

Educators' Exposure to Manipulative Materials

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Abstract– This is qualitative research that examines the exposure of educators to manipulative materials using a phenomenological approach. Phenomenology is a qualitative research method for educational research, enabling flexible activities to understand complex phenomena and human social experiences (Alhazmi & Kaufmann, 2022). A total of 12 participants were included in the study: 4 Math teachers, 4 Science teachers, and 4 English teachers. They were selected based on two criteria: (1) they were educators teaching Math, Science, and English; and (2) they are aware of the manipulative materials. The study used semi-structured interviews, conducted in virtual and face-to-face settings, with 30-40 minutes each. The results highlighted ten themes including educators' awareness, perspectives, utilization, challenges, independent learning behavior, learning comprehension, positive attitude, self-identity, and integration.

Keywords: Educators, Exposure, Manipulative, Materials

I. INTRODUCTION

Manipulative materials or manipulatives refer to any materials that are explorative and interactive that can assist in the learning process. The approach has been utilized in the fields of mathematics in the form of blocks, sinners, or organs. (Calgary Board of Education, n.d)

Manipulatives have been proven to be effective based on the studies by, Moyer, Kieren, and many more in the field of mathematics. But very few studies cover its effectiveness in other fields such as English and Science. It is a common practice in 21st-century education to use visual materials such as video presentation and slides but such a passive approach cannot be considered as true manipulatives since the participation of the students remain passive. The stagnation of the utilization of manipulatives can be rooted in the limitations of manipulation in the traditional form. This limitation cannot simply be resolved due to several factors; economic and feasibility. In this regard, the usage and potential of manipulatives remains in the field of mathematics to provide symbolic equivalent to numerals.

This methodology stagnation and exclusivity are slowly mitigated by the increase in the usage of technology. Researchers release in the current century heavily focused on the migration of traditional means to virtual. In the field of literature teaching, this is prominent in the usage of movies and films to teach stories. The time I spent as a research panel member opens a more complex definition of virtuality. The rise of virtual manipulation, in contrast to traditional, introduced new capabilities different from the passive engagement that video viewing provides. The new field of software toolkits and programs for visual representation provides a

more dynamic approach. This new form of manipulatives removes some of the limitations in traditional forms, Moyer.

Spicer (2000), discussed the difference between static and dynamic representation. Static representation can be associated with the likes of pictures and projection whereas the use of film is under. The other type is a dynamic representation which uses the virtual representation of the “objects” that traditional manipulatives use since this can be manipulated or controlled. Such an approach has been accidentally applied to contemporary materials such as Dora the Explorer in the game version on its aim of vocabulary enrichment and diction. The potential of manipulatives to aid learning is affirmative and unquestionable by multiple studies in the past. This study aims to identify the amount of presence and utilization of manipulatives in the academe across Bulacan areas.

II. METHODS

A. *Research Design*

This researchers employed a qualitative research method of inquiry using a phenomenological approach. Phenomenology is a qualitative research method for educational research, enabling flexible activities to understand complex phenomena and human social experiences (Alhazmi & Kaufmann, 2022). It helped the researchers to explain assumptions and meanings from the participants’ interview transcript providing detailed descriptions of investigated phenomenon.

B. *Participants and Sampling Technique*

Purposive sampling was used in this study. A qualitative research technique for selecting individuals with specialized knowledge or experience to maximize limited resources and identify information-rich cases (Patton, 2002 cited in Palinkas, et. al, 2016). This involves identifying knowledgeable individuals or groups for particular phenomena of interest (Cresswell & Plano Clark, 2011 cited in Palinkas, et. al, 2016).

The participants of this study were selected based on two criteria: (1) they were educators teaching Math, Science, and English; and (2) they were aware of the manipulative materials. A total of 12 participants were included in the study: 4 Math teachers, 4 Science teachers, and 4 English teachers. To protect the privacy of the participants, and encourage them to express themselves freely, they were assigned pseudonyms and their names were withheld. Their pseudonyms were composed of a letter and a number, such as R1, R8, R12, etc. The participants were informed about the study’s nature before the interview started and were notified that they could disengage at any point they wanted.

C. *Data Gathering Procedure*

A semi-structured interview was employed in this study. The interviews were conducted both virtual and face-to-face whatever was convenient for the participants. 30-40 minutes were allotted for each individual for the said virtual and face-to-face interview. The interview questions include: (1) Are you aware of manipulative materials? (1.1)What are your thoughts about manipulative materials? (2) Do you use manipulative materials in your classes? (2.1)Why do you use it? (2.2)What stops you from using manipulative materials? (3)What topic/s do you believe manipulations be integrated? (4)What factors do you consider in using manipulative materials in your teaching? (5)Based on your experiences in using manipulative materials in your teaching, what do you think are the prospects and challenges? (6)Based on your experience, do you think manipulative materials are effective means to foster students’ class participation? Why do you say so? (7)Based on the result of your assessment, do you think the use of manipulative materials is an effective way to enhance students’ comprehension? Why do you say so? (8)Based on your experience, do you think the use of manipulative materials is an effective way to boost students’ attitudes about learning? Why do you say so? (9)Will you continue using manipulative materials in your teaching? Why or why not?.

