LOCALIZED MANIPULATIVES AND NON-MANIPULATIVES IN TEACHING MATHEMATICS AND LEARNERS' MATHEMATICAL SKILLS

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ABSTRACT

This study was designed to determine the significant effects of using localized manipulatives and non-manipulatives in teaching mathematics to the learners' mathematical skills. The study sample comprised one hundred eighty (180) selected grade 10 students in Pagsanjan Integrated National High School. The 180 respondents were from the four (4) grade 10 sections which are divided into experimental and controlled group. Experimental group had used localized manipulatives in learning the Math concepts, while controlled group are those who undergo Non-Manipulatives.

The quasi-experimental method of research was used in this study to analyze and interpret the data being gathered to the respondents of this study. The descriptive quantitative research design was used in this study to determine the significant effects of using localized manipulatives and non-manipulatives in teaching mathematics to the learners' mathematical skills. Survey questionnaires and examinations (Pre-test and Post-test) were used as the research instrument. The statistical treatment used to answer the questions stated above is the mean and standard deviation for the descriptive statistics, and the T-test for the inferential statistics.

The study revealed that Localized Manipulatives and Non-Manipulatives in teaching mathematics has a significant effect to the learners' mathematical skills. On the basis of these findings, it is recommended that educators may integrate the use of Localized Manipulatives into their discussion of mathematics concepts. Having known that most teachers apply Non-Manipulatives or direct instructions daily, it would be best if they combine it with Localized Manipulatives for a more development of students' mathematical skills. In this way, they can create a learning environment that is more interactive, and students can realize the importance of each concept because they can see its application into their lives.

Teachers can make use of both Localized Manipulatives and Non-manipulatives as part of their lesson planning. They may create a long-term mathematical knowledge and skills to students through interactive activities that combination of Localized Manipulatives and Non-Manipulatives can provide. Moreover, teachers may prioritize on improving the higher-order thinking skills of the learners, so they can teach them make decisions in a reasonable manner.

Keywords: Localized Manipulatives, Non-Manipulatives, Teaching Mathematics, Mathematical Skills

INTRODUCTION

Different subject matter requires engaging instructional materials. Mathematics, as one of the subjects taught in school, can be easily understood if teachers will provide models and illustrations and concrete experiences. Mathematics teachers make use of manipulatives in explaining the concept to students. Because much time and effort are needed or consumed, the use of manipulatives are sometimes disregarded.

Aside from the effort and time needed by using manipulatives, Covid-19 pandemic adds up to the obsoleteness of it. Having a distance education limits the use of any manipulatives because of the difficultness of teaching the process of using them, also, students can't buy and provide the materials for themselves. Using non-manipulatives in teaching mathematics during distance education would alleviate the academic needs of students. However, using manipulatives in teaching even in distance learning can

be recommenced. It is through the utilization of the localized materials available in the community. Through this, teachers can still explain the concepts of the mathematics lessons, provide hands-on experiences to students, and integrate the mathematics' concepts to real-life scenarios.

Mathematical reasoning is essential to any endeavor to comprehend not only the universe but also ourselves. Arithmetic is a great tool for developing self-control and a more methodical style of thinking. Mathematical literacy is essential to comprehending the material presented in other disciplines, including science, history, and even the arts. Having a firm grasp of mathematics is an asset in all aspects of life, from keeping track of time and preparing for work to managing finances. These are the kinds of talents that kids pick up in school and then utilize regularly after they have a job. Having a firm grasp of mathematics is useful in every aspect of life.

Using localized manipulatives and non-manipulatives in teaching mathematics can be both beneficial to students' learning. But the abstract reasoning and the integration of students' knowledge with their thoughts to understand the mathematical concepts cannot be achieved without the concrete experiences which teachers can possibly give to their students. With this, conducting this research will determine the effects of using localized manipulatives and non-manipulatives in teaching mathematics to the students' mathematical skills.

