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The Effectiveness of Manipulatives in the Elementary School Classroom

By Holly Berkseth

"I hear and I forget. I see and I remember. I do and I understand."
- Confucius

Introduction

What are the best teaching strategies? How can educators help children learn most effectively? Are there strategies that can be used to teach children in meaningful and engaging ways while still keeping up with state standards? Questions like these have been raised by parents and educators for many years and are widely discussed and debated topics in the educational realm. Numerous research studies have been conducted to try and answer these questions effectively and efficiently. A common topic of interest and debate in these studies has been the use of three-dimensional objects called manipulatives.

The following paper aims to present the different sides of the "manipulatives debate" and provide additional research findings on the topic. The results of this study will benefit those affected by the practices and procedures in the elementary school setting and will provide useful information to current elementary school teachers in regards to the planning of their lessons and implementation of strategies. The results of this study aim to assist teachers in providing the most efficient and effective means of education to elementary school students.

Background

In recent years, elementary school teachers have accepted the use of three-dimensional educational materials, often referred to as manipulatives, as an effective classroom practice. (A. Daigger & Company, n.d.; McNeil & Jarvin, 2007; Moch, 2008; RAFT, 2009) Much research has been performed to investigate the effectiveness of these manipulatives on student comprehension, particularly in the area of mathematics. This section will outline empirical research done in three areas: the use of manipulatives in elementary classrooms, teacher planning, and kinesthetic/experiential education.

Using Manipulatives in the Elementary School Classroom

One of the arguments for the use of manipulatives in the classroom is that manipulatives provide an additional channel for conveying information. Nicole McNeil (2007) presents both sides of the manipulatives debate. According to McNeil, those who support the use of manipulatives suggest that manipulatives facilitate learning by not only providing an additional channel for conveying information, but also by activating real-world knowledge and improving memory through physical actions. On the opposite side of the argument are those that suggest that manipulatives might lead students to focus on having fun at the expense of learning or might even make learning more difficult because they require dual representation. In response to these arguments, McNeil looked at the theories of past child psychologists and theorists, such as Jean Piaget and Maria Montessori, and expanded on their findings. From her research, McNeil found that "children do not come into the world with the capacity for abstract thought. Instead, children must construct abstract concepts through their interactions with concrete objects in the environment." (McNeil & Jarvin, 2007) In order for children to gain complex understandings of the world around them, they must first be given opportunities to explore the physical objects in their environment.

Dewey also adhered to these beliefs about a child's learning: "Under normal circumstances, learning is a product and reward of occupation with subject matter... This means that students shall be occupied with subjects for real reasons or ends and not just as something to be learned." (Dewey, 1975) Dewey further explained in his writing that teaching is like art. Artists in every branch depend upon thorough acquaintance with materials and tools and the manipulation of them. (Dewey, 1975) These beliefs are aligned with the natural behavior of children. According to an article on hands-on learning, "children are by nature observers and explorers, and the most effective approach to learning should capitalize on these intrinsic abilities." (RAFT, 2009)

A second argument for manipulatives is that they help students think, reason, and solve problems. Peggy Moch conducted a study on the use of manipulatives with a class of 16 fifth-graders at a local elementary school. (Moch, 2008) She found that these students scored a class average of 49 percent on Florida's practice standardized test and wished to increase these scores. She worked with students twice a week for 90 minutes, using lesson plans that were based on current research related to semantic and episodic memory. During these lessons, manipulatives were used in a variety of ways. They were used for data collection, as tools for practicing concepts taught during mini-lessons, and as a way for students to explore independently and find their own connections and understandings. Additionally, manipulatives (such as tangrams and centimeter cubes) were used to help students get a better grasp on spatial sense and abstract geometric concepts. Although Moch chose to use manipulatives in a variety of ways in her lessons, each lesson followed a similar style. Students would first be organized into different groups where they were asked to use some sort of manipulative. Then, students would be asked to write about their perceptions of the experience. In her research, Moch found that using manipulative activities in the classroom engaged both semantic and episodic memory systems, further enhancing the opportunity for retention. (Moch, 2008)

Moch's strategies proved to be successful. Not only did students' scores increase from 49 to 59 percent when the practice test was retaken, but students also gained a new love for learning and a sense of self-motivated inquiry in regards to their own education. In Moch's (2008) conclusions, she presented the following suggestions:

