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Gauging the educational efficacy of geometrical manipulatives in teaching the curriculum contents

Kent N. Maningo [a *], Lorenzo C. Tanza Memorial National High School, Faculty of Senior High School, Department of Education, Cebu Province, 6050, Philippines, https://orcid.org/0000-0002-7923-1682

Porferio M. Almerino, Jr. [b], Cebu Technological University, Faculty of Education, Cebu City, 6000, Philippines, https://orcid.org/0000-0001-6614-7396

Lourdes M. Garciano [c], Cebu Technological University, Faculty of Education, Cebu City, 6000, Philippines, https://orcid.org/0000-0002-0159-3253

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Abstract

This study examines the condition on whether or not there is an advantage on integrating manipulatives in the instruction against traditional teaching involving concept building and students' performance in geometry. To well achieve this objective, 48 Grade-9 students from a remote public school and island in the Philippines were invited and were then divided into control and experiment groups. After such inferences, empirical results showed that there was no significant mean difference on the scores between the two groups, which implies that one method does not outperform the other. Indeed, post-evaluation revealed that there are other variables which trigger the variation of scores from these groups, respectively, as shared by the subjects themselves. Thus, it is proposed that future relevant researches, shall peek into those variables that can nonetheless support the efficacy of intended curriculum contents and correspondingly address the diverse learning styles.

Keywords: Education, manipulative, mathematics, remote island;

* ADDRESS FOR CORRESPONDENCE: Kent, Maningo, Department of Education, Cebu Province, 6050, Philippines
E-mail address: maningokent20@gmail.com /Tel.: +639-1936-9673

1. Introduction

Most students in schools claim that Mathematics is difficult for them. But on the other hand, some of them possess these exceptional talents and skills to resist numbers into their minds. As this quote says, “Mathematics is not from the genes, it is a matter of constant practice.” This only signifies that no matter how skillful your parents or relatives are in the field of Mathematics; you can acquire the same too. The theory of Mathematics requires patience and hard work. It needs a constant practice. Verily, an empirical study on such regard pointed out that the affective beliefs of students have somehow been influenced by their perception, values, emotions, and behaviors towards this subject matter (Almerino et al., 2019). That is why most of the students find it difficult in the sense that they are diverted to different things. This scenario is indeed true and disheartening especially among students who belonged to a marginalized family, where the focus is more on sourcing additional income to defray expenses for their basic needs than studying the lesson itself. It calls here on how the instruction and teaching pedagogy should be managed as the same is vital in the students’ acquirement of knowledge, skills and competencies. Such teaching pedagogy must critically look into the probable patronization of technology-aided instruction to achieve the intended learning outcomes.

With the latter condition, the classroom becomes a battleground to teachers since they frequently face a lot of obstacles such as differences in abilities, resources’ insufficiency, population of students, time constraints – the list goes on. But conceivably, the fear of mathematics is considered as the most difficult hindrance (Newton, 2015). Hence, this case necessitates a timely and equivalent intervention among all concerned stakeholders. One particular research, in fact, endorsed that students must always be involved in class discussion, interaction or in any activities through facilitating in any means (Peteros et al., 2019). Hence, it is essential that the concerned education bureau and school should once again peek into this scientific-based proposal wherein various teaching strategies, approaches, methods, or scheme should be maximized to address the foregoing.

Indeed, there are numerous learning obstacles that students possibly encounter that obstruct their fluency in mathematics. Numerably, these factors that obstruct the fluency of learning mathematics are visual perception, language perception, integration, conceptual understanding, memory, writing, and independence. As proposed, to be fluent in mathematics, the students must proficiently create a strong foundation in mathematics. Previous trends from the past international evaluations sadly divulged the condition where the younger generation of Filipino learners had been found out struggling in mathematics and sciences. Thus, it is imperative that the prevailing issues and concerns of such performance in a worldwide level must be dealt appropriately. As like reading, the students crucially need to practice mathematical activities constantly to become more articulate (Math Learning & Barriers, 2014). Thus, the daily lesson/log plan must critically consider the potential incorporations of resources which can alleviate the incumbent state of learning.

Individuals usually misinterpreted the essence of Mathematics. They did not realize that the concept of Mathematics is everywhere, and its influence is nowhere. Everything in this world can be associated with Mathematics. That is why everyone must try to learn how to learn Mathematics. It is given that there are students who show lack of interests when it comes to Mathematics. However, there are some better means that teachers may incorporate in the teaching–learning process such as educational games, devices and technologies and drills. Educational materials, for instance, essentially provide a drastic factor towards the students’ performance in any learning environment. The appropriate usage of instructional devices and/or manipulatives can ideally sustain the students’ learning and increase the rate of student success. Verily, these instructional manipulatives are said to be part of the instruction procedure, thus, its availability is highly necessitated in attaining the desired learning outcomes.

