# COMPARING MANIPULATIVES AND OUTDOOR LEARNING: TWO APPROACHES TO TEACHING ADDITION

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STUDENT OUTPUTS

# Comparing Manipulatives and Outdoor Learning: Two Approaches to Teaching Addition

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# Comparing Manipulatives and Outdoor Learning: Two Approaches to teaching Addition

**Abstract:** Mathematics is one of the core subjects taught in schools from pre-school until college. One of the basic skills taught in this subject is addition, which is done in early childhood. Many researches have established that getting quality Mathematical education in the early years encourage successful learning of more complex mathematical concepts in succeeding levels. In this paper, the researchers aimed to determine if using manipulatives and using outdoor learning are effective approaches in teaching addition to 5 to 6-year old kindergarten children, and examine the similarities and differences between a common approach and an emerging approach. Low performing children were identified through their previous performance records and a 16-item basic addition assessment was given before the intervention. These students were then equally divided into two groups. One group was assigned to use manipulatives, while the other group engaged in outdoor learning. Both interventions were administered for five consecutive days. Through direct observation, pictures, and interview, the researcher recorded the children's behavior, responses, and approaches to both tasks. Post assessment was administered to both groups after the intervention to determine if their performance improved. The study concluded that both innovations are effective means of teaching addition to kindergarten children as both utilized the children's senses. The primary difference was that using manipulatives were done indoors, while exposure to outdoor environment promoted experiential learning using diverse resources found in nature. Basic skill in addition was enhanced using manipulatives, since the concept was demonstrated using concrete objects that they can operate. Conversely, outside learning approach enabled them to make meaningful connections between the concept and their experiences outside, and lead to significant retention and improved execution of the skill.

## Introduction

Mathematics is one of the core subjects being taught in schools, taken up from the Kindergarten level up to college (SEI-DOST & MATHTED, 2011). Math, in its totality is considered as problem solving, as it engages children in "creative, persistent thinking" (Smith, 2001).

One of the basic concepts taught in the Kindergarten level is the concept of Addition. It makes up majority of the early years curriculum (Kilpatrick, Swafford, & Findell, 2001). As much as it's basic, it's also one of the highly salient and mostly used skill in a person's everyday life. Therefore, it is an important skill to master in such an early age as it is fundamental in learning later concepts (Sun, 2008).

Children learn best when their senses are engaged in their learning. Young children in particular need concrete materials they can manipulate in order to visualize the concepts being taught. Hence, the advent and wide spread use of manipulatives (Clements, 2009; Smith, 2001). Introduction of concepts in Mathematics particularly make use of various manipulatives to aid teaching and learning. Outdoor learning is gaining popularity as a method of teaching, especially in the West, as they try to curb the reliance of children in technology (Dowdell, Gray, & Malone, 2011) and to produce well-balanced, holistically-developed and healthy children (Cooper, 2015).

Both approaches appear promising in helping teachers introduce and reinforce the concept of addition in kindergarten students. The difference between the two approaches is that introduction of manipulatives are done indoors and these materials are often used inside the classroom, while outdoor learning happens outside the usual classroom setting, in the vast natural environment.

## Importance of Mathematics in Early Childhood Education

Children are believed to have the natural proclivity for Mathematical thinking and learning (National Research Council, 2009; Linder, Costello, & Stegelin, 2011). The National Association for the Education

of Young Children (NAEYC) further stressed this in a joint position statement with the National Council of Teachers of Mathematics (NCTM) (2002; 2010):

"Throughout the early years of life, children notice and explore mathematical dimensions of their world. They compare quantities, find patterns, navigate in space, and grapple with real problems such as balancing a tall block building or sharing a bowl of crackers fairly."

There is a growing recognition of the importance of early childhood level as a first step of a child's academic journey (Aubrey, Dahl, & Godfrey, 2006), and as the prime time for learning to be transmitted because it is the rapid period of holistic development and for interest in different areas to be cultivated and shared (Department of Education, 2016). This time is also the perfect opportunity to instill zeal for life-long learning. Therefore, experiences and instruction in terms of Mathematics should be meaningful and purposeful, as these will ultimately affect and mold their outlook towards the subject (NAEYC, 2009).

Most of the researches in the area of early childhood Mathematics discuss the importance of being exposed to quality instruction in the early years, as it plays a pertinent role in the later academic performance of a child (Clements & Sarama, 2009).

Aubrey, Dahl, and Godfrey (2006) reported in their study that children who have been exposed to mathematical instruction and were given mathematical knowledge in the early years carry that knowledge and put them in advantageous level, in terms of mathematical progress throughout their stay in primary school.

Another example is the longitudinal study done by Jordan, Kaplan, Ramineni, and Locuniak (2009) that examined children's number competence in the beginning of Kindergarten in relation to their mathematical achievement when they reached 3rd grade, suggests that the relationship between early number competence and achievement was found to be strong and significant. The findings of their study articulates the importance of kindergarten number competence as foundation of progress in elementary school mathematics, as children who have been ahead in skills are advancing in mathematics learning, while those who have been left behind are playing catch up, and are just acquiring the necessary skills.

Indeed, the benefits gained by young children in early childhood settings, particularly the quality of their experiences serve them in the long-run.