"Manipulatives can be important tools in helping students to think and reason in more meaningful ways. Manipulatives can contribute to the development of well-grounded, interconnected understandings. The use of manipulatives in the classroom is necessary; it offers a natural way for children to make sense of the mathematics they are trying to learn. It is important to have manipulatives available to children to support their thinking. After all, students have been 'using objects to model the situations long before they have memorized facts or learned to use written symbols'." (p. 83)

These conclusions are supported by research that was conducted by the Educational Teaching Aids division of A. Daigger & Company – a corporation that produces manipulative-based educational and supplemental materials for Pre-Kindergarten and grades K-12. The research by ETA states: "Manipulatives help students learn by allowing them to move from concrete experiences to abstract reasoning. Manipulatives can be important tools in helping students to think and reason in more meaningful ways." (A. Daigger & Company, n.d.)

Another argument for the use of manipulatives is that they activate real-world knowledge and abstract thinking, reducing the time it takes for children to master skills. According to Moch in her study of fifth-graders, "The relevant application of manipulatives to real-world as well as to classroom situations helps students visualize

and develop problem-solving strategies. Conceptual approaches to instruction result in good achievement, good retention, and a reduction in the amount of time children need to master skills." (Moch, 2008) This is supported by McNeil's research as she states: - "[Through the use of manipulatives], students gain a deeper understanding of abstract concepts when those concepts are linked to the real world...Manipulatives can help children draw on their practical, real-world knowledge." (McNeil & Jarvin, 2007)

A final argument for the use of manipulatives is that they can make learning fun. Moch wrote in her study that many of her students had never realized that learning could be so much fun! The students also stated that by doing the work provided by Moch during lessons, they felt they were learning a lot more than by just doing worksheets like they had been doing before. Additionally, students' general reaction to the use of manipulatives was very encouraging. Several children experienced 'aha' moments. (Moch, 2008)

However, not all researchers and educators support the use of manipulatives. One argument against their use is that they lead students to focus on having fun instead of deep learning. According to McNeil, research often suggests that students tend to view manipulative activities as playtime, an association that may hinder learning as it devalues the potential of these materials as representations for learning. (McNeil & Jarvin, 2007) Another argument is that manipulatives do not work for everyone or everything. Both Moch (2002) and McNeil (2007) recognize that the use of manipulatives for teaching in the classroom may not work for everyone or for everything and cannot cure every problem encountered by students.

Even though there are apparent problems with manipulative use, a counterargument claims that many of these problems could be avoided altogether by allowing students to

work with manipulatives prior to dealing with them on a more abstract level.

Developing ideas through scaffolded lessons that move from concrete to semi-concrete, semi-abstract, and finally abstract levels is a well-documented and known pedagogy for teaching elementary school children. (Moch, 2002)

Manipulatives and Teacher Planning

A second area to discuss in regards to the use of manipulatives is teacher planning. As stated in the above section, a counterargument claims that many of the problems with manipulatives can be avoided through the strategic planning of scaffolded lessons by the teacher. In order to accomplish these goals, teachers must assess their current programs, the amount of time they currently spend re-teaching concepts, and then carefully reflect on how they could properly introduce and use manipulatives in their professional practice. (Moch, 2002)

One of the most common problems teachers face when using manipulatives is that they don't have time to include manipulatives as part of their lessons. Moch (2008) found in her study that there are many underlying factors affecting this including lack of availability of kits, insufficient budgets for manipulatives, lack of administrative support, and being overwhelmed with other classroom responsibilities. Additionally, the need to cover a large amount of curriculum quickly, limited classroom time, and the pressure imposed by standardized testing inhibits teachers from using manipulatives. Some teachers also claim that they do not have time to stay up-to-date on the latest findings, and this is what restricts them from utilizing manipulatives in their classrooms. (McNeil & Jarvin, 2007)