This research is made with the aim of determining significant effects of using localized manipulatives and non-manipulatives to the learners' mathematical skills, specifically it sought to answer the following questions:

1. What is the level of using Localized Manipulatives in Teaching Mathematics with regards to:
   1.1 Collaborative;
   1.2 Interactive; and
   1.3 Integrative?
2. What is the level of using Non-Manipulatives in Teaching Mathematics with regards to:
   2.1 Collaborative;
   2.2 Interactive; and
   2.3 Integrative?
3. What is the performance of learners in the mathematical skills with regards to:
   3.1 Critical Thinking;
   3.2 Problem Solving; and
   3.3 Reasoning?
4. Is there a significant difference in the learners' mathematical skills before and after using Localized Manipulatives in Teaching Mathematics?
5. Is there a significant difference in the learners' mathematical skills before and after using Non-manipulatives in Teaching Mathematics?
6. Is there a significant effect in using Localized Manipulatives in Teaching Mathematics to the learners' Mathematical Skills?
7. Is there a significant effect in using Non-Manipulatives in Teaching Mathematics to the learners' Mathematical Skills?

REVIEW OF RELATED LITERATURE

Students are better able to communicate their own mathematical thinking and elevate their mathematical ideas to a higher cognitive level thanks to the use of manipulatives, which allow them to integrate their knowledge and associate them with their thoughts to fully grasp mathematical topics. They make learning enjoyable for everyone involved (teachers and students alike) and contribute to long-lasting retention of material by leveling the playing field for education (Sahin, 2013).

While manipulatives do aid in the student's intellectual development, they also promote the growth of psychomotor skills (Cope, 2015) by appealing to the student's multiple senses, both in and out of the classroom.

According to Van Harpen & Presmeg (2013), students' critical thinking and mathematical aptitude can benefit greatly from their ability to formulate and articulate problems, thus it's becoming increasingly crucial that they develop this talent. As a result, engaging students in tasks that force them to think critically can be facilitated by the use of manipulatives. The findings reveal that students become more interested in and enthusiastic about their studies.

Krapp (2019) argues that teachers should take note when their pupils show signs of increased enthusiasm and engagement in class. It was said that when pupils had a pleasant experience participating in the activity, their interest and intrinsic motivation grew. It was hypothesized that students' pique in mathematics was sparked by the process of studying the subject through practical application. Furthermore, pupils were invested in the task at hand when they realized its significance to their lives. Students' engagement and motivation can increase if they view school as something they look forward to doing.

Burns and Silbey (2017) argue that providing students with opportunities to engage in concrete problem-solving and explore alternative representations of mathematical solutions can help them reach this developmental milestone. At this early level, the value of practical exercises cannot be overstated. With the help of these exercises, students are able to grasp mathematical concepts and ideas as tangible, problem-solving resources. Teachers may choose to employ manipulatives while introducing abstract ideas like place value and mathematical operations to their students.

According to Eggen and Kauchak (2018), students gain experiences while using the resources that form the basis for more sophisticated mathematical thinking. Materials also give students a way to evaluate and confirm their ideas, which boosts their mathematical confidence. Recognizing that each learner is unique and giving them access to a variety of mathematical representations does just that. One strategy for fostering cognitive growth at this juncture is providing students with opportunity to express mathematical solutions in a variety of formats (including symbols, graphs, tables, and words). It was pointed out that while some pupils may find one depiction of a topic to be relevant, another may find a different representation to be more so.

Students can better understand and retain mathematical topics with the aid of manipulatives. In spite of the widespread belief that using physical models of mathematical objects can help students grasp the concepts behind them, there are many who claim that this is not necessarily the case (Furner & Worrell, 2017). It is widely held, however, that children at the operational concrete level of cognition benefit much from it when studying mathematics.

Monte (2021), teachers need the right tools to help their students learn and succeed. This can be particularly difficult with mathematics since concepts are so abstract, but research has shown that one specific tool called manipulative is effective. Manipulatives are tools that can demonstrate how effective this aid can be in the learning process. With some help and support, teachers can adjust their mathematical teaching, so they can engage students with the use of manipulatives, and in return create stringer and more confident problem solvers.

Kwon and Capraro (2018), on their research about The Effects of Using Manipulatives on Students’ Learning in Problem Solving: The Instructors’ Perspectives, states that in order to be successful in mathematics, students must have the capacity to formulate and articulate problems effectively. Doing so improves both their critical thinking and their math skills. The results suggest that teaching with manipulatives is a viable option for problem-based learning. Based on the findings, students' motivation grew, and they were more involved and enthusiastic about their studies.

