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# THE MOST COMMONLY USED MANIPULATIVE MATERIALS AND THE DEGREE TO WHICH THEY ARE USED IN MATHEMATICS BY SPED TEACHERS

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## Abstract

**Background and objective:** Helping children how to understand abstract concepts, such as addition and multiplication, and the symbols that are used to represent these concepts has always been a persistent dilemma for teachers of mathematics regardless of the students' condition; however, how much more those who are handling students with mental disability.

**Methods and Findings:** This study utilized a descriptive research design, the respondents included thirty-one (31) teachers in which 14 of them were SPED major while 17 belongs to the regular teachers handling SPED students under mainstream program out of the total of 65 population. The teachers utilized often the pattern blocks to integrate mathematical lessons to their students. There are five manipulatives materials, which are comprehensively used in teaching mathematics.

**Conclusions:** The teacher-respondents utilize varied materials in enhancing their students' skills in Mathematics. One of the materials they use is commonly known as manipulative materials which are concrete objects that are designed to assist the learners to perceive some mathematical concept by manipulating it, or through a hands-on experience.

**Keywords**: Manipulative Materials, SPED Teachers, Mathematics.

## Introduction

Teachers utilize varied teaching materials in order to make their students learn. Since ancient times, people of many different civilizations have used physical objects to help them solve everyday math problems and it has always been the aim of teachers and education per se to provide equal access to learning regardless of students' condition or disabilities.

Helping children how to understand abstract concepts, such as addition and multiplication, and the symbols that are used to represent these concepts has always been a persistent dilemma for teachers of mathematics regardless of the students' condition; however, how much more those who are handling students with mental disability.

At present, teachers face varied and even double challenges in making students realize the value of a certain object and how it can be used for students to understand basic math concepts. According to Merrit & Brandon, symbols may be difficult to teach to children who have not yet grasped the concepts that they represent. At the same time, the concepts may be difficult to teach to children who have not yet mastered the symbols. However, the researcher believes that the introduction of "manipulatives" or manipulative materials gave students more ways to better understand Math concepts particularly those with mental disability.

According to Oladejo et al manipulative teaching material is defined as any object from the real world that children can move around, play with or even build model of, to show a scientific concept. They are concrete, hands on models that appeal to all the senses and can be touched by students. These manipulative teaching materials should relate to a student's real world.

Concurrently, there are some situations when the teacher has a hard time explaining some math concepts to his/ her students because they have

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limited ability; but as seen by the researcher, the uses of manipulative devices are of great help since they can concretely identify and manipulate those objects or devices. Since the researcher is a special education teacher who has come across varied types of learners with disability, she found that students significantly react to manipulative materials, which are utilized in the classroom. Hence, she wants to know other manipulative materials which other special education teachers utilize in teaching and the extent to which those devices effect the cognitive development of students; and if it also applies to other students who have mental disability.

The researchers believe that all students must have the opportunity to learn and meet the same high standards if they are to access the knowledge and skills necessary in their lives; thus, she would like determine the effects of manipulative materials in the cognitive development of students with mental disability and decided to conduct a study entitled, "Effects of Manipulative Materials for Mathematics in the Academic Performance of East District Division of Valenzuela: Basis of an Enhanced Training Program."

## Research Methodology

### 1. Research design

The researcher employed the descriptive research design in undertaking the study. This research design is used to describe characteristics of a population or phenomenon being studied; it also addresses the "what" question.

### 2. Respondents of the study

Out of the total of 65 population in the entire region of Valenzuela, the respondents of the study included thirty-one (31) teachers in which 14 of them were SPED major while 17 belongs to the regular teachers handling SPED students under mainstream program from the East District. The respondents were chosen to be part of the study as they are using manipulative materials to improve students' performance in Mathematics in the Division of Valenzuela City. Part of the inclusion criteria focuses on teachers who are handling intellectual disabled students under special education program. Further, the respondents are holding a permanent position within the Academic Year 2018-2019.

### 3. Sampling technique

In this study, the researcher used a purposive sampling. All teachers who were handling intellectual disabled student in special education program in East district of Valenzuela for the SY 2018- 2019 were selected to participate in the research.

