.13	.82	A
4. pay attention to class discussions.	3.53	.51	SA
5. pay attention to tasks instructions.	3.08	.92	A
6. enjoy working collaboratively in classroom tasks.	3.55	.50	SA
7. participated well in group tasks.	3.08	.92	A
8. would like to engage myself again in more tasks using this strategy.	3.43	.55	SA
9. feel confident in engaging myself learning lessons in Mathematics.	3.20	.61	A
10. tried hard enough learning new lessons to ensure success.	3.40	.59	SA
11. challenged by the lessons in learning new things.	3.28	.75	SA
12. engage myself in working with tasks for I may receive good grade.	3.15	.70	A
13. establish learned concepts in Mathematics to apply in reality.	2.95	.68	A
14. helps me understand difficult concepts by engaging myself.	3.15	.62	A
15. arouses my curiosity, even if it is difficult to learn.	3.28	.64	SA
Overall	3.27	.35	SA

Scale: 3.26-4.00- Strongly Agree/ Highly Engaged, 2.51-3.25- Agree/ Engaged, 1.76-2.50- Moderately Agree/ Slightly Engaged, 1.00-1.75- Disagree/ Not Engaged

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As shown in table 6, the level of engagement of the student-respondents in doing Mathematical tasks using Parallel Achievement Division, most of the respondents strongly agreed that they are well engaged in learning Mathematics when exposed to Parallel Achievement Division as a CL approach with its over-all mean of 3.27 and standard deviation of 0.35. The innovative learning process conditions students to become highly engaged in Mathematics whereas they enjoy working collaboratively in classroom tasks ($\bar{X}$=3.55) given during group collaboration.This is supported by the claim [7] that exposing students to group work will give a good effect on the engagement of the students in learning mathematical concepts. Every member becomes confident to understand concepts and master competencies when they exercise, depict, explore, and solve problems with their groupmates. Learning could be widened socially, cognitively and emotionally by allowing the students to work with others.

As a result they paid attention ($\bar{X}$=3.53) to someone who discussed the solutions or the working process in the group so that when they compete with their opponent in the parallel competition they would be successful to receive points and their accumulated success will earn a reward after one week of class sessions ($\bar{X}$=3.53). Students who showed true focus or full attention in learning Mathematical concepts lead to the success of retaining the lessons well. This is what highlighted in the claim shared [29] that when a student does not possess the ability to pay attention in learning things, it would be tough for them to hold emotional concepts that would hinder in attaining success in learning mathematical ideas. To gain retention to a longer period, maximum support to maintain the attention in learning the lesson must be given emphasis. These learning situations assert that Parallel Achievement Division as a collaborative learning approach makes students highly engaged in learning Mathematics.

Moreover, students are more encouraged to work on tasks if they are given rewards or incentives to pay off on their efforts rendered. Students in the group express more effort to give their full potential for this is attributed to group overall points. This is inconsonant to the findings [30] that students work best to attain correct responses if they will be given prizes, points, incentives or any means to attain success within the group.

As revealed by table 7,the test of difference in the pre-test and post-test scores of the student-respondents in Mathematical thinking skills Using Parallel Achievement Division, the test of the difference between the pre-test and post-test posted significant in remembering (t=11.036, p=0.000), illustrating (t=8.616, p=0.000), analyzing (t=14.834, p=0.000), solving (t=6.647, p=0.000) and applying (t=15.564, p=0.000) mathematical concepts since the p-values resulted in less than 0.05 level of significance.

Table 7. Test of Difference in the Pre-test and Post-test scores of the Student-Respondents in Mathematical Thinking Skills Using Parallel Achievement Division

Skill	Paired Difference		95% CI of the Difference		T	Sig.
	Mean	SD	Lower	Upper		
Remembering	23.63	13.54	19.29	27.96	11.04	.000
Analyzing	17.68	12.97	13.53	21.82	8.62	.000
Illustrating	22.95	9.78	19.82	26.08	14.83	.000
Solving	12.40	11.80	8.63	16.17	6.65	.000
Applying	33.08	13.44	28.78	37.37	15.56	.000

p<0.05 - Significant

This reveals that after being exposed to Parallel Achievement Division, students were able to improve their Mathematical thinking skills. As supported by previous tables, students from poor to low level during pre-tests were able to obtain very satisfactorily to an outstanding rating which suggests high improvements in their Mathematical thinking skills. They have already mastered the competencies set for functions and relations and maximized their ability to think mathematically.