Larbi and Mavis (2016), the study of mathematics enhances one’s understanding of the world through the language of symbols and abstract representation of phenomena. Learning basically occurs when learners interact with the environment and encounter some experiences through which discoveries and relationships are made among concepts. Instructional media or manipulatives provide the physical media through which the intents of the curriculum are experienced.

METHODOLOGY

Quasi-experimental method of the research was used to analysis and interpret the data. It often involves extensive study and observation to provide rich type of research.

The respondents of the study were 4 regular Grade 10 sections from Pagsanjan Integrated National High School to which were divided into experimental and control groups. Each Grade 10 sections is consisting of 45 students. Two sections, with 90 students in overall, were used as the experimental group, while the remaining two sections (with a total of 90 students as well), are the controlled group.

Survey questionnaires and examinations (Pre-test and Post-test) were used as the research instrument.

The mean, standard deviation, and T-test were used for the statistical treatment in order to analyze and interpret the data given by the respondents. After the survey questionnaires and examinations were administered, all the data were gathered, analyzed, tabulated, and interpreted.

RESULT AND DISCUSSION

The following tabular presentations and discussions will further characterize the Localized Manipulatives and Non-Manipulatives in Teaching Mathematics and the Learners' Mathematical Skills.

Table 1. Level of Teaching Mathematics using Localized Manipulatives with regards to Collaborative

Statement	Mean	SD	Remarks
Students are able work together to figure out how to use a concept to solve math problems by using tools and other things they find around them.	4.33	0.82	Strongly Agee
Math manipulatives allows learners to brainstorm with peers in the application of concepts learned.	4.28	0.90	Strongly Agree
Localized manipulatives give students math instructions that let them explore ideas together in a complex and meaningful way.	4.33	0.76	Strongly Agree
Localized manipulatives encourage students to ask questions, make discoveries, and work together to get a deeper understanding of the skill.	4.27	0.83	Strongly Agee
Different kinds of localized manipulatives can be used to teach the same idea, and students should be able to direct their own learning and to share it with peers by choosing what they can use to master a concept.	4.30	0.81	Strongly Agree
Weighted Mean	4.30		
SD		0.66	
Verbal Interpretation		Very High	

Table 1 presents the level of Teaching Mathematics using Localized Manipulatives with regards to Collaborative.

Students *strongly agree* that teaching mathematics using localized manipulatives enables them to work together to figure out how to use a concept to solve math problems by using tools and other things they found around them ($Mn = 4.33; SD = 0.82$). Localized manipulatives give students math

instructions that let them explore ideas together in a complex ang meaningful way ($Mn = 4.33; SD = 0.76$). They also *strongly agree* that different kinds of localized manipulatives can be used to teach the same idea, and student should be able to direct their own learning and to share it with peers by choosing what they can use to master a concept ($Mn = 4.30; SD = 0.81$). On the other hand, students *strongly agree* that localized manipulatives encourage students to ask questions, make discoveries, and work together to get a deeper understanding of the skill ($Mn = 4.27; SD = 0.83$).

The weighted mean of 4.30 indicates that the level of Teaching Mathematics using Localized Manipulatives in terms of Collaborative is *Very High*. From this result, it can be inferred that Localized Manipulatives is a better strategy into which Mathematics teachers can engage collaboration among students that allow them to explore their ideas. Group activities will be improved, and students can build confidence in communicating with their groupmates through the use of Localized Manipulatives.

Table 2. Level of Teaching Mathematics using Localized Manipulatives with regards to Interactive

Statement	Mean	SD	Remarks
Math manipulatives are an important part of teaching math in a way that it allows students explore ideas in a deep and meaningful way.	4.51	0.69	Strongly Agree
Students are more interested in math when they can do something with the concept instead of just sitting and watching it be shown to them.	4.46	0.74	Strongly Agree
Manipulatives give students a chance to learn by doing the work.	4.47	0.75	Strongly Agree
Manipulatives give students a chance to learn a skill while they are doing it.	4.47	0.78	Strongly Agree
Teachers can get students involved in math discussions by using localized manipulatives and learning materials that students can relate to or are already familiar with.	4.49	0.69	Strongly Agree
Weighted Mean		4.48	
SD		0.62	
Verbal Interpretation		**Very High**	

Table 2 displays the level of Teaching Mathematics using Localized Manipulatives with regards to Interactive.