### 4. Research instrument

The researcher utilized a self-constructed questionnaire that was patterned on the program of special education in the Philippines. In addition, the questionnaire tool was also based on similar studies and or studies related with the present study. This research instrument was drafted and formulated upon the recommendations of the researcher's thesis adviser and other experts who were part of the pre-oral defense. Thus, the questionnaire tool was validated and the researcher conducted a pilot testing to the 10% of the population sample to ensure the reliability of the result.

### 5. Statistical treatment of data

Frequency and Percentage distribution was used by the researcher to describe the profile of the teachers based on problem number 1 of the study. Weighted Mean was used by the researcher to determine the most common manipulative materials, the extent to which teachers utilize those materials in teaching pupils with mental disability and the level of the effects of manipulative materials in the cognitive development of pupils with mental disability.

### 6. Ethical consideration

Ethical guidelines were followed for the whole research period. The researcher submitted the study for review and approval of the Ethics Review Board of the university. It followed the National Ethical Guidelines for Health and Health-Related Research 2017 prepared by the Philippine Health Research Ethics Board.

## Results

Majority of the respondents belong to age 36-40, which is 38.7% of the total number of respondents. Most of the participants are female with a total of 83.9% of the whole population. Further, 83.9% of the respondents are married and 54.8% are currently undertaking their master's degree. Specifically, the respondents are Special Education major which constitute a frequency of 11 or 35.5%. In addition, 41.9% of the respondents only have more or less than 5 years of experience in handling students with special needs, which most of them are rank as teacher 1.

### 1. Most utilized manipulative materials

**Table 1: Most Utilized Manipulative Materials**

| Manipulative Materials | f | % |
|---|---|---|
| 1. Geoboards | 2 | 6.45 |
| 2. Pattern blocks | 6 | 19.35 |

| | | |
|---|---|---|
| 3. Color Tiles | 2 | 6.45 |
| 4. Unifix/Snap Cubes | 5 | 16.13 |
| 5. Triman Compass | 1 | 3.22 |
| 6. Cuisenaire Rods | 1 | 3.22 |
| 7. Base-10 Blocks | 2 | 6.45 |
| 8. Number Tiles | 2 | 6.45 |
| 9. IT Explorer Plus Calculator | 1 | 3.22 |
| 10. Two-sided Counters | 1 | 3.22 |
| 11. Judy Clock | 2 | 6.45 |
| 12. Abacus | 1 | 3.22 |
| 13. Scale/Balance | 1 | 3.22 |
| 14. Tangrams | . 4 | 12.90 |
| 15. Other materials, please write: | | |

This result reveals the most utilized manipulative materials in their Mathematics class to improve their students' performance. The analysis demonstrates that the pattern blocks (f=6, 19.35%) is widely used by the respondents which was followed by the unifix/snap cubes (f=16.13%). Another most utilized is the tangrams (f=4, 12.90%) and the geoboards, color tiles, base 10 blocks, number tiles and judy clock (f=2, 6.45). On the other hand, there are also materials which are not a preferred option of the teachers; these are the triman compass, Cuisenaire rods, IT explorer plus calculator, two-sided counters, abacus and scale/balance (f=1, 3.22%).

According to this finding, tangible objects that can be easily manipulated were widely used to grasp the student's comprehension and interest in learning Mathematics. Moreover, it is evident that the respondents utilized the simplest things which is constantly encountered in the students' environment. In addition, the result illustrates that the respondents were applying various manipulative materials to enhanced the scholastic performance of the intellectual disabled students in learning Mathematics. Thus, this serves as a framework to promote critical thinking and to improve their cognitive development.

This result was supported by Ball which clearly explains and highlights the need for both teachers and mathematics researchers to apply an improved method that is significantly useful to children in learning mathematical concepts and symbols. Thus, numerous attempts to improve mathematics instruction have called for greater use of concrete objects.