Researchers have uncovered another possible problem with manipulatives – the ineffective use of the tools by classroom teachers. Studies have shown that some teachers

see manipulatives as a type of reward system for good behavior rather than as an important formative tool for routine use in teaching concepts. Other problems arise when teachers attempt to give students answers too quickly, or force students to perform manipulative-based tasks in a step-by-step procedure instead of allowing them to explore the manipulatives on their own. (Moch, 2008) In her presentation of the manipulatives debate, McNeil suggests that “to use manipulatives effectively, teachers need to embrace reform efforts that emphasize hands-on learning. They need to recognize that students can construct their own knowledge. Otherwise, they will not be able to create conditions that allow their students to learn from interacting with manipulatives. In short, the basic idea is that manipulatives are beneficial, but only if teachers embrace them and use them properly – as tools for constructing knowledge, not as toys.” (McNeil & Jarvin, 2007) Additionally, Moch and A. Daigger & Company suggest that using manipulatives effectively takes time and practice. Using them strictly because they are the latest fad or because of some administrative mandate, without teachers investing their time or interest, results in a less than desirable outcome for students, teachers, and administrators. (Moch, 2008) Teachers play a crucial role in helping students use manipulatives successfully, so that they move through the three stages of learning (concrete, representational, abstract) and arrive at a deep understanding of concepts. (A. Daigger & Company, n.d.)

Both long-term and short-term planning and utilization of manipulatives by the teacher can help alleviate some of the issues of limited classroom time and the need for increased classroom management. At all stages of the planning, the teacher should draw specific links between manipulatives and the academic content they are representing. The manipulatives should be used as a bridge rather than as a substitute for learning. Scaffolded lessons should also be provided to assist children in learning academic content progressively. (Balter, 2005) Additionally, manipulatives should be used long-

term. Research shows that use of manipulatives over the long-term provides more benefits than short-term use does. With long-term use of manipulatives, educators have found that students make gains across the curriculum. (A. Daigger & Company, n.d.)

A common theme in research is that worksheets and lecture-style teaching should not be the beginning or the end of any student's educational experience. Teachers should always be looking for new and exciting ways to aid student learning, and manipulatives seem to offer an exciting way to make this happen. (McNeil, 2007) Additionally, it is important to note that the amount of time often wasted re-teaching concepts far outweighs the amount of time required to use manipulatives to teach academic material more effectively in the first place. (Moch, 2002) Manipulatives save time in the long run when planned for and utilized appropriately by classroom teachers.

Manipulatives and Experiential Education

A final area to discuss is experiential education. The theory of experiential education (more commonly known as "hands-on" or "kinesthetic" education) revolves around the idea that learning is enhanced when students acquire knowledge through active processes that engage them. Studies have shown that manipulatives can be key in providing these types of opportunities for students. (A. Daigger & Company, n.d.)

According to McNeil's analysis of the manipulatives debate, hands-on educational materials (or manipulatives) tend to induce physical action, which has been shown to enhance memory and understanding in elementary-aged students. (McNeil & Jarvin, 2007) In her own studies, Moch found that the use of manipulative activities engaged both semantic and episodic memory systems, further enhancing the opportunity for students to retain the information presented to them in the classroom. (Moch, 2008)

Several other research studies have displayed similar results. A meta-analysis of 15 years of research on the advantages of hands-on learning, including 57 studies of 13,000 students in 1,000 classrooms, demonstrated that students in activity-based programs performed up to 20% higher than groups using traditional or textbook approaches. Students in these programs made gains in creativity, attitude, perception, and logic. (RAFT, 2009) Furthermore, the National Assessment of Educational Progress (NAEP), also known as “The Nations’ Report Card,” shows that teachers who conduct hands-on learning activities on a weekly basis out-perform their peers by more than 70% of a grade level in math and 40% of a grade level in science. (U.S. Department of Education, 1996)

Despite consistent study results on the cognitive and academic benefits of manipulatives for students, criticisms exist that must be discussed. One such criticism is that manipulatives require dual representation. Students often acquire one set of knowledge through hands-on activities, and then must alter this understanding to fit with written expressions (like those seen on state assessments). Research suggests that once children represent an object or a concept one way, it is difficult for them to let go of that representation so they can represent it in a new way, making manipulatives hard to utilize with the increasing pressure for students to achieve high standards on state and district assessments. (McNeil & Jarvin, 2007)

Child psychologist, Lawrence Balter, agrees with the dual representation criticism, however, he believes there may be a solution to this problem. In his book on child psychology, Balter suggests that proper teacher planning and scaffolding of lessons can gradually lead students away from a focus on concrete manipulatives and toward a focus on written representations. He suggests using *The Building Blocks* curriculum, which includes activities that require students to use manipulatives to gain insight into

academic concepts, but also to link manipulatives to other forms of representation.