Students *strongly agree* that math manipulatives are an important part of teaching the subject in a way that it allows students explore ideas in a deep and meaningful way ($Mn = 4.51; SD = 0.69$). They also *strongly agree* that teachers can get students involved in math discussions by using localized manipulatives and learning materials that students can relate to or are already familiar with ($Mn = 4.49; SD = 0.69$). On the other hand, students *strongly agree* that they are more interested in math when they can do something with the concept instead of just sitting and watching it be shown to them ($Mn = 4.46; SD = 0.74$).

The weighted mean of 4.48 indicates that the level of Teaching Mathematics using Localized Manipulatives in terms of Interactive is *Very High*. This means that through using Localized Manipulatives in teaching Mathematics, teachers can create and conduct lessons that will allow students to interact with each other. Moreover, students can be more engaged to learning, since they are able to interact in the class discussions.

Table 3. Level of Teaching Mathematics using Localized Manipulatives with regards to Integrative

Statement	Mean	SD	Remarks
Mathematics concepts are better understood if the problem is integrated by a real-life scenario.	4.41	0.78	Strongly Agree
Mathematics concepts are better understood if it is integrated by manipulatives which are locally available into the community where the learners belong.	4.38	0.79	Strongly Agree
Connecting localized manipulatives to math problems would help students learn better because they can relate to it.	4.36	0.72	Strongly Agree
Adding localized manipulatives to math problems would help students understand how important different math concepts are to their lives.	4.41	0.73	Strongly Agree
When localized manipulatives are used to solve real-world problems, students can see how important math concepts are.	4.54	0.62	Strongly Agree
Weighted Mean	4.42		
SD	0.62		
Verbal Interpretation	**Very High**		

Table 3 shows the level of Teaching Mathematics using Localized Manipulatives with regards to Integrative.

Students *strongly agree* that when localized manipulatives are used to solve real-world problems, students can see how important math concepts are ($Mn = 4.54; SD = 0.62$). They also *strongly agree* that mathematics concepts are better understood if the problem is integrated by a real-life scenario ($Mn = 4.41; SD = 0.78$). Adding localized manipulatives to math problems would help students understand how important different math concepts are to their lives ($Mn = 4.41; SD = 0.73$). On the other hand, students *strongly agree* that connecting localized manipulatives to math problems would help students learn better because they can relate to it ($Mn = 4.36; SD = 0.72$).

The weighted mean of 4.42 indicates that the level of Teaching Mathematics using Localized Manipulatives in terms of Integrative is *Very High*. The result explains that Localized Manipulatives when use in teaching Mathematics can be a great tool in incorporating the topics to the community where the students live. Students can find the relativeness of Math concepts to scenarios they might encounter in real life. Students can be more engaged to learning because they can see the significance of it once applied to their lives.

Level of Teaching Mathematics using Non-Manipulatives

In this study teaching mathematics using Non-Manipulatives include collaborative, interactive, and integrative.

Table 4. Level of Teaching Mathematics using Non-Manipulatives with regards to Collaborative

Statement	Mean	SD	Remarks
Students are able work together to figure out how to use a concept to solve math problems by direct instruction	2.58	0.76	Undecided
Direct instruction of math concepts allows learners to brainstorm with peers in the application of concepts learned.	2.42	0.92	Disagree
Non-manipulatives give students math instructions that let them explore ideas together in a complex and meaningful way.	2.49	0.75	Disagree
Direct instructions of math concepts encourage students to work together to get a deeper understanding of the skill.	2.36	0.88	Disagree
Non-manipulatives allow learners to direct their own learning to share with peers by choosing what strategies they can use to master a concept.	2.38	0.83	Disagree
Weighted Mean	2.44		
SD	0.55		
Verbal Interpretation	**Low**		

Table 4 illustrates the level of Teaching Mathematics using Non- Manipulatives with regards to Collaborative.