Integrating educational manipulatives in the learning process exceptionally allows the students to connect conceptual understanding in mathematics to concrete objects. As denoted, these learning tools have critically honed the understanding of the students to variety of situations. Hence, manipulatives are a perfect tool in performing an authentically different instruction that promotes experiential learning (Spielgaben, 2014). As claimed, these learning activities, resources and schemes can somehow reinforce instruction for the learners to manifest the subject holistically. However, based on experiential accounts by the researchers' colleagues, instances there were that acquirements of concepts had remained a challenging objective despite the teachers' utilizations of these manipulatives during instruction.

Hence, the current research aims to scrutinize the outcomes when the process of learning is in the traditional chalk-board method and with the integration of the geometrical devices as partner in learning. Albeit, there were declarations that the inclusion of the latter has an advantage over the former teaching method, it is however the objective of the recent study to further look into whether or not the previous findings were absolutely fixed or not of their assertions. By this mean, the recent study could address the gap that shall be pointed out and hopefully the results and findings could add to the pool of knowledge relevant to this matter.

2. Methods

A quasi-experimental design was employed in this study as it examined whether there is mean gain or not between the pretest and posttest scores for both experimental and control groups. The groups' comparability prior to the treatment and the determination of the latter's effects on the outcome variable (Rogers & Revesz, 2019) qualify such choice of a design.

The Grade-9 students from one of the remote public schools and islands in the Philippine, where 3 male and 21 female for the control group and 8 males and 16 females for the experiment group, have been purposively chosen as research subjects and were then invited to participate in the evaluations. This adapts the complete enumeration and is representative of the population itself in such level in a provincial district schools where some children preferred not to go to school due to instances like child labouring, lack of parental support, laziness, and poverty. These occasions remain a burden for education preceptors and leaders to utilize educational policies addressing these distinctive needs and other potential gaps in a rural community (Preston, J. et al., 2013). Notwithstanding, the criterion in the selection of these subjects is solely anchored on their individual performances for the past quarters, academically, where diverse levels of achievements have been considered too in the full grasp of geometry-concepts. Such sampling considered here has satisfied that of purposive sampling, where the decision concerning the individuals to be included in the sample are taken by the researchers based upon a variety of criteria (Ilker et al., 2015). On the other hand, to respond well to the ethical requirements, the school division's approval, parents' consent and assent consent were expedited before the actual conduct of the study. From such protocol and following the research design standards, the subjects took the 25 competency-based tests items, which were in conformity and compliance of the education bureau's evaluation guide. Moreover, to ensure the reliability and validity of the given test, the items had been subjected to Cronbach's Alpha at 0.733 with internal consistency of "acceptable".

From there, all of the collected data were statistically treated using the difference between two population means based on two independent samples. Accordingly, the results in both groups were tabulated, analyzed and interpreted for the purpose of arriving to its scientific findings and/or results, where conclusions and recommendations were eventually presented.

3. Results/ Findings and Discussion

In response to the objective of the current study, discussions are here made that disclose the outcomes when the process of learning has been done by a traditional teaching method or manipulative-supported instruction. Moreover, statistical inferences of the gathered data (i.e. pretest and posttest scores) provided a glimpse on whether or not there were significant mean gains in the tests from both groups, which will address the articulated gap on whether or not the previous findings or claims of some authorities in this field are indeed absolutely fixed or not as regards the positive influence of manipulatives in the delivery of intended curriculum contents.

As can be gleaned, the first set of tables explicitly shows the performance level of the experimental and control groups while the next set reveals their individual rating on whether or not there was a significant gain in the scores from the two (2) given tests which in this instance can now bestowed, at least, a better picture of the scenarios. Furthermore, the remaining set of tables, this time, concretizes one's comprehension of the case under empirical scrutiny.

Table 1. Performance level of the control group

Performance Level	Score	Pretest		Posttest	
		f	%	f	%
Very Good	19 – 25	--	--	--	--
Good	13 – 18	--	--	2	8.33
Fairly	7 – 12	15	62.50	22	91.67
Poor	0 – 6	9	37.50	--	--
Total		24	100.00	24	100.00

From the obtained data, 62.50% of the group performed fairly and 37.50% performed poorly upon administering the pretest. Subsequently, the same group of respondents who took the posttest evidently displayed a slight progress with their performance level; 8.33% of the group got a score that ranges from 13-18 or "Good" in terms of the performance level, while 91.67% of the group performed fairly in the mathematics assessment. In addition, no respondents performed poorly during the posttest.