(Balter, 2005)

A second criticism of experiential education relates to the selection of objects utilized during lessons. It suggests that many of the objects found in hands-on education end up distracting students from learning, instead of assisting them. According to Balter, "The concreteness of manipulatives may contribute to the problem of linking manipulative-based solutions to written solutions by focusing children's attention on the characteristics of the objects themselves rather than on what the objects are intended to represent. Therefore, objects that are interesting in their own right may not make the best manipulatives. Observations of manipulative use in other countries have supported the idea that a good manipulative is not necessarily an inherently interesting object."

(Balter, 2005)

The debate over experiential education is clearly a subject for discussion and analysis. One side of the debate suggests that when hands-on activities are employed, teaching is more fun and students are more motivated to learn. (RAFT, 2009) The other suggests that hands-on activities take away from learning because of distractions and difficulties with dual representation. In these regards, the debate over experiential education is an extension of the initial argument offered in the manipulatives debate.

The following research study hopes to address and analyze this debate even further. It expands upon prior data collection in order to look into the effectiveness of manipulative use in additional subject areas (i.e. social studies, language arts, science) and how they are related to student comprehension and the ability to accomplish the academic goals set by state curriculum standards. It was designed as a small-scale research project that investigated the following research questions:

- “How do teachers perceive manipulatives and the use of manipulatives in the elementary school classroom?”
- “How do teachers perceive the kinesthetic experiences provided by these manipulatives in regards to student comprehension?”

Methods

Setting

This study was conducted at Suburban Elementary (pseudonym) in a first-ring suburb of a large urban area. The majority of the homes within the suburb surrounding the school were one-family residential homes, with the exception of a few apartment complexes. The neighborhood was clean and well kept. Local family businesses and a local zoo were great assets found in the community. A public library and community center were also located within a half mile of the school, police and fire departments were nearby and easily accessible, and a major hospital was located within a mile of the school. Public transportation was not of much availability or necessity in this community as most commuters had their own cars. Teachers and administrators reported high parental involvement and family support which they saw as a consistently high priority.

In regards to demographics, the school and community were about 70% Caucasian, with some (but few) African Americans, Hispanics, and those of Asian descent. According to the 2011 National Assessment of Educational Progress Report, 70.5% of students at the school were Caucasian, 16.5% of students were African American, 6% of students were Hispanic, 3% of students were of Asian descent, 2% were of two or more races, 13% were classified as having disabilities, and 3.5% were English Language Learners (State of Michigan, 2002). Approximately 500 students were in attendance at Suburban Elementary when this study was conducted. There were 20 regular classroom teachers at

the school, 95% of which were Caucasian females between the ages of 22 and 65. The remaining 5% consisted of Caucasian males in the same age range. Out of the eight specials (art, music, media) and resource room teachers, 88% were Caucasian females between the ages of 22 and 65. The remaining 12% consisted of African American males in the same age range.

Suburban Elementary is a Title I school. It made AYP in the 2011-2012 academic year, and met all 16 of the participation and proficiency targets set by the State of Michigan. The school also received an "Education Yes Report Card" grade of a "B". 51.8% of students in grades 3-8 were proficient in math and reading, a growth of 8 percentage points from the previous school year. 65.3% of students at the school were eligible for a free/reduced lunch program. (State of Michigan, 2002)

Participants

There were 20 teachers at Suburban Elementary who were approached to participate in this study. Nine teachers responded, thus the response rate was 45%. As discussed in the above section, of the 20 regular classroom teachers at the school, 95% were Caucasian females between the ages of 22 and 65. The remaining 5% consisted of Caucasian males in the same age range.

Instruments

Participants were asked to complete a 10-question short answer survey that was administered online using the website SurveyMonkey (See Appendix A). The survey questions were open-ended questions. The survey took approximately 10-20 minutes to complete, and participants were given the option to withdraw from the study at any time. A total of nine participants completed the survey.