Students are *undecided* that they are able to work together to figure out how to use a concept to solve math problems by direct instruction ($Mn = 2.58; SD = 0.76$). They *disagree* that non-manipulatives give students math instructions that let them explore ideas together in a complex and meaningful way ($Mn = 2.49; SD = 0.75$). On the other hand, students *disagree* that direct instructions of math concepts encourage students to work together to get a deeper understanding of the skill ($Mn = 2.36; SD = 0.88$).

The weighted mean of 2.44 indicates that the level of Teaching Mathematics using Non-Manipulatives in terms of Collaborative is *Low*. The result shows that Non-Manipulatives or the direct instructions of Math concepts, which most teachers do, has a little impact to students' engagement to group collaborations among them.

Table 5 discusses the level of Teaching Mathematics using Non- Manipulatives with regards to Interactive.

Students *disagree* that non-manipulatives are an important part of teaching math in a way that it allows students to explore ideas in a deep and meaningful way ($Mn = 2.52; SD = 0.85$). They also *disagree* that non-manipulatives give students a chance to learn by doing the work ($Mn = 2.47; SD = 0.75$). On the other hand, students *disagree* non-manipulatives give students a chance to learn a skill while they are doing it ($Mn = 2.38; SD = 0.84$).

Table 5. Level of Teaching Mathematics using Non-Manipulatives with regards to Interactive

Statement	Mean	SD	Remarks
Non-manipulatives are an important part of teaching math in a way that it allows students to explore ideas in a deep and meaningful way.	2.52	0.85	Disagree
Students are more interested in math when they are just sitting and watching it be shown to them.	2.39	0.86	Disagree
Non-manipulatives give students a chance to learn by doing the work.	2.47	0.75	Disagree
Non-manipulatives give students a chance to learn a skill while they are doing it.	2.38	0.84	Disagree
Teachers can get students involved in math discussions by direct instructions.	2.42	0.72	Disagree
Weighted Mean		2.44	
SD		0.56	
Verbal Interpretation		**Low**	

The weighted mean of 2.44 indicates that the level of Teaching Mathematics using Non-Manipulatives in terms of Interactive is *Low*. Non-Manipulatives when compared to Localized Manipulatives in teaching Mathematics can be less effective in terms of the level of interaction they might give to students. Students tend to interact more to class discussions when there are manipulatives available that would help them understand the Math concepts better.

Table 6. Level of Teaching Mathematics using Non-Manipulatives with regards to Integrative

Statement	Mean	SD	Remarks
Mathematics concepts are better understood if the problem is integrated by unrealistic or imaginary problems.	2.44	0.74	Disagree
Mathematics concepts are better understood if it is taught through direct instruction.	2.52	0.72	Disagree
Connecting non-manipulatives to math problems would help students learn better because they can relate to it.	2.36	0.77	Disagree
Integrating direct instructions to math problems would help students understand how important different math concepts are to their lives.	2.36	0.75	Disagree
When formulas and direct instructions are used to solve real-world problems, students can see how important math concepts are.	2.41	0.83	Disagree
Weighted Mean		2.42	
SD		0.50	
Verbal Interpretation		**Low**	

Table 6 shows the level of Teaching Mathematics using Non- Manipulatives with regards to Integrative.

Students *disagree* that mathematics concepts are better understood if it is taught through direct instruction ($Mn = 2.52; SD = 0.72$). They also *disagree* that mathematics concepts are better understood if the problem is integrated by unrealistic or imaginary problems ($Mn = 2.44; SD = 0.74$). On the other hand, students *disagree* that connecting non-manipulatives to math problems would help students learn better because they can relate to it ($Mn = 2.36; SD = 0.77$). Integrating direct instructions to math problems would help students understand how important different math concepts are to their lives ($Mn = 2.36; SD = 0.75$).

The weighted mean of 2.42 indicates that the level of Teaching Mathematics using Non-Manipulatives in terms of Integrative is *Low*. The result shows that Non-Manipulatives or the direct discussion of Math concepts does not make the concepts integrative to real life. Students cannot view the significance of Math concepts into their lives because Mathematics problems were not integrated or connected to the real-life scenarios.