Relevant to the foregoing, various research studies examined the effectiveness of the typical mode of giving instructions such as the usage of the chalk and board as the primary tool in learning. This assertion on effectiveness of such method remained a battling hypothesis between students from old schools and those 21st century learners. However, one of those studies divulges the advantages of this method such that writing on the board tends to facilitate more on note taking and active participation. Additionally, this strategic mode of instruction also keeps attentiveness of the student's behavior in class since procedures are done in a "step-by-step" manner (Armour, et al., 2016).

To some extent there was truthfulness to this claim from the latter source although there were more than half of the subjects who only derived "Fairly" as an equivalent rating from this table results. Plainly, this entails that the matter on attentiveness involving traditional teaching method has indeed benefitted them to somehow seize the geometrical concepts, thus, resulting to such level of performance from the posttest. Others' difficulties to grasp the same, based from observations, could be theoretically attributed by their varying multiple intelligences (i.e. auditory, kinesthetic, naturalist, spatial, etc.), which would partially traffic the storage of content knowledge.

In general, the table exhibited that there is a slight degree of progress in terms of the performance level during the posttest. This implies that the "chalk and talk" method of instruction prior to the posttest gave a positive effect and improvement on the performance level of the respondents. Besides, the utilization of blackboards had already been the norm in education, where it is presumed that a classroom is incomplete without its presence (Gershon, 2017). It cannot be denied that even professors from well-noted colleges and universities can been seen utilizing hitherto the board and marker as a medium in sharing their thoughts and expertise through an online platform (i.e *youtube*). Such scholastic-based presentation virtually made by these discussants from *youtube* still received good feedbacks from many students of the researchers as they can observe the flow of writing, presentation and discussions on the board, virtually. Hence, by these articulations, the traditional teaching method still has it certain edge.

Table 2. Performance level of the experimental group

Performance Level	Score	Pretest		Posttest	
		f	%	f	%
Very Good	19 – 25	--	--	--	--
Good	13 – 18	--	--	7	29.17
Fairly	7 – 12	19	79.17	17	70.83
Poor	0 – 6	5	20.83	--	--
Total		24	100.00	24	100.00

The students in the experiment group have also undergone a series of procedures in obtaining their respective scores in both pretest and posttest. Each of the student's score was also described as "Poor", "Fairly", "Good", and "Very Good" in their performance level. Additionally, the range scores of the students were also categorized as similar with the control group.

Table 2 depicted the performance level of the experimental group in the pretest and posttest. As revealed in the pretest, 79.17% of the group performed fairly while the remaining 20.83% got a poor performance during the mathematics assessment. During the teaching process, the manipulatives were introduced to physically represent the given mathematical figures. As a result, during the posttest of the same group of respondents, there were evident alterations in the level of performances of the students; 29.17% of the group got a "Good" performance while 70.83% achieved a "Fair" performance level during the assessment. The results indicated that the posttest scores of the respondents significantly increased compared to their pretest. Such condition implies that the delivery of instruction supplemented by these manipulatives has reasonably influenced the performance of the students in some extent.

Interestingly, there are few other revelations from these results which were done after the assessment itself. Based from post-evaluation huddles, there had been informal sharing which elucidated such decline of students' performance within the "Fairly" level. One of those reasons is the actual vision on these manipulatives against what was asked from test. For instance, the teacher only displays one kind of pyramid (let us say a pyramid with a square base) and thereafter discusses its basic parts. During posttest, however, the given test item sought from these students to choose among the choices (triangle, circle, square, polygon) which will best answer the question on "What base a pyramid could have?". Fixated at such moment, certainly, these students would find certain degree of difficulty to answer the test item having been exposed only to one kind of pyramid as learning manipulative. Pertinent to this case, recommendations were offered that teachers must: (1) efficiently choose the appropriate manipulatives that cater the students' interest, (2) design the learning environment for effectivity of the results, and (3) give emphasis to the connectivity of the concrete and abstract (Fulmer,

2017). It is apparent here that the alternative lecture does not absolutely ascertain to fully support a concept building if wide displays of manipulatives and comprehensive discussions are not carried. This briefly explains why there was a diminished rating at such level of performance.