Analysis

Participant responses were submitted via the website SurveyMonkey. Participants remained anonymous and no identifiers were used. No personal information was collected from participants during this study. In order to analyze data, the researcher organized responses according to survey question number. For example, each of the nine responses to question one on the survey were compiled and analyzed together. The same method was used to analyze each remaining question and its responses.

Findings

As was discussed earlier in this paper, this study aimed to investigate the following research questions:

- “How do teachers perceive manipulatives and the use of manipulatives in the elementary school classroom?”
- “How do teachers perceive the kinesthetic experiences provided by these manipulatives in regards to student comprehension?”

This section aims to present the results of the survey responses provided by study participants. It is divided into subcategories in order to address particular areas of interest regarding the use of manipulatives in current elementary school classrooms.

Teacher Perceptions of Classroom Manipulatives

Defining Manipulatives

In order to establish a common ground, participants were asked to first define the word manipulatives in their own words. Participant responses showed that the term “manipulatives” was understood in a very similar way. According to participants’ responses, manipulatives are hands-on tools that help children gain a more concrete understanding of the subject being studied. They allow students to lift, move, build, and “manipulate” objects in order to visually explore an idea or concept in a concrete way

(i.e. for use in counting, sorting, measuring, etc.). Manipulatives can be physical or digital representations that allow students to "feel" the concept being taught.

Math and Science

After a common ground was established, participants were asked about their classroom use of manipulatives in particular subject areas. When asked about manipulatives in math and science, all participants said that they use manipulatives regularly, with the exception of one participant who explained that they did not teach these subject areas.

The results showed that manipulatives were used primarily in math, more than they were used in science to help students understand or visualize what they were learning, to give students the chance to show their thinking, and to help students solve problems. Many examples of math manipulatives were provided in participant responses, including base-ten blocks, money, geoboards, rulers, counters, pattern blocks, and unifix cubes. Only one participant mentioned the use of manipulatives in science (in the form of unifix cubes) as they stated that unifix cubes were occasionally used in science to take measurements.

Participants explained that when manipulatives were utilized in math and science, they were used both independently and occasionally in small groups. Additionally, some participants explained that they use manipulatives for whole group instruction. One participant wrote, "When used in lessons, manipulatives are often introduced at the beginning of a unit as a way of modeling and are then made available either on student tables or in the math center for students to access whenever they choose." Several participants expressed these same ideas and noted that manipulatives are always accessible and students are allowed to use them whenever they feel they need them.

Language Arts and Social Studies

When asked about the use of manipulatives in the subject areas of language arts and social studies, participants had varying responses. Two of the nine participants explained that they very rarely use manipulatives in social studies, explaining that the social studies curriculum does not easily lend itself to the use of manipulatives. The seven other participants did not touch on the area of social studies in their responses.

Several participants explained that they occasionally use manipulatives in language arts lessons for activities such as word work, comparison and contrast, word studies, and spelling. Examples of the manipulatives that were given included magnetic letters, wiki-sticks, sand trays, and letter tiles. Additionally, two participants wrote that they did not use manipulatives at all in language arts or social studies, but would be interested in seeing how teachers are using them in these subject areas

Lessons v. Centers

Responses showed that manipulatives were used for both modeling by the teacher during lessons and also individually by students in centers or math workshop rotations. Generally, the teacher first models how to use manipulatives to solve a problem to the whole group. After whole group instruction, students are invited to complete a problem along with the teacher, and then are allowed to work independently or in small groups to explore concepts on their own.

Some teachers, however, expressed that they use manipulatives as a way for students to explore prior to a lesson or before instruction begins. One participant wrote: "Students are always encouraged to branch out, however, not all students feel comfortable with this. Therefore, modeling a variety of uses is important. They should always have time to "play" with new manipulatives. This helps with the management aspect."

Teacher Perceptions of the Effectiveness of Manipulatives

Manipulatives and Assessment

One survey question in this study aimed to address whether or not manipulatives were used as an alternative form of assessment in the elementary school classroom (in contrast to traditional paper-and-pencil testing). Even though this study showed no signs of manipulatives as an *alternative* form of assessment, it did show some inclusion. Interestingly, many responses showed that manipulatives were commonly used as an aid during tests. Students may use manipulatives to help them build or think through a problem, but then are required to draw out models of the manipulatives and how they were used. Additionally, two participants wrote that although manipulatives do not replace a written paper-and-pencil assessment, they are sometimes used as formative assessments as they provide teachers with the chance to record observations of student manipulative use and to keep track of student understanding in order to provide additional instruction in the future.