Performance of Learners in Terms of Mathematical Skills

In this study using Localized Manipulatives and Non-Manipulatives, learners' performance on the before and after test were discussed and with accordance to their mathematical skills.

Table 7. Performance of Learners in Terms of Mathematical Skills

Mathematical Skills	Localized Manipulatives		Mean Gain Score	Non-Manipulatives		Mean Gain Score
	Before	After		Before	After	
Critical Thinking	3.52	9.11	5.59	3.52	7.09	3.57
Problem Solving	2.73	6.84	4.11	3.82	6.8	2.98
Reasoning	2.57	8.57	6	3.5	5.9	2.4

Table 7 presents the performance of learners in terms of mathematical skills.

As the learners in the experimental group whom uses localized manipulatives in analyzing the problems given in the test, the after test when compared to before test shows an improvement to the mathematical skills of the students. Similar to that was the result of the after test of the learners who underwent non-manipulatives method of teaching and learning mathematics concepts. Comparing the mean gain score of experimental and controlled group, it reveals that there are progress in both teaching methods, however, localized manipulatives shows greater gain score than the non-manipulatives.

The results show that localized manipulatives and non-manipulatives when used in teaching mathematics concepts can increase the development of learners' mathematical skills.

Significant Difference in the Learners' Mathematical Skills Before and After Using Localized Manipulatives and Non-Manipulatives

In this study, significant difference in the learners' mathematical skills before and after using Localized Manipulatives, as well as Non-Manipulatives, were discussed.

Table 8 presents the significant difference in the learners' mathematical skills before and after using localized manipulatives in teaching mathematics.

The Before and After test of using Localized Manipulatives in teaching Mathematics was observed to have any significant difference to the mathematical skills of the learners. This is explained the p-values obtained which are less than the significance alpha (0.05), hence there is presence of a significance.

Table 8. Significant Difference in the Learners' Mathematical Skills Before and After Using Localized Manipulatives in Teaching Mathematics

Mathematical Skills	Test	t-stat	p-value	Analysis
Critical Thinking	Before After	40.075	0.000	Significant
Problem Solving	Before After	24.214	0.000	Significant
Reasoning	Before	57.243	0.000	Significant

The results entail that after using Localized Manipulatives in teaching Mathematics concepts, students' scores have changed positively. Localized Manipulatives can be a useful tool in enhancing learners' mathematical skills, particularly critical thinking, problem solving, and reasoning.

Table 9. Significant Difference in the Learners' Mathematical Skills Before and After Using Non-Manipulatives in Teaching Mathematics

Mathematical Skills	Tests	t-stat	p-value	Analysis
Critical Thinking	Before After	21.918	0.000	Significant
Problem Solving	Before After	22.368	0.000	Significant
Reasoning	Before	18.583	0.000	Significant

Table 9 presents the significant difference in the learners' mathematical skills before and after using non-manipulatives in teaching mathematics.

The Before and After test of using Non-Manipulatives in teaching Mathematics was observed to have any significant difference to the mathematical skills of the learners. This is explained by the p-values obtained which are less than the significance alpha (0.05), hence there is presence of a significance.

The results entail that after using Non-Manipulatives in teaching Mathematics concepts, students' scores, as well, have changed dramatically. With the fact that students can gain knowledge and skills once the teacher taught and explained the Mathematics concepts, difference among their scores can obviously be seen with or without manipulatives. However, the level of mathematical skills students learned is to consider. Non-manipulatives or the direct instruction of Math concepts can still help students in improving their mathematical skills, and it was proven by the reality that most educators make use of this method in delivering the lesson to their students.

Significant Effects of Using Localized Manipulatives and Non-Manipulatives to the Learners' Mathematical Skills

In this study, the significant effects of using Localized Manipulatives and Non-Manipulatives to the learners' mathematical skills were tackled.

Table 10 presents the significant effect of using Localized Manipulatives to the Learners' Mathematical Skills.

The Localized Manipulatives as a way of teaching Mathematics appears to have a significant effect to the critical thinking skills, problem solving skills, and reasoning skills of the learners based on the result of their after test. This is in accordance to the computed p-values obtained from the tests which are less than the significance alpha of 0.05.