**Use of Manipulatives in Mathematics**

There is a general consensus among early childhood educators that in an early childhood classroom, children should be provided with various materials and play-based activities to engage children and facilitate their learning. It is no wonder that manipulatives have gained recognition as an important tool for early mathematics instruction. As for the teaching of Mathematics from K-3 in the Philippines, SEI-DOST and MATHTED (2011) outlined the characteristics of math teaching as (1) experiential and hands-on, (2) informal, (3) rich in basic foundational concepts and skills, and (4) integrated. They also recommended instructional features one of which is purposeful play and manipulative activities.

Laski, Jor'dan, Daoust, and Murray (2015), defined manipulatives as "concrete materials used to demonstrate a mathematics concept or to support the execution of a mathematical procedure". It takes root from the idea that children learn best when they are interacting with concrete objects and that these materials are used to represent symbols and concepts that are found challenging to teach to young children (Uttal, Scudder, & DeLoache, 1997). However, literature regarding the advantages of manipulatives have been

inconsistent, in that some studies conclude that it facilitates learning, while others determinedly conclude that it hinders it (Laski et al, 2015).

In the meta-analytic review by Carbonneau, Marley, and Selig (2013), with the expressed purpose of examining the effect of using concrete manipulatives in teaching mathematics, the findings suggests that manipulatives have a small to moderate-sized effect in favor of instructional strategies that employ it. However, they would only be beneficial under definite conditions. They have an essential role, but they have to be used with care to craft a significant comprehension and justification of the procedures. Caution must be exercised when using manipulatives and they should not be viewed as something that carries the mathematical idea to the learner by itself and that there should be a gradual step from concrete to symbolic understanding of the concepts (Clements & Sarama, 2016). This ties well with Uttal's (1997) sentiment, in that while manipulatives are inherently interesting for young children and are effective motivator for them, the meaning that they often attach to it may be starkly different from its purported use, unless it is guided and made explicit by a teacher.

Nevertheless, one cannot discount the benefits of using manipulatives and that it still holds a weight in effectively teaching mathematical concepts to young children.

**Outdoor Learning**

In the early days of history, most of the people then have learned, not in a formal school setting that we know of now, but rather, outside of one (Waite, 2010). It is with the rise of industrialization and urbanization of communities that have urged the shift to deliver learning in closed classrooms and limited children's access to nature (Rivkin, 2000; Dowdell, Gray, & Malone, 2011). The growing technological advances and concerns about children's safety are also factors that might have shifted this outlook. They further stressed that this situation is concerning for early childhood experts that emphasize the need for children to engage with nature (Louv, 2008 as cited by Nedovic & Morissey, 2013).

Outdoor learning is once again gaining recognition as a worthwhile approach to teaching and learning, especially in the early years (Rivkin, 2000). Nevertheless, despite the numerous and various researches undertaken regarding the benefits of outdoor learning, it is still mostly overlooked by governing bodies that plot and plan the curriculum of education (Cooper, 2015). Therefore, a lot of its potential to enhance learning is lost (Dyment, 2005).

The Kindergarten Curriculum guide (2016) emphasize the promotion of play-based activities that calls for exploring the environment and encouraging children to discover and create, allowing them to be risk takers and planners, help them naturally gain knowledge and help them develop holistically, to prepare them for formal school tasks.

Outdoor learning is believed to have benefits that greatly encompass the different areas of development. While in most researches, the focus is on the benefits in cognitive development, there have also been observed benefits in terms of affective, and physical development (Dillon et al, 2005). Dowdell, Gray, and Malone (2011), have cited various cognitive benefits that exposure to nature has including improvements in terms of awareness, reasoning, observation skills, creativity, concentration, and imagination.

As for the affective development, students and teachers alike report that learning has become more engaging and meaningful, as the students have actively engaged their senses (Dyment, 2005). It also has inherent restorative value and aids in relaxation and coping with stress experienced every day (Louv, 2008, as cited by Gill, 2014). It also promotes constructive, imaginative, and collaborative play (Cooper, 2015).

Relationship with peers also improve as children have been observed to be less confrontational when outside and are more likely to cooperate (Ouvry, 2003 as cited by Maynard & Waters, 2007). It develops self-confidence and respect for nature as they learn to appreciate it even more (Cooper, 2015).

In terms of physical development, as children are encouraged to be active by running and jumping around (Rivkin, 2000), it promotes gross and motor skills, as well as improve nutrition as children appear to be more well-balanced and coordinated, and they generally appear healthier (Cooper, 2015; Maynard & Waters, 2007).

With these purported benefits, outdoor play appears to be an essential approach in the arsenal of early childhood educators and merits further exploration and use.

## Purpose

The aim of this action research is to examine whether using manipulatives and using outdoor learning as an approach to teach addition would help in improving the performance of the students in the said concept and skill and identify the aspects that made it effective.

Specifically, this study aimed to answer the following questions:

1. What were the behaviors observed among the learners who received the sensory learning intervention (use of manipulatives)?
2. What were the behaviours observed among the learners who received the outdoor learning intervention?
3. What were the changes observed with the learners with regards to their addition skills after the sensory intervention? After the outdoor learning intervention?
4. Considering all the above mentioned and results of performance of the learners, which approach appears more effective?

## Methodology

Presented in this chapter are the research design and procedure used in this study.