Manipulatives at Home

When asked whether or not manipulatives were allowed to go home with students, responses varied. Several participants wrote that they allow manipulatives to go home, and several suggested other alternatives. Of those that allow manipulatives to go home with students, one participant wrote: "Parents are always welcome to come to me with questions, and I may give the parent manipulatives/materials they could borrow to help support at home." Another participant wrote: "Manipulatives may go home with a student. I do not run any parent instruction on how to use manipulatives.". Of those that do not allow manipulatives to go home, participants wrote: "They are encouraged to be used and practiced with at home, but don't go home. We discuss things that can be used as manipulatives at home. This is because of limited supplies and the fear they may not be returned."; "I do not send manipulatives home, but would not be opposed

to it. I always tell kids and parents that it's important developmentally to use tangible things to help with mathematical concept, but I am good at sharing what I have."

There were additional participants that expressed interest in including home use of manipulatives as part of their lessons as they had not thought about it before.

Included in this category of manipulatives at home, is the suggestion of parent training. A survey question asked whether or not parents were instructed or exposed to the use of manipulatives in the classroom. Only two participants discussed this in their responses. One response stated: "I often mention the use of manipulatives when talking to parents about specific classroom topics, and some students do take manipulatives home to assist them. I often try to show students how they can make their own manipulatives at home (torn up paper instead of counters, etc.) so that they always have something to assist them if needed. We also offer parent workshops throughout the year to provide more specifics on certain topics, as well as how manipulatives can be of assistance."

Challenges to the Use of Manipulatives

Once subject areas were addressed, participants were asked whether or not they had any challenges that affected their use of manipulatives. Six of the nine participants had no response or wrote "not applicable". However, several participants expressed some concerns they had about manipulative use in the classroom. One participant explained that as kids get older, they tend to be less inclined to want to use manipulatives. Another participant explained that budget was a restriction from using manipulatives more often in the classroom. A third participant expressed that there were some manipulatives that they did not have and that they were unsure whether this was because of budget or not.

Teacher Perceptions of the Kinesthetic Experiences Provided By Manipulatives

Student Attitudes About Learning with Manipulatives

Overall, responses showed that students were more excited about learning when they were given the opportunity to use manipulatives. However, there were several areas of concern that participants expressed. For lower elementary school grades (Kindergarten - 2nd Grade), one participant explained that students were more likely to remain engaged when they have something tactile to work with that helps them solve. Another participant wrote that “manipulatives make students more excited to learn because they have the opportunity to truly engage in the lesson instead of just ‘sit and get’ learning.” For upper elementary school grades (3rd Grade - 5th Grade), one participant explained manipulatives deepen student engagement, even in the older grades because they make their learning that much more meaningful.

In addition, participants expressed that manipulatives are an effective way to demonstrate, and they require students to think and talk about their learning. One participant wrote: “I always allow my students a few minutes to play with the manipulatives without any instruction. This allows them to explore on their own before any direct instruction is given.”

Despite this common theme that manipulatives create more excitement amongst students in the classroom, several concerns were expressed by participants in their responses. One such concern was that manipulatives require a need for greater classroom organization and management. Two participants explained an additional concern regarding manipulatives - that student excitement is determined by and is different for every student in the classroom: “Some students who already have a grasp on the concept sometimes find that having to build a model slows them down. Other students love using them, and others love using them but not always to do the math!”;

“Some students prefer not to use manipulatives because they don’t need to. They can get the answer quick and just want to move on. Most do enjoy using them and it will often bring more discussions.”