The results of the study shows that Localized Manipulatives have impacted the development of learners' mathematical skills significantly. This teaching method can be useful to students learning and it can give more assistance to learners' improvement of their mathematical skills. With the incorporation of Localized Manipulatives in teaching Mathematics concepts, students' mathematical thinking skills can be

honed. It can build students' confidence by giving them a way to test and confirm their reasoning. Additionally, it can make learning Math interesting and enjoyable.

Table 10. Significant Effect of Using Localized Manipulatives to the Learners' Mathematical Skills

Localized Manipulatives	Mathematical Skills (After)	r-value	p-value	Degree of Correlation	Analysis
Collaborative	Critical Thinking	-0.065	0.000	Very Weak Relationship	Significant
	Problem Solving	-0.001	0.000	Very Weak Relationship	Significant
	Reasoning	0.081	0.000	Very Weak Relationship	Significant
Interactive	Critical Thinking	-0.005	0.001	Very Weak Relationship	Significant
	Problem Solving	-0.006	0.000	Very Weak Relationship	Significant
	Reasoning	0.089	0.001	Very Weak Relationship	Significant
Integrative	Critical Thinking	-0.206	0.000	Weak	Significant
	Problem Solving	-0.059	0.000	Very Weak Relationship	Significant
	Reasoning	-0.050	0.000	Very Weak Relationship	Significant

Scale	Strength
±0.80 – ±1.00	Very Strong
±0.60 – ±0.79	Strong
±0.40 – ±0.59	Moderate
±0.20 – ±0.39	Weak
±0.00 – ±0.19	Very Weak

Table 11 presents the significant effect of using Non-Manipulatives to the Learners' Mathematical Skills.

The Non-Manipulatives as a way of teaching Mathematics with regards to collaborative appears to have a significant effect to the critical thinking skills, problem solving skills, and reasoning skills of the learners based on the result of their after test. Moreover, interactive as compared to critical thinking skills ruled out a significant effect. The same analysis was decided to the integrative when compared to critical thinking skills and problem solving skills of the learners. These interpretations are in accordance to the computed p-values obtained from the tests which are less than the significance alpha of 0.05.

On the contrary, there is no significant effects shown between interactive and problem solving skills, as well as reasoning skills. In addition, testing for the significant effect of integrative to the reasoning skills of learners resulted to have a no significance. These interpretations are in accordance to the computed p-values obtained from the tests which are greater than the significance alpha of 0.05.

The results of the study shows that Non-Manipulatives have impacted most of the development of learners' mathematical skills significantly. The direct instructions of mathematics concepts enable students to improve their mathematical skills, specifically, critical thinking skills.

Table 11. Significant Effect of Using Non-Manipulatives to the Learners' Mathematical Skills

Non-Manipulatives	Mathematical Skills (After)	r-value	p-value	Degree of Correlation	Analysis
Collaborative	Critical Thinking	-0.027	0.002	Very Weak Relationship	Significant
	Problem Solving	0.065	0.000	Very Weak Relationship	Significant
	Reasoning	-0.031	0.000	Very Weak Relationship	Significant
Interactive	Critical Thinking	0.048	0.009	Very Weak Relationship	Significant
	Problem Solving	0.179	0.895	Very Weak Relationship	Not
	Reasoning	0.029	0.113	Very Weak Relationship	Not
Integrative	Critical Thinking	-0.071	0.015	Very Weak Relationship	Significant
	Problem Solving	0.149	0.015	Very Weak Relationship	Significant
	Reasoning	0.042	0.165	Very Weak Relationship	Not

Scale	Strength
±0.80 – ±1.00	Very Strong
±0.60 – ±0.79	Strong
±0.40 – ±0.59	Moderate
±0.20 – ±0.39	Weak
±0.00 – ±0.19	Very Weak

CONCLUSION

Based on the findings above, the following conclusions are hereby drawn:

All dependent variables show a significant difference on the before and after using Localized Manipulatives in teaching Mathematics. Therefore, it was concluded that the null hypothesis was rejected.

Learners' mathematical skills show a significant difference on the before and after using Non-Manipulatives in teaching Mathematics. Therefore, it was concluded that the null hypothesis was rejected.