## 2. Extent of the use of manipulative materials

**Table 2: The Extent of Use of Manipulative Materials in Mathematics Among Respondents**

| Manipulative Materials | Mean | Rank | Verbal Interpretation |
|---|---|---|---|
| 1. Geoboards | 3.3226 | 12.5 | Moderate Extent |
| 2. Pattern blocks | 3.8065 | 2 | High Extent |
| 3. Color Tiles | 3.6452 | 3.5 | High Extent |
| 4. Unifix/Snap Cubes | 3.3871 | 9.5 | Moderate Extent |
| 5. Triman Compass | 3.1613 | 14 | Moderate Extent |
| 6. Cuisenaire Rods | 3.4839 | 7 | Moderate Extent |
| 7. Base-10 Blocks | 3.6129 | 5 | High Extent |
| 8. Number Tiles | 3.9677 | 1 | High Extent |
| 9. IT Explorer Plus/Calculator | 3.3548 | 11 | Moderate Extent |
| 10. Two-sided Counters | 3.4194 | 8 | Moderate Extent |
| 11. Judy Clock | 3.3871 | 9.5 | Moderate Extent |
| 12. Abacus | 3.3226 | 12.5 | Moderate Extent |
| 13. Scale/Balance | 3.6452 | 3.5 | High Extent |
| 14. Tangrams | 3.5161 | 6 | High Extent |
| 15. Other materials | 3.0645 | 15 | Moderate Extent |
| **Total Mean** | **3.4730** | | **Moderate Extent** |

The result of weighted mean on the extent of use of manipulative materials in Mathematics among respondents has five usual manipulative materials utilized by the teachers in teaching Mathematics which are the following: number tiles (ẍ=3.9677, Rank 1), pattern blocks (ẍ=3.8065, Rank 2), color tiles and scale/balance (ẍ=3.6452, Rank 3.5), base 10 blocks (ẍ=3.6129, Rank 5) and lastly, tangrams (ẍ=3.5461, Rank 6). Hence, these manipulatives were utilized to a high extent based on the response of the respondents.

On the other hand, the manipulative materials with the least mean result are as follows: unifix/snap cubes and judy clock (ẍ=3.3871, Rank 9.5), IT explorer plus calculator (ẍ=3.3548, Rank 11), geoboards and abacus (ẍ=3.3226, Rank=12.5), triman compass (ẍ=3.1613, Rank 14), and other materials (ẍ=3.0645, Rank 15). Therefore, these manipulative materials were utilized by the respondents to a Moderate extent.

This result illustrates that there are manipulative materials which are used to a certain extent by the respondents, therefore, this indicates that these were perceived to be efficient to incorporate in their Mathematics class since the students require skills, however, it should be in an easiest way that is best fitted to their level of learning. Further, the use of simple materials allows the learners to become more confident in learning Mathematics and to master the skills which are essential for them.

The result is evident in the study of Uttal, Scudder & DeLoache, that coincides through interacting with concrete objects, thus, the students' interest is stimulated with the aid of manipulative materials in mathematics. Further, manipulative materials have also been shown to provide a strong foundation for students mastering the following mathematical concepts: number relations, measurement, decimals, number bases, percentages, probability, and statistics.

## Discussion

The teachers utilized often the pattern blocks to integrate mathematical lessons to their students. Also, at some point the use of unifix/snap cubes are observed to be effective for the students to gain understanding towards mathematical solutions or equations. Tangrams, geoboards, color tiles, base 10 blocks, number tiles and Judy clock are also present in the materials being introduced to the students. However, the triman compass, Cuisenaire rods, It explorer plus calculator, two sided counters, abacus and scale/balance are not widely applied since it is more advanced then the materials mentioned above. Thus, this will create confusion for the students with intellectual disabilities rather than helping them understand Math.

There are five manipulatives materials, which are comprehensively used in teaching mathematics. The number tiles, pattern blocks, color tiles and scale/balance, base 10 blocks and lastly, tangrams. These manipulatives are used to a high extent based on the responses of the respondents. On the other hand, there are manipulative materials which are available but not commonly used by the students. The unifix/snap cubes and judy clock, IT explorer plus calculator, geoboards and abacus, triman compass, and other materials. These manipulative materials were utilized by the respondents to a Moderate extent.

## Conclusion

The respondents are teachers who are mostly in their mid-40's and are female. They are also married and have acquired units in their masters' degree program. Hence, they are generally Special education majors who have less than 5 years of experience in handling students with special needs; thus, majority of them hold a Teacher 1 position.

The teacher-respondents utilize varied materials in enhancing their students' skills in Mathematics. One of the materials they use is commonly known as manipulative materials which are concrete objects that are designed to assist the learners to perceive some mathematical concept by manipulating it, or through a hands-on experience.

The teacher-respondents utilize number tiles, pattern blocks, color tiles and scale/balance, base 10 blocks and tangrams to a high extent which implies that they are effective in enhancing the cognitive skills of the students in Mathematics subject.

## Conflict of Interest

There is no conflict of interest between the authors in this manuscript.

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