On the contrary, the increased number of 29.7% within the "Good" level in the posttest from its zero percent (0%) initial rating during the pretest is fundamentally traced from the students' studying the lesson ahead of time since the same was already given to them earlier as assignment. This condition is support by a specific research which accounted that with the kind of study habits that the student have, it can be seen as one of the reasons for their satisfactory performance in mathematics (Capuno et al., 2019). Hence, even if there was only one kind of pyramid that was exhibited, they already knew then that a pyramid could not only have a square or triangle as its base. Consequently, this wider range of information acquired by the concerned students has placed them to better land on a "Good" performance level. In fact, such advanced studies have made them more interested to cognitively know, physically observe and visualize how a solid look like if transformed into a plane figure when deconstructed. On the contrary, if the students would not prepare for the next lessons, tendency there is that their performance will not be faring well based from their anecdotal records.

For years, manipulatives have been used in the classroom. For these to be efficient, students crucially need time to craft a strong relationship between concrete materials and the abstract ideas they represent (Laski, et al., 2015). Numerous related researches on the integration of learning manipulatives to mathematics instruction pointed out that students tend to feel more comfortable in posing their own strategies about the subject matter. Through the presence of these learning manipulative, students possess significantly interesting traits such as excitement and attentiveness in the learning process. Consequently, there is already a strong interconnectedness between real life scenarios and abstract concepts that drive to a meaningful learning (Kwon & Capraro, 2018). By these theoretical assertions, one can posit that the inclusion of these learning manipulatives during teaching could foster concepts building among concerned students in some level.

Generally, the results in Table 2 emphasized that the experimental group performed quite well during the posttest when compared to the control group who likewise demonstrated an equally fine performance. This implies that the introduction of these manipulatives to the former, coupled with a lecture, had aroused the interest of some students in certain instance which resulted to such performance. Accordingly, one particular study pointed out that there is also novelty in an instruction that promotes experiential learning with geometrical manipulatives being introduced. Thus, an efficient integration of these learning tools can contribute to the students' conceptualization of the subject matter (Larbi & Mavis, 2016).

The latter finding has its sense when viewed at the actual scene as there are students with learning disabilities who could now explain basic concepts of both solid and plane figures when asked after the research undertaking. In fact, many of them in such group voiced out their preference for these manipulatives to be displayed during further lecture.

Table 3. Test on significant mean gain between the pretest and posttest scores of the control group

Source of Difference	Mean	Standard Deviation	N	Df	Computed t-value	Critical t-value	P-value	Decision
Pretest	6.58	1.56						
			24	23	10.00*	1.72	0.0000	Reject Ho
Posttest	10.04	1.71						

*significant level at 0.01 (one-tailed)

The average score of the control group during the pretest was 6.58 as to this table. After the posttest was administered, the mean score of the group increased to 10.04 subsequently. As to the

comparability test, there was a statistically significant mean gain difference between both test scores of the students in the control group (p≤0.05). From the results, it is evidently presented that the posttest scores of the students progressed during the process. In this connection, the result implies that the utilization of the chalk and board method primarily provides a positive learning outcome. Albeit the instruction comes at such medium, even so, ordinarily-used visual aid is still the most available material inside the classroom. Thus, students' performances are more likely set to its customs where their thinking abilities improve leading to an effective visualization of their own ideas (PELT Journal, 2013).

Since then, knowledge facilitators have relentlessly tried to improve in terms of teaching strategies and methods that are integrated in the learning process. Commonly, even in some provinces, teachers already practiced the use of advance technologies such as projectors and other electronic educational devices. Contrariwise, the presence of traditional instructional materials still exists. It cannot be denied that there are some teachers who still prefer the utilization of chalk and board in teaching. In some studies, using chalk and board as an instructional material sets the pace of the discussion since it promotes writing while talking (Brown, 2018). Moreover, the nature of this teaching method addresses the students' involvement during the instruction. Thus, such conventional teaching approach creates an enjoyable and meaningful learning environment.

On a personal note, the study habit of these students, which was observable, has nevertheless helped in the derivation of such gain in reference to the mentioned teaching method and such given appraisals. Having lived in a far-flung area where the internet is not yet so accessible, these students could only have their lecture notes and government-funded books at home to do study. Thus, they are left to instead read and do their assignments for the morrow's drills and exercises. Cognizant to this, a related study had found out that there was a significant association between a study orientation and academic performance, wherein students with high study orientation tend to achieve more than those with lower study orientation (Guinocor at al., 2020). As to this group, one probable root as to the attainment of students' concept building of the subject matter could be mapped out from their studying the lesson ahead of time – just like what the experimental group has shared.