The study presents a significant effect between localized manipulatives and learners' mathematical skills. Therefore, it concluded that the null hypothesis is rejected.

The majority of the outcome shows a significant effect of independent variables to the dependent variables. Therefore, it concluded that the null hypothesis was partly rejected.

RECOMMENDATIONS

1. Localized Manipulatives and Non-Manipulatives show a significant effect on the learners' mathematical skills. With that, it is suggested that educators may integrate the use of Localized Manipulatives into their discussion of mathematics concepts. Having known that most teachers apply Non-Manipulatives or direct instructions daily, it would be best if they combine it with Localized Manipulatives for a more development of students' mathematical skills. In this way, they can create a learning environment that is more interactive, and students can realize the importance of each concept because they can see its application into their lives.

2. Teachers can make use of both Localized Manipulatives and Non-manipulatives as part of their lesson planning. They may create a long-term mathematical knowledge and skills to students through interactive activities that combination of Localized Manipulatives and Non-Manipulatives can provide. Moreover, teachers may prioritize on improving the higher-order thinking skills of the learners, so they can teach them make decisions in a reasonable manner.
3. Future researchers may conduct studies regarding math manipulatives, because this will help the education sector to see the importance of including manipulatives in the curriculum implementation, not just for kindergarten, but in high school as well.

ACKNOWLEDGEMENTS

This completion of this paper would not be possible without the help and counsel of the following persons to whom the researcher extends her heartful gratitude and admiration.

First and foremost, to **ALMIGHTY GOD** for supporting and guiding her spiritually to sustain her strength and knowledge in making this study attainable;

BENJAMIN O. ARJONA, EdD, thesis adviser, for his incomparable suggestion assistance, for giving his precious time and effort, for giving valuable suggestions, ideas, comments, untiring professional guidance, and in-depth analysis of the study;

Her loving parents, **GUILLERMO ORDIALES** and **JENNIE QUISTERIANO,** for the love, inspiration, guidance and support both financially and morally, this would not have been possible without their support, unconditional love, financial support and not giving up on her;

To her loving husband, **MARK ANTHONY C. UMALI**, for the love, inspiration, support, and understanding of her busy days in conducting the study;

To her supportive friends for always believing in her, for all the support and motivation to finish her study.

REFERENCES

Burns, M., & Silbey, R. (2017). So you have to teach math? Sound advice for K-6 teachers. Sausalito, CA: Math Solutions Publications.

Cope, L. (Spring 2015). Math manipulatives: Making the abstract tangible. Delta Journal of Education, 5(1),10-19.

Eggen, P. D., & Kauchak, D. P. (2018). Educational psychology: Windows on classrooms (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Furner, J. M., & Worrell, N. L. (2017). The importance of using manipulatives in teaching math today. Transformations, 3(1), 1-25.

Krapp, A. (2019). Basic needs and the development of interest and intrinsic motivational orientations. Learning and Instruction, 15(5), 381-395.

Kwon, Hyunkyung & Capraro, Mary Margaret (July 2018), "The Effects of Using Manipulatives on Students' Learning in Problem Posing: The Instructors' Perspectives ", Texas A&M University

Larbi, Ernest and Mavis, Okyere (2016), "The Use of Manipulatives in Mathematics Education", Catholic University College of Ghana, Fiapre, P.O. Box 363, Sunyani, Journal of Education and Practice, ISSN 2222 – 1735 (Paper), ISSN 2222 – 288X (Online), Vol. 7, No. 36, 2016

Monte, Jade (2021), "An Exploration of Manipulatives in Math Education", Virtual Commons – Bridgewater State University

Şahin, T. (2013). Somut ve sanal manipülatif destekli geometri öğretiminin 5. Sınıf öğrencilerinin geometric yapıları inşa etme ve çizmedeki başarılarına etkisi (Yayımlanmamış yüksek lisans tezi). Bolu: Abant İzzet Baysal Üniversitesi, Eğitim Bilimleri Enstitüsü.

Van Harpen, X. Y., & Presmeg, N. C. (2013). An investigation of relationships between students' mathematical problem-posing abilities and their mathematical content knowledge. Educational Studies in Mathematics, 83(1), 117-132.