The researchers adopted descriptive type of the study to obtain data and explain the results. The study was descriptive because it determined the necessary information through observation and interview which gave rich and vivid descriptions to the variables such as the impact of outdoor learning and manipulatives to the learners' basic addition skills.

The study utilized a qualitative approach to research. It used semi structured and open-ended interview questions which determined the pupils' subjective description of their experiences with outdoor learning and use of manipulatives. The study also made use of observation as the main method of data gathering. Observation reports were consistently written every session for the duration of interventions.

### *Sampling Technique*

The researcher used Purposive Sampling Method to determine effectively the limited, yet relevant number of learners who were the primary data sources on where the intervention is highly needed. The respondents came from two (2) Kindergarten classes in an elementary public school in Mendez, Cavite.

***Respondents of the Study***

Kindergarten C pupils from an elementary public school in Mendez, Cavite, both morning and afternoon session who have difficulty in basic addition skills with ages ranging from 5 to 6 years old were the participants of this study. In order to identify the pupils in need for the program, the researchers based the criteria from the available assessment data and observation reports from their Teacher Adviser.

Twenty-two (22) kindergarten pupils were chosen as target participants in the study. Their difficulty in basic addition we're manifested in their previous assessment records in mathematics. Eleven (11) pupils from the morning session experienced the use of manipulatives, and the eleven (11) pupils from the afternoon session received the Outdoor Learning Approach.

***Research Intervention***

Upon identifying the target participants based on the standard criteria of having 60% rate of score in their previous addition assessment test, it was highly assumed that all of them have basic background in addition, but exhibiting a hard time executing the skill appropriately.

The first group comprised of eleven (11) pupils from the morning session were taught basic addition concepts and counting through the use of manipulatives such as counting rods and drawing sticks inside the classroom. While the second group comprised of eleven (11) pupils from the afternoon session learned basic addition concepts outside the classroom with abundant exposure from natural elements such as stones, leaves, twigs, etc.

In order for an unbiased comparison between the two (2) groups to be possible, high resemblance of their class routines were made sure. Same teacher handling both classes, with duplicate teaching approach, environment, lesson, activities, and time allocation for each work period. These external conditions were planned and executed coequally except for the interventions given to each group. Basic addition skills were taught for one (1) hour every day for five (5) consecutive days for both the morning and afternoon sessions. Pretest was given to both groups before the intervention program to test and recognize their basic level of addition skills. The Pre-test consisted of sixteen (16) basic numerical addition problems. After five (5) days of interventions, posttest was administered to obtain and describe the results gathered.

*Morning group*

The teaching approach for this group was through the use of manipulatives for teaching addition. Counting rods were introduced to the children in order for them to describe, differentiate, count, and add using sensory materials. All the instructions and execution of addition practices were done inside the classroom on their own seats.

*Manipulatives*

Before the intervention, pretest was administered to the target children. On the first and second day, outside environment was introduced to them, they were given ample time to observe and share what they saw outside. Upon instruction, they roamed around the vicinity and collected any natural materials they can see. Circle time was the next activity on where they have counted their collected things and practiced demonstrating simple addition skill using the environmental materials. Then meditation as concluding activity. On the second day, they were instructed to find a partner, to combine their collected things and count together. On the third day and fourth day, same routines were executed, but this time, application of addition on paper and pencil were taught and done. During the last day, as concluding part of the activity,

the pupils shared their thoughts and experiences about the five-day activity. Posttest was administered after the intervention.

*Afternoon group*

Outside learning was be the focal point of the intervention given to the afternoon group. Instructions were given inside the classroom before going out. Each children brought their own baskets on where they placed the things they found outside. After fifteen minutes of exploring and collecting things, each one of them will count orally what they have gathered. For the following days, same preliminary activities were executed, but this time, they were instructed to find a pair, combine and count the things they have gathered together with their partner. After working and exploring outside, their addition skills were practiced through paper and pencil addition problems. Same outside routine was implemented with varying degrees of numbers added using environmental elements.

*Outdoor Learning*

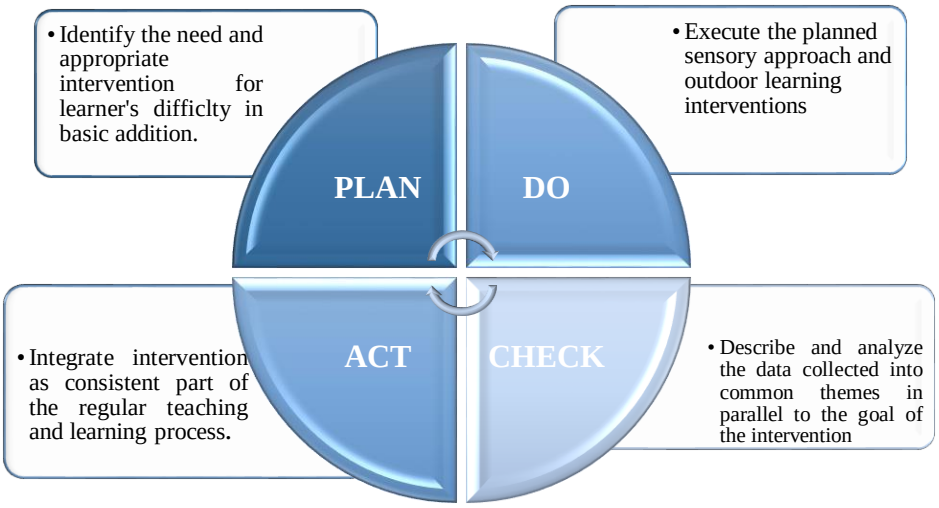
Before the intervention, pretest was administered to the target children. On the first and second day, manipulatives was presented and introduced. Children were given ample time to observe and describe their finding about the manipulatives. They demonstrated their basic zero to ten counting skills. The teacher instructed a number and the children collected sensory rods based on the number instructed. Afterwards, they demonstrated basic addition skills using the sensory rods. Then clean up time as an ending activity. On the second day, they were instructed to find a partner, to combine their manipulatives and count together. On the third day and fourth day, same routines were executed, but this time, application of addition on paper and pencil were taught and done. During the last day, as concluding part of the activity, the pupils shared their thoughts and experiences about the five-day activity. Posttest was administered after the intervention.