D. Data Analysis Tools

To identify patterns, issues, and themes in participants' responses, content analysis was used. Researchers read the interview transcripts and reviewed each response individually. Units of information, such as words, phrases, and concepts, were identified as meaningful and could be interpreted by others. The researchers coded and categorized the extracted information based on the common themes and subcategories and further analyzed their meaning.

III. RESULTS AND DISCUSSION

This section discusses the themes that emerged in the study. Interview excerpts were presented as original without grammar and sentence structure, reflecting natural data characteristics. The themes were labeled based on the following:

- i. Educators' awareness of the manipulatives – The emerging sub-themes were related to educators' knowledge about the use of manipulations in the teaching and learning process
- ii. Educators' perspectives on the manipulatives – The emerging sub-themes were related to the effectiveness of manipulatives in the teaching-learning process.
- iii. Educators' utilization of manipulatives – The emerging sub-themes were related to how frequently educators use manipulations in their teaching.
- iv. Educators' consideration in using manipulatives - The emerging sub-themes were related to the availability of the resources, time constraints, target learning competency, relevance of the materials to the lesson, and the level of student's capacity to manipulate the material
- v. Educators' challenges of using manipulatives – The emerging themes were related to the cost, availability, efficiency, and suitability of manipulations.
- vi. Manipulatives support independent learning behavior – The emerging themes were related to fostering student engagement and interaction and encouraging students to make independent discoveries.
- vii. Manipulatives foster student learning comprehension - The emerging themes concerned with enhancing students' comprehension and helping their visualization.
- viii. Manipulatives encourage a positive learning attitude – The emerging themes centered on making learning more engaging and enjoyable and enhancing students' focus and motivation.
- ix. Manipulatives strengthen self-identity – The predominant themes were developing a deeper comprehension of oneself and exploring one's values, beliefs, roles, and culture.
- x. Topics where manipulation is integrated – The participants provided a list of topics for their respective subjects handled where manipulations can be used efficiently and effectively.

Table 1
Awareness of Manipulatives

Sub- Theme	Theme
Educators use manipulatives in their teaching	Most educators are aware
Manipulatives were taught in school	
Educators are aware of the manipulatives	
Manipulatives are important for educators	
Educators definition of manipulatives	
Not aware of the manipulatives	
Manipulatives boost student's creativity and critical thinking	Positive Perspectives on manipulatives
Manipulatives enhance student's retention	
Manipulatives are effective learning tool for young learners	

The majority of educators responded that they were familiar with manipulative materials because they use them in their classrooms, it was taught in school, manipulatives were essential to educators, and they played an important role in the educational setting

Due to the effectiveness of the manipulatives, many educators are becoming reliable and prominent even from decades back such as Fennema’s work in her paper Manipulatives in the classroom (1973)

Educator’s Perspectives on Manipulatives

The participant's perspective on manipulative materials was extracted from a variety of perspectives, including manipulatives raising students' ability to think critically and creatively, increasing student retention, and being effective for young learners. The informants believe through their experience that using of manipulatives is highly encouraged supported by Suydam (1984) that manipulatives have a high confidence to be used by educators.

Table 2
Utilization of Manipulatives

Sub- Theme	Theme
Rarely use in higher level	Few of the educators utilize manipulatives
Use ICT most of the time	
Only use for experiential learning	
Use of manipulatives decreases as the student progress to a higher level	
Use for student active learning	Use of manipulatives aid the teaching-learning process
Availability of the resources	Educator's factors to consider in using manipulatives
Time constraints	
Target learning competency	
Relevance of the materials to the lesson	
Level of student's capacity to manipulate the material	
Manipulative materials are too costly	Educator’s Challenges of Using Manipulatives
Manipulative materials are not available	
Manipulatives are not efficient for the subject and less relevant for instruction	
Manipulatives are time-consuming	

Few participants mentioned the use of manipulatives in their classes for the following reasons: the use of manipulatives reduces as students advance to higher levels, and they are only used for experiential learning

Table 3
Application of Manipulatives

Sub- Theme	Theme
Manipulatives foster student's engagement and interaction	Manipulatives support independent learning behavior
Manipulatives help student's discover things on their own	
Manipulatives improve student's understanding	Manipulatives foster student learning comprehension
Manipulatives helps student's visualization	
Manipulatives makes learning more interesting and fun	Manipulatives encourage a positive learning attitude
Manipulatives improve student's attention-span and motivation	

Manipulatives develop understanding of one's self	Manipulatives strengthen self-identity
Manipulatives help explore one's values, beliefs, roles, and culture	

Five subthemes emerged regarding educator considerations for manipulative materials. These were the cost and availability of the resources, the constraints of time, the objective learning competency, the relevance of the materials to the lesson, and the student's ability to manipulate the materials."