The performance of the students when exposed to group activities helps students to learn more things in the classroom. [31], [32] When students are exposed in a collaboratively enriched climate leads to a greater potential of cognitive performance, metacognition, retention and social relationships with others. Also, the supported claims stated that in collaboration, more students perform better in mathematical problem-solving.

Table 8. Test of Relationship between Student's Engagement in the Class and their Mathematical Thinking Skills Level Using Parallel Achievement Division

Skill	r	Sig.
Remembering	.762**	.000
Analyzing	.462**	.003
Illustrating	.614**	.000
Solving	.625**	.000
Applying	.575**	.000

***. Correlation is significant at the 0.01 level (2-tailed).*

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As shown in Table 8,the test of the relationship between student's engagement in the class and their Mathematical thinking skills level using Parallel Achievement Division, it is noted that there exists a significant relationship between the engagement of the students in the class and their level of Mathematical thinking skills using Parallel Achievement Division. The engagement of the students posted a positive high relationship in remembering, illustrating and solving and positive moderate relationship to analyzing and applying. It implies that whenever the students are more engaged in learning Mathematics it could lead them to excel and score a very satisfactory to outstanding performance in the subject. High level of engagement and attention to collaborative work accompanied by the points and rewards system play a huge role in making the students think deeply and logically in Mathematics.

If teachers are to encourage mathematical thinking in students, then they need to engage in mathematical thinking throughout the lesson themselves. [33] [34] Students who actively engage themselves in studying mathematical concepts aids them to understand even better and remember concepts that are needed to Mathematical problem-solving. [35] This ensures that the concepts shared by the teacher in Mathematics are well-executed to properly solve problems.

CONCLUSION AND RECOMMENDATION

The result of the pre-test of the students before they were exposed to the Parallel Achievement Division shows poor to a low level of Mathematical thinking skills particularly in remembering, illustrating, analyzing, solving and applying concepts. After exposure to the introduced collaborative learning approach students have reached a very satisfactory to an outstanding level of Mathematical skills since most of the students obtained a rating of 85 and above on each skill.

The results of the study revealed that the use of the Parallel Achievement Division increases the level of thinking skills of the students, thus, teachers could utilize the introduced collaborative learning approach to improve the thinking skills of the students in Mathematics.

Based on the obtained results in the survey on student's Mathematical engagement, the majority of the students strongly agreed in most of the statements which imply that they are highly engaged in learning Mathematics when exposed to the Parallel Achievement Division.

Further, the data displayed that the use of the approach could help students to become more engaged in learning Mathematics and doing tasks, Mathematics teachers could use the approach and incorporate creative materials and structured activities that would result to highly engaged students who are participative in classroom discussions and learning tasks.

For the teachers and other researchers, it is recommended to create another collaborative learning approach in teaching Mathematics to further develop the thinking skills of the students and increase the engagement of the students. Parallel Achievement Division could also be applied for a longer period of time as compared to a one-hour implementation in this study. Other researchers may consider secondary and mathematics major students as their participants. In addition, the effect of the Parallel Achievement Division could also be explored to investigate the problem-solving skills, critical thinking skills and mathematical creativity of the students for these are the required skills in the 21st century and anchored in the Mathematics Framework for basic and higher education.

The study is limited in a one-month scheme instructional design where 40 non-mathematics major students of the College of Teacher Education were exposed to an innovative learning approach. The testing material utilized by the researcher is a set of multiple-choice type of questions following the protocol of the College in preparing students for the Licensure Examination. With this, the researcher advises future researchers to administer the same learning approach to a greater number of students with the use of rubrics, interview, and journal as supplementary tools for assessment. Besides, the use of non-routine and open-ended problem is highly suggested for these could give more reliable data in analyzing the Mathematical abilities, performances and creativity of the students.

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