**Data Collection Analysis**

The main data used in this study were pictures taken by the researchers, observation reports of the teacher, transcribed interview with the participants, and the pre-test post-test result. In order to come up with common themes in accordant with the research questions, raw data such as the observation reports and transcribed interview results have undergone initial coding, followed by thematic analysis to cluster the similar themes together. Pictures served as supplementary evidence for the observed themes. Raw scores and descriptive statistics of pre-test and post-test results act as supporting data and were used as basis for comparison of effectiveness of both interventions.

**Plan, Do, Check, Act**

A four-step model below shows specific actions in this study in cycle form of planning, implementing, evaluating, and applying.




**Presentation and Analysis of Data**

This part presents the discussion of the results and themes gathered by the researcher through the direct observation, semi-structured interview, and pretest posttest result of the twenty-two kindergarten pupils divided into the use of manipulatives and outdoor environment.

**Observation reports**

The teacher-researcher recorded observation reports throughout the 5-day duration of both the use of manipulatives and outdoor learning. Summarized below were the dominant observable behaviors of the children in progress within the span of both interventions.

***Outdoor Learning***

During the first dad, the children were hesitant to explore the place at first, but eventually, they comfortably roamed around. They happily pointed each thing they saw, from the branches above to the ground below them. One pointed out that there was a bottle hanging on the branches above. One said that he felt strong wind while walking. The other one noticed the leaves below moving, and the rocks on the ground. They were excited to pick things they found in the environment. Smiles on their faces were highly noticeable. All of them greatly participated without any idle moment. During the activity, children most commonly picked stones and leaves. After ample time of roaming and choosing what to get, they proceeded to circle time on where they counted the objects they got. Each one had the chance to count loudly with variety of numbers. Some were helpful enough to count together with others who had hard time counting. They followed instructions accurately and when they were told to quiet down, they did. When told to count, stop, and listen, they performed it right away. Managing and controlling the kids outside was not hard nor laborious. They were highly attentive and listened to instructions and performed it right away. Every time the teacher called them for circle time using a whistle, they immediately gathered around. They were highly

attentive, and voluntary answered every question asked to them. Comparing to classroom setting, the children were easier to manage outside. After the activity, the children told their teacher that they were happy and expecting to do the activity again the next day.

Same routines were done and performed for the second day. But this time, their reactions and behaviors differ from the first day. During the intro phase of observation of their environment, children's response varied. This time, they didn't have common answer on what they saw and observed. They enumerated various objects, like clouds, sticks, soils, ground, strong wind, etc. They were confident with their answers and showed abruptness in thinking. They were active right from the very start and maximized their time of roaming and picking things from the environment. When instructed to start picking things up, it was highly evident that most of them collected big numbers of things, mostly exceeding ten (10). During circle time, once again each of them counted the things they have. Most of them have 13, 15, 16, 10 quantities. It was observable that they were able to count things accurately. Upon finding a partner and combining things they have, at first, most of them were confused as to what they will do. But with twice demonstration, they were able to execute the activity properly. Together with their partners, they've counted, although some of them were fast enough and some of them were not. They had a hard time counting the leaves since the wind was strong and blew it all the time. During the interactive demonstration of basic addition using the materials they have gathered, they were all attentive, counting together with the teacher, and tried to answer. It made them happy that the materials that the teacher used were from them. Most of their answers were correct, though some got the wrong answers, but the numbers they got were near to the correct answers. Discipline, control, and management were not issues during outside teaching and learning. The second day of exploring outside, the pupils' excitement was overflowing and cannot be contained. The moment I entered the room, the first question they asked was if we will be going outside again. Their hats and baskets were ready, and they proudly showed me their things. This kind of excitement and happiness were not manifested with their everyday classroom routines. After the activity, three (3) pupils told me that they enjoyed the activity so much, and repeatedly exclaimed how happy they were. Their energy, enthusiasm, and energy were all high during the whole hour activity.

Performing the different parts of the activity outside for the third time made noticeable changes with the children's behavior and numeracy skills. During self-counting of the things they've collected, their counting skills improved. They counted faster and more assertive in their answers. During basic addition with their partners, they were also able to add and count swiftly. Most of them can already visualize the process of combining. Three (3) of them answered instantly even before combining physically the two (2) quantities. Those who counted slowly during the past sessions showed improvement with their speed and accuracy. It was also observed that the children were more helpful with their classmates who had hard time in counting and combining. Peer tutoring was evident, and helpful. Upon exchanging of partners, they've also adjusted their counting behaviors and approaches. Some of them were assertive in counting. Those who were can add and count faster were more dominant in collaborative addition. But they were also willing to help and tutor their partners eventually.