Freer Weis (2006) urges the use of manipulatives for children to develop their constructive capabilities. The experience it provides can be great training to create and build. Thus, the manipulative can be used as a material to reach the highest level of learning.

Educators' challenges of using manipulatives

There were four subthemes identified for issues that educators face when utilizing manipulations in the teaching and learning process. These were the cost, time constraints, availability, subject effectiveness and instructional relevance, and suitability of the topic

Manipulatives support independent learning behavior

The emerging sub-themes were related to fostering student engagement and interaction and encouraging students to make independent discoveries, as affirmed by the following lines

An informant said, *"makes the class actively engaged in the lesson."* One detailed that she *"saw how the students were getting excited to participate because it is rare for them to have a class with things they can manipulate."* Another, acknowledged that the use of manipulations inside the classroom helped in *"enhancing engagement and motivation by making learning more hands-on and active"* during the teaching and learning process. Lastly, they concluded that manipulations aid students become independent learner *"because they discover things by their own and you can see they can improve right away."*

Manipulatives foster student learning comprehension

The emerging sub-themes concerned with enhancing students' comprehension and helping their visualization. R8 assured that the *"use of manipulatives can aid in comprehension of the students because it supplements existing teaching and learning materials."* Likewise, R11 added that manipulations were essential to foster student learning comprehension *"because it leads the students to understand the nuances of the language, the subtleties of the concepts, and the implications of the ideas. It also helps them to understand the connections between different parts of the lesson and to see how the big picture fits together."* R4 revealed that in Mathematics, manipulative materials *"helps students understand complex mathematical concepts more concretely and effectively."* Finally, R3 exposed that manipulations were *"very helpful especially for things that is hard to describe and hard for the students to visualize."*

Manipulatives encourage a positive learning attitude

The emerging sub-themes centered on making learning more interesting and fun and enhancing students' focus and motivation. R2 disclosed that *"when students see something that they use in learning, they become more interested."* In addition, R5 affirmed that the use of manipulations in the classroom *"is entertaining the students while learning."* R8 concluded that students *"also improves their attention span and motivation to learn the lesson"* with the use of manipulative materials in teaching the lesson.

Manipulatives strengthen self-identity

The predominant themes were developing a deeper comprehension of oneself and exploring one's values, beliefs, roles, and culture. R3 stated that manipulative materials strengthen the students' self-identity because it *"helps them explore their values and beliefs and develop better understanding of themselves as individuals."* On the other hand, the utilization of manipulative materials in the classroom facilitate students' learning and allow them to *"experiment with different identities and roles to learn more about who they are"* (R10). As a final point, manipulatives strengthen self-identity because *it helps the students discover their interests and talents, as well as their strengths and weaknesses"* (R2).

Table 4
Topics of Integration

Topics where manipulation be integrated	
Mathematics	Shapes
	Measurement
	Numbers
	Fractions
	Problem Solving
Science	Figures of animals
	clouds
	rocks
	human organs
	solar system,
English	Literature
	Research
	designs
	Methodologies

The topics for Mathematics: shapes, measurement, numbers, fractions, and problem-solving; for Science: figures of animals, clouds, rocks, human organs, solar system, and science experiments; and for English: literature, research designs, and methodologies.

IV. CONCLUSIONS

1. The study found few participants mentioned the use of manipulatives in their classes for the following reasons: as students advance to higher levels, the use of manipulatives decreases, and they are only used for experiential learning.
2. The study highlighted the cost, time constraints, availability, subject effectiveness, and instructional relevance, as well as topic suitability as the main challenges experienced by educators when using manipulative materials in their teaching.
3. The cost and availability of the resources, constraints of time, objective learning competency, the relevance of the materials to the lesson, and the student’s ability to manipulate the materials were the five sub-themes that appeared in educators’ consideration when using manipulative materials.
4. The extracted themes: manipulatives support independent learning behavior, manipulatives foster student learning comprehension, manipulatives encourage a positive learning attitude, and manipulatives strengthen self-identity suggesting that manipulative materials are effective tools in the teaching-learning process.

The study identified ten themes related to manipulatives in education, including educators' awareness, perspectives, utilization, considerations, challenges, support-for-independent learning behavior, learning comprehension, positive learning attitude, self-identity, and integration of manipulation in teaching. Manipulatives are essential for students' creativity, critical thinking, retention, and effectiveness for young learners. They are rarely used at higher levels and are only used for experiential learning. Educators must consider resource availability, time constraints, target-learning competency, material relevance, and student capacity to manipulate.

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