Student Discussion and Engagement

Much like with student excitement, responses showed that there tends to be more discussion when manipulatives are used in the classroom, especially when used in groups. There is not only more discussion, but deeper discussion and opportunities for students to explain their thinking process. Manipulatives provide a channel for opening up discussion and exploration in the classroom and allow students to feel more comfortable engaging in discussions with classmates. Despite this common theme regarding student discussion, problems were also expressed in participant responses. One problem was that manipulatives could sometimes become a distraction. One participant wrote: “I think manipulatives open up discussions, but I do think if kids are not used to using them on a regular basis, and if they’re not appropriately modeled, they can become a distraction.” A second problem in regards to student discussion is that not all students need them because they can get an answer quickly and then want to move on.

In regards to whether or not students ask more questions, participants seemed unsure. One participant stated: “I am not sure if there are more or less questions being asked. It depends on what the topic is that we are working on.” Another wrote: “I would say students tend to ask more questions, but they are more often related to the use of the manipulatives v. questions about the actual problem being solved.”

Going along with classroom discussion and student questions is the area of student engagement. Responses showed that students were more engaged and more aware in

the classroom when manipulatives were managed correctly. Many participants additionally noted that the amount of student engagement is determined by the student that is using them. One participant wrote: "It depends on the student. I think it is just another way to meet the needs of a variety of learners. Some children benefit more than others from manipulatives." Another participant explained that student engagement depends on the topic/concept being taught and how well the manipulatives match up with the concept. The more abstract the concept, the more helpful the manipulatives are for some students in helping them see the problem and how they might go about solving it.

Despite the benefits of manipulatives in regards to student engagement, problems were also expressed in participant responses. Several participants expressed concern that manipulatives can be frustrating for students to use, causing them to actually be less engaged: "I do find that when we attempt to transition to paper-and-pencil work that some find it more difficult. Also, some students that are particularly strong with mental math have difficulty showing their work with manipulatives. They arrive at the answer quickly, so modeling their work feels like backtracking."; "I always have one student who is visually confused when they see an area model and I can't move them from not being able to see this."

Conclusion

The following section aims to provide a summary of the research study discussed in this paper. It examines how this study relates to prior research, addresses several study limitations, offers proposals for future research, and presents closing remarks regarding analysis of study findings in relation to the research questions this study aimed to address.

Relating Study Findings to Prior Research

The findings from this study can be related to the research that was examined in the background section of this paper. The manipulatives debate presented by Nicole McNeil (2007) was not resolved in this study. Elements of both sides of the debate were present. Although most participants seemed to support the use of manipulatives in their classrooms, several criticisms and concerns arose in participant responses, such as the criticism that manipulatives do not work for every student, along with the various problems manipulatives cause with classroom management.

The arguments that Moch (2002) presented in her research - that manipulatives help students think, reason, and solve problems, and also make learning fun – were also present in this study's findings. Overall, responses showed that students were more excited about learning when they had the opportunity to use manipulatives and to become truly engaged in the lesson. Several problems and criticisms of this argument were also apparent in the results of this study. One problem that was expressed by study participants is that manipulatives require a need for greater classroom organization and management. Additionally, participants suggested that student excitement is determined by and is different for every student in the classroom.

The argument that manipulatives do not work for everyone or everything (Moch, 2002; McNeil & Jarvin, 2007; A. Daigger & Company, n.d.) was supported by this study. Many participants wrote that the amount of student engagement is determined by the student that is using them noting that some children benefit more than others from manipulatives. Additionally, several participants expressed concern that manipulatives can be frustrating for students to use, causing them to actually be less engaged. Some students who already have a grasp on the concept sometimes find that having to build a model slows them down.

The debate over teacher planning and other restrictions to the use of manipulatives in the classroom that Moch (2002) presented in her research was not an area of concern for participants in this study. Findings showed no evidence of problems finding time to include manipulatives as part of everyday lessons, or challenges such as lack of availability of kits, insufficient budgets for manipulatives, lack of administrative support, and being overwhelmed with other classroom responsibilities.

When experiential learning was discussed in the background section of this paper, a criticism was presented regarding the argument that manipulatives require dual representation. Study results supported this criticism. Several participants expressed concern that manipulatives can be frustrating for students to use, causing them to actually be less engaged. Findings showed that when transitioning from manipulatives to paper-and-pencil work, students sometimes seem confused. Also, some students that were particularly strong with mental math, had difficulty showing their work with manipulatives.