On the fourth day was the actual use of paper and pencil, the children wrote down the number of things they have, and their partner's, and on the bottom, the total number combined of their things. Most of them did it well, though some of the pupils were confused on where to properly write down the numbers, but they got the concept correctly. As day progresses, the children were more playful and alive during activities. They were more expectant, and energized even before going out of the classroom. Even though they were somehow used with activities and its progression, still, their excitement and enthusiasm were always on the maximum level. They were quicker in comprehending instructions and more accurate in executing tasks, since they were well adjusted in working outside the classroom. No dispute or petty misunderstandings occurred within the activity unlike inside the classroom on where small conflicts arise during activities.

During the last day of the outdoor learning activity, notable changes were observed. During collaborative addition, almost all of their answers were correct. Most partners count their things together. It was also

observed that five (5) children were using hand methods for faster counting and combining during group discussions. Upon discussing and over all addition interactive activity, the children showed comprehension of the addition process by answering each addition problem by their own, performing their own addition technique that they've discovered. The last activity was the sharing time, on where they get to express their sentiments and feelings about the 4-day outdoor activity conducted. Each one of them was given ample time to say what they wanted within the group circle. One pupil said that the outdoor activity was her most favorite part of the day. Most of them exclaimed that they were always too excited to go to school, looking forward for this activity. All of them said that they've enjoyed it so much and wanted to do this activity every day. They stated that they've enjoyed counting things that they themselves collected.

During the conduct of this 5-day outside learning activity, gradual, yet noteworthy changes were observed with the pupils. With their subtle shyness to move, indecisiveness to answer, progressing to assertive expressiveness, initiative to take responsibility, and accountability to their own learning. These aspects of their development were not that evident within the classroom normal set-up. Yet, highly manifested during their outside learning activity. Managing them outside was easily done as long as they know their limitations and boundaries. Executing tasks were done accurately, since their attention and focus were undisrupted.

***Manipulatives***

On the first day, children were enjoyed upon seeing the colorful sensory rods that they will be using. During introduction and orientation, they listened well and anticipated using the sensory rods. When asked what they observed with the rods, they immediately answered and identified the colors of the rods; blue, red, green, and yellow. All of them were familiar with color identification. Upon distributing of the rods being equally divided to all of them, the children were asked to count the rods given to them. All of them counted correctly, except for on pupil who had difficulty in counting the rods. He seemed confused in counting the rods one by one. Upon progression of the activity, the teacher will say a number, and the pupils will raise the corresponding number of rods. For all the numbers stated, all of them demonstrated an understanding with one to one correspondence except for one certain child who just follows his classmates. He had a hard time synchronizing his verbal counting with his fine motor skills of separating the rods. With this, his counting was always wrong. His classmates had the initiative to help him counting. With introduction of basic addition process using sensory rods, children were attentive and accurate in counting and getting the correct answers. Implementing this sensory rod approach was not quite different compared to the normal classroom setting. The only difference was that the approach was more individualized, since the pupils formed small group during the activity. They were easy to manage, though at first, they had hard time following instructions. They were also joyed that they used sensory rods, which was also uncommon for them. Fine motor skills of the pupils were fine, except for one pupil who had hard time with coordination.

Children were still excited to use the sensory rods for the second day. They've counted it for the starters. Some of them got 5, 6, 7 and 8 sensory rods. Then they proceeded in finding a partner and adding certain number of rods based on the teacher's instructions. Almost all of them followed instructions without hardships and ended with the right answer. Using sensory rods had been easy for them. They adjusted well and counted more accurately with sensory materials as representation of number concepts. Although the pupil having difficulty in counting were dealt one on one, and eventually, with the help of the classmates. During the basic addition demonstration, they grasped the concept of combining and counting, which made them arrived at the right answer. The children were well-behaved all throughout the activity. But while others are counting, two (2) of the pupils were playing the sensory rods, while the others blankly stared outside the window. It was evident that when it was not their turn, they tend to be distracted.

Children knew already the routine and what they need to do with sensory rods during the third day. They have counted well and combined the rods with their partner's. But when they wrote down the numbers on their paper, most of them were confused on how and where they will properly write the numbers. Some of them wrote big numbers that the succeeding numbers did not fit. Others, when faced with numeral numbers,

easily get confused and lost the concept. But with individual instructions and demonstrations, most of them did it well. Some of them were seen copying their partners, especially those who were having a hard time. Consistently, they were told and encouraged to count on their own and not be pressured by their classmates. Same behaviors were observed with the pupils for this session. They were highly attentive when it's their time to speak, count, and perform the task. But there were moments on where they tend to do other things like playing with the rods, going under the table, and talking with their seatmates. These distractions were present especially when they knew the routine and sequence already.

High familiarization of the routines was observable on the fourth day. Automatically, children knew what to do next, how to merge the manipulatives, count individually and with partner. But when they tried to write down the numbers on a paper and count, most of them were confused as to how they will perform it using paper and pencil method. After some time, some of them managed to perform the activities accurately. Though half of the children tend to play during the counting activities. They were noisy and not that attentive as to compare with their first day.

During the last day, it was highly observable that the children's counting and adding skills improved both verbal and written. They can perform basic addition with abruptness and accuracy with their answers. They did good in both working individually and with partners. Peer tutoring and concern with others developed. Though decrease in attention span and focus were evident. Upon asking how they felt about the activity, most of them were happy and considered the intervention as a play activity.

**Pretest and Posttest Results**

A 16-item simple addition test was administered to both morning and afternoon kindergarten pupils before exposure to the interventions. After the span of five days, same assessment tool was used to measure if there's any improvement with the children's addition skill.

Based on the pre-test and posttest scores of the pupils, seen in Tables 1 and 2, there is an observable improvement in in their performance in paper-and-pencil task in addition, in both the manipulatives and outdoor learning group. The results demonstrates a marked improvement in the performance of the kindergarten pupils in addition in both groups and are reflective of the effectiveness of using manipulatives and using outdoor learning methods.

Based on the distribution seen on Tables 3 and 4, there is an observed significant improvement in the scores of the pupils in the paper-and-pencil test. Before the intervention, during the pretest, both groups show a below average performance based on their scores, with a few pupils in the outdoor learning group reaching the average more than the manipulatives group.

After the interventions were administered, and the post test was given, the results showed that most pupils have reached the average and above average ranges, with the majority of the pupils in the manipulative group in the average ranged, while majority of the pupils in the outdoor learning group in the above average range.

**Interview**

A four-item semi-structured questions were verbally asked and recorded by the teacher-researcher. A total of eight (8) pupils were interviewed; four (4) who used manipulatives, and four (4) that experienced outdoor learning. Common themes were identified upon transcription and initial coding.

Based on the interview with the pupils, the following themes were found to be common among their responses: 1) appreciation of using sensorial materials; 2) feelings of happiness and excitement; 3) concept of play; 4) evidence of learning.

Students remembered the materials they used during the activity. "*Nagbilang ng* sticks." [Counted sticks], a student pertaining to the manipulatives said. "*Nagpulot ng mga bato at dahon."* [Picked up stones and leaves], a student from the outdoor learning states, pertaining to the materials found in the natural environment.

While research about using manipulatives have been inconsistent at best, this study demonstrated that it is still an effective method to promote learning which in this case, is the concept of addition. This ties in with Clements (1999) statement that "manipulative use increases scores on retention and problem solving tests".

The teacher-researcher observation also noted that the students showed interest when introduced the manipulatives, and were excited at the prospect of using it. A positive reaction that ties well with what Clements (1999) stated that attitudes toward mathematics learning improved instruction. This is supported by a student's response "*...masaya laruin yung sticks."* [The sticks are fun to play with].

This observation is also supported by Swan and Marshall's study (2010), when they surveyed teachers about their reasons for using manipulatives, and one of the common responses was that it heightens the enjoyment and 'fun' factor for the kids.

However, there seemed to have an issue with sustaining their attention, especially when it is not their turn to work, and sometimes would even use the rods improperly. Another thing, is that they refer to the activity as 'playing'. "*...nakapaglaro kami"* [We played], quipped a student.

While these observations and responses are not particularly detrimental, this is consistent with the warning that oft comes with using manipulatives and is the reason why they become inefficient instead of effective, in that explicit connection between the mathematical concept and the manipulatives used must be made during instruction, so that the children will see it as a learning tool instead of a toy and to enable it to promote learning (Laski et al, 2015).

Outdoor learning on the other hand is an emerging approach gaining popularity to address the saturation of gadget use among young children. The results of this study, in the outdoor learning front is highly consistent with the lauded benefits of outdoor learning. Primarily, it increased knowledge in the particular concept of addition, as supported by the majority of the pupils achieving perfect scores on the paper-and-pencil assessment after the intervention. In one instance, the teacher-researcher even noted a student eventually found easier ways to add the materials available in nature, resulting in promotion of cognitive development (Cooper, 2015).

More than that, the teacher-researcher observed other salient improvements in confidence, attention span and social interaction, in that she noted that they were easily manageable, and that collaboration came naturally as they progress with the activity. Pupils' responses were highly indicative of their enjoyment of the activity as well. A student was clearly happy when they said that (they are) "*Sobrang saya*" [Very happy]. Another expressed excitement at the prospect of going out of the classroom, "Excited *ako nung lalabas tayo"* [I was excited because we went outside].

Indeed this is consistent with the findings that outdoor learning promotes collaborative play, increases focus and improve self-regulation and helps children be more assertive in exploring their environment (Cooper, 2015).

Evidence of learning was also clearly demonstrated, firstly, by basing on the scores of the students on the paper-and-pencil posttest assessment given. But more than that, it was also clear from their responses, wherein a student said that "*Opo kasi alam ko po yung plus. Nakikita ko kung paano gawin*" [Yes, because now I know 'plus'. I saw how it was done].

Based on the results of the observation and assessment results both interventions improved the children's ability to perform addition, as noted by the teacher - researcher, in that accuracy and speed in answering have improved in the sensorial group, which also reflects the same result for the outdoor learning group and also evident in their posttest results, wherein majority of the pupils have achieved significantly higher scores. It also appears that outdoor learning is more effective than using manipulatives, not only based on the scores and in improving cognitive aspects, but in other non-cognitive aspects as well.