Study Limitations

One of the limitations of this study relates to the demographics of the participants and of the school from which participants were gathered. As noted earlier in this paper, the school and community used in this study were about 70% Caucasian, with some (but few) African Americans, Hispanics, and those of Asian descent. Additionally, of the 20 regular classroom teachers who participated in this study, 95% were Caucasian females between the ages of 22 and 65. The remaining 5% consisted of Caucasian males in the same age range. These demographics fail to represent a diverse population. This limits the research study as the data collected expresses only those opinions and perceptions of the majority Caucasian participants and fails to represent other ethnic groups appropriately.

Another limitation was that this was a very small-scale research study. A small pool of 20 teachers was approached to participate. Only 45% (nine participants) of this pool responded and participated. Another limitation related to this is that all of the participants came from the same elementary school. This limits the results of this study because participants were of similar backgrounds, in regards to the resources that are provided by their district and the demographics and academic level of their students.

Proposals for Future Research

In order to address these limitations, the researcher presents possible adjustments and areas of interest for future research. To address demographics limitations, a larger number and variety of elementary schools should be used. This would yield not only a larger number of participants, but also a wider variety of demographics amongst participants. It would also address the issues of similar backgrounds due to resources provided by school districts and the varying demographics and academic levels of students.

To further this study, future researchers should consider performing research with elementary school students through the implementation of manipulative-based lessons. The effectiveness of these lessons on student comprehension and achievement on standardized tests could be analyzed over a set amount of time, and student samples of work could be included as evidence to the findings of the study.

Discussion and Closing Remarks

In closing, an interesting trend was apparent in the findings of this study that should be addressed. Whether intentional or not, participant survey responses frequently mentioned the subject area of mathematics. This might suggest that manipulatives are often automatically associated with the subject area of mathematics, and not necessarily

with other subject areas like science, language arts, and social studies. When participants were asked very general questions, such as whether or not manipulatives make students more or less excited or whether manipulatives are used mainly in lessons or in centers, responses typically included references and specific examples related to mathematics lessons, and did not often include references related to other subject areas.

Overall, the findings of this study suggest that teachers perceive manipulatives as helpful tools that assist children in gaining a more concrete understanding of academic content. The findings of this study also suggest that teachers generally perceive the kinesthetic experiences provided by these manipulatives as being important assets to student comprehension, engagement, and excitement in the classroom. Although manipulatives do not benefit every student, teachers seem to perceive them as being helpful tools and necessary components of best teaching practices in their classrooms.

This research study did not completely resolve the manipulatives debate, however it did provide compelling evidence to support the use of manipulatives in the elementary school classroom. It appears that criticisms of manipulatives might always exist, but further experimentation and research with manipulatives in the elementary school classroom may be able to clear up some of these problems and address continuing criticisms.

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Appendix A Survey Questions

1. In recent years, the use of manipulatives in the elementary school classroom has become a widely practiced teaching strategy. In regards to your own teaching, how would you define “manipulatives”?
2. In your classroom, are manipulatives used in Math and Science lessons?
 - If so, are the manipulatives used independently or in groups? Explain.
 - If not, would you be interested in incorporating manipulatives into these lessons? Why or why not?
3. In your classroom, are manipulatives used in Social Studies and Language Arts lessons?
 - If so, are the manipulatives used independently or in groups? Explain.
 - If not, would you be interested in incorporating manipulatives into these lessons? Why or why not?
4. If manipulatives are not used in your classroom, what restricts you from using them? (time, budget, curriculum standards, lack of student interest)
5. Do you find that using manipulatives makes students more excited or less excited about learning? Explain.
6. Are manipulatives used during actual lessons given by the teacher, or are students asked to work with them separately / on their own in centers?
 - If used during lessons, are students given time to find their own solutions to problems v. simply modeling after the teacher?
 - If not used during lessons, continue on to the next question.
7. When manipulatives are used, do you find that there is more or less classroom discussion? Do students ask more or less questions? Explain.
8. When manipulatives are used, do you find that students are more aware / engaged or do you find that students become easily confused? Explain.
9. In your classroom, are manipulatives used as an alternative form of assessment? Are students given the option to demonstrate their learning through means other than traditional paper / pencil testing? Explain.
10. Are parents instructed or exposed to the use of manipulatives in the classroom? Are manipulatives allowed to go home with students? Explain.