## Conclusion

Both approaches that were utilized in this study, namely, using manipulatives and using outdoor learning have both resulted to an increase in scores and general improvement of knowledge and skills in basic addition of both groups of children. Outdoor learning appears to be more effective compared to manipulatives, not only in the development and retention of the concept and skill, but also in the development of affective and social skills.

Letting children explore and use their senses in learning is a highly valuable and effective means of teaching, despite it being done mostly indoors and with the use of inorganic and customized materials. However, it will be more effective if this aspect is injected with elements of nature and if children are consistently exposed to the natural environment and make use of the materials found therein, as this promotes not only cognitive skills, but affective and social skills as well.

## Recommendations

The researchers recommend a more in depth research and lengthier observation period to further examine the effects of outdoor learning on the cognitive, affective, and social development of young children. Future researchers are also encouraged to make use of other concepts or other topics from other subjects. They are also encouraged to gather more samples, as the results of this study may not be reflective of the whole population.

**Reflection**

*Bravo, Anakim T.*

It is such a relief that this research was able to provide some evidence and insight regarding the importance of outdoor learning and sensorial learning. While it is a given concept, especially in out chosen field in the academe, there is a certain satisfaction in seeing it happen right before your eyes, or at least, in my case, seeing the results and the improvement that these methods have brought upon the children. The conclusion of our study challenges me to think of better ways of executing a lesson, taking into consideration the outdoor exploration school children needs at this young age. It urges me to adapt activities like this, not just to enhance learning, but also to enhance the quality of experiences that I, as an educator, should provide to the children I teach.

*Cipriano, Samantha Danelle C.*

Identifying the problem, working on the process and structure of the intervention, and personally executing the methods of the study with the children were indeed rewarding both personally and professionally. Witnessing and observing the subtle changes with their behaviors, their positive responses, and the happiness each activity gave them totally made the whole study worthwhile. Truly, learning will never happen on cognitive level alone. Each processing of information, from attention to synthesis will only be possible with positive involvement of every domain. Upon conducting this research, it made me realize once again, that in facilitating effective “learning”, the process is as valuable as the outcome.

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## APPENDIX A

*Table 1 Pretest Results*

| GROUP 1 (Manipulatives) | GROUP 2 (Outdoor Learning) |
|---|---|
| 7 | 5 |
| 5 | 4 |
| 1 | 10 |
| 4 | 5 |
| 5 | 10 |
| 3 | 6 |
| 1 | 11 |
| 2 | 1 |
| 4 | 3 |
| 1 | 4 |
| 8 | 2 |
| **3.73** | **5.55** |

*Table 2 Posttest Results*

| GROUP 1 (Manipulatives) | GROUP 2 (Outdoor Learning) |
|---|---|
| 13 | 12 |
| 10 | 13 |
| 10 | 16 |
| 11 | 16 |
| 12 | 16 |
| 14 | 14 |
| 8 | 16 |
| 10 | 14 |
| 14 | 14 |
| 8 | 15 |
| 16 | 11 |
| **11.45** | **14.27** |

*Table 3 Range of Scores and Distribution of Scores using Manipulatives*

| Range | Pretest | Posttest |
|---|---|---|
| **13 to 16** | 0 | 4 |
| **8 to 12** | 1 | 7 |
| **4 to 7** | 5 | 0 |
| **0 to 3** | 5 | 0 |

*Table 4 Range of Scores and Distribution of Scores using Outdoor Learning*

| Range | Pretest | Posttest |
|---|---|---|
| **13 to 16** | 0 | 9 |
| **8 to 12** | 3 | 2 |
| **4 to 7** | 5 | 0 |
| **0 to 3** | 3 | 0 |

## APPENDIX B

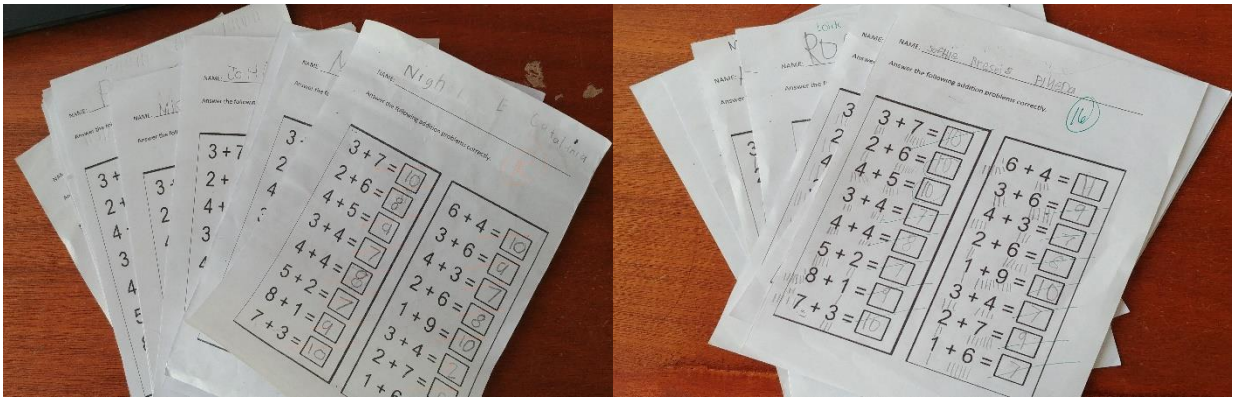


*Figure A1.* The 16-item basic addition used as both pretest and posttest with the children.

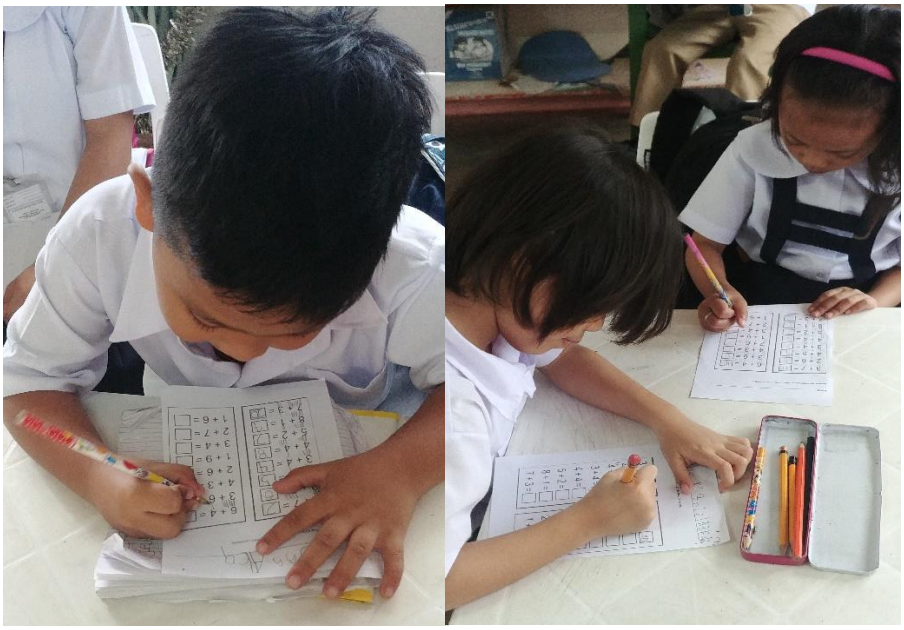

*Figure A2.* Children answering the basic addition test.

*Figure A3.* Children performing tasks using Manipulatives.

*Figure A4.* Children performing tasks under the outside learning approach.

*Figure A5.* Children counting the materials they have gathered from the outside environment.

*Figure A6.* Children during circle time on where they shared their varied experiences outside.

## APPENDIX C

**Interview Questions**

1) What activities did you do?
   *(Anu-ano ang iyong ginawa?)*
2) What did you feel during your learning activities?
   (Ano ang iyong mga naramdaman habang ikaw ay nasa labas o gumamit ng manipulatives?)
3) Why?
   (*Bakit?)*
4) Were you able to understand addition easier outside/ using manipulatives?
   (*Mas naintindihan mo ba ang addition noong nag-aral kayo sa labas o gumamit ng manipulatives?)*

## APPENDIX D

### Four Pupils Interviewed under Outdoor Approach

Pupil 1

1) Namumulot ng bato, at dahon. Naglaro kami nina Loick.
2) Ang saya. Ang saya mamulot ng bato.
3) Nung lalabas na tayo, excited na ako.
4) Opo. Mas madali kasing bilangin yung mga bato.

Pupil 2

1) Pulot ng bato, dahon at ihip ng hangin. Nag addition.
2) Masaya, sobrang saya.
3) Yung nakasobrero masaya, yung hindi nakasobrero hindi masaya.
4) Opo. Alam ko na po ang plus. Lahat alam ko po kasi po nakikita ko po kung pano gawin.

Pupil 3

1) Nag-plus sa bato. Nagpabilog sa labas. Lumabas po tayo.
2) Masaya.
3) Kasi lumabas po tayo.
4) Opo. Kasi po nahahawakan ko po ang mga bato at dahoon.

Pupil 4

1) Gumawa po tayo ng bilog. Tapos po kumuha tayo ng mga bato, dahon. Tapos gumawa tayo ulit ng bilog.
2) Masaya po.
3) Kasi po lumabas tayo.
4) Opo. Kasi po nag plus tayo sa mga dahoon at bato.

## APPENDIX E

**Four Pupils Interviewed under the Use of Manipulatives**

Pupil 1

1) Nagbilang ng sticks, nagsabi ng kulay, nagsabi ng numbers
2) Masaya
3) Kasi may mga sticks na iba’t ibang kulay
4) Opo. Kasi nabibilang naming ‘yung sticks

Pupil 2

1) Humawak ng mga sticks. Nagbilang. Naglagay.
2) Masaya
3) Kasi nakapaglaro ng mga sticks
4) Medyo. Kasi nagbilang kami.

Pupil 3

1) Kumuha ng mga sticks tapos nagbilang ng maraming beses
2) Masaya
3) Kasi naglaro tsaka nagbilang
4) Opo. Kasi nagbilang kami ng numbers at naglaro ng sticks

Pupil 4

1) Nagbilang ng mga sticks, nagsabi ng kulay. Nagdagdag at alis.
2) Masaya
3) Kasi masaya laruin yung mga sticks
4) Opo. Kasi masaya magsticks