Table 4. Test on significant mean gain between the pretest and posttest scores of the experimental group

Source of Difference	Mean	Standard Deviation	N	Df	Computed t-value	Critical t-value	P-value	Decision
Pretest	7.46	1.18						
			24	23	8.93*	1.72	0.0000	Reject Ho
Posttest	11.50	2.26						

*significant level at 0.01 (one-tailed)

In this table, the average score of the experiment group during the pretest was 7.46 while the mean score of the respondents in the posttest progressed to 11.50 as shown. Based on the scientific results, there was a significant mean gain difference between the test scores of the students (p≤0.05). In general review of the empirical results, such mean gain basically entails that the students, with their exposures to the manipulative-integrated teaching, have at least grasped the concepts introduced by the teacher to them in some extent. It should be noted, however, that such decline of performance between the two sets of test, by many of these students, does not necessarily mean that the inclusion of manipulatives during the delivery of instruction has not steered their ability to learn. As explained from the preceding tables, there are related factors which caused them to arrive at such performance rating which must be appropriately addressed.

On the other hand, the instruction that was blended with learning manipulatives prior to the posttest has increased the achievement of some students since this method has helped them built and concretized abstract concepts in mathematics (Senyefia, 2017). In fact, post-evaluation reviews specifically disclosed that those students, who are known to usually study beyond school hours, tend to

appreciate the integration of these manipulates while their teacher lectures the concepts of geometry. This implies that the discussion that is supported with learning manipulatives has bestowed positive influence particular to those students who scholastically venture further by studying their lessons in advance.

It should not be misinterpreted that those students, who did not study their lessons ahead of time, were the ones who caused the declination of such rating in the posttest. There are many of them, too, who have performed well during such posttest. Most of them shared that they have understood more the concepts when the lecture is supplemented with such learning manipulatives and expressed further that they have better recall of the same. Also, a study revealed that various students preferably learn better through a hands-on approach in learning mathematics. Hence, integrating manipulatives in the instruction supplements the students' innate abilities for them to establish new levels of comprehensive understanding to dealing with mathematical concepts (Eredics, 2014).

As to the foregoing, these environments are far different from the traditional learning process wherein students are just merely evaluated whether they are correct or incorrect through paper-and-pencil assessment. Hence, manipulatives are a perfect tool in performing an authentically different instruction that promotes experiential learning. (Spielgaben, 2014). The latter declaration has been validated by numerous studies about the impact of such optimization of these learning tools during instruction. Different accounts were also articulated wherein these manipulatives have enhanced the students' retention and conceptual abilities in mathematics. Thus, the utilization of these geometrical manipulatives promotes an active and holistic learning process (Akaazua, et al, 2017). Aside from this, another scientific study explained that mathematics-based manipulatives can be anything as long as it can represent and visualize the abstract concepts efficiently. Moreover, these materials can enhance the visual-spatial intelligences of the learners in achieving their learning successfully (Finney, 2013).

Table 5. Test on significant mean gain difference between the scores of the experimental and control group

Source of Difference	Mean	Standard Deviation	N	Df	Computed t-value	Critical t-value	P-value	Decision
Control	3.46	1.70	24	46	1.02	1.68	0.16	Do not reject Ho
Experimental	4.04	2.22	24					

*significant level at 0.01 (one-tailed)

As presented, control group has a mean score of 3.46 for both tests while the mean score of the experimental group for both tests slightly increased to 4.04, too. Based on the table, it appears that there was no significant mean gain difference between the two groups ($p>0.05$). The result entails that the two methods of instructions had similar outcomes in introducing the concepts of such subject matter. However, actual observations from both groups placed the experimental group at least in a fine position as to understanding and learning the geometrical concepts with the manipulatives being introduced by the teacher to them during instruction. In fact, the students from the experimental group exhibited activeness and alertness during the lecture as purposefully monitored. This is true in some other empirical investigations where students in an experimental group displayed excitement and enthusiasm during the learning process since they were able to manifest the topic in a different and alternative approach (Enki, 2014).

The case here has been reaffirmed by a particular study which disclosed that several research studies provide indicators that manipulatives effectively enhance the learning of the students. In connection, learners who routinely use manipulatives in mathematics perform remarkably than those who do not (Gaurino, et. al., 2013). In addition, when the students are experientially engaged to these

learning manipulatives, they are more motivated and excited to learn especially in doing various mathematical activities (Kwon & Capraro, 2018). Moreover, there are a lot of benefits of integrating manipulatives in the discussion especially in mathematics. One of these is the acquisition of students' capacities to exert themselves in generating solutions to problem solving without merely depending on directions from the teachers (Lee, 2015).

Hence, instruction in mathematics is indeed crucial in molding the students' creativity and cognitive skills. A range of strategies and methodologies are already implemented to cater to the needs and interests of the learners. Furthermore, as the advancement of modernized technologies rapidly progress, trends in education inevitably variate. The usage of varied teaching strategies vitally improves the basic math skills of the students especially in their future endeavors (Concordia University–Portland, 2018). One of the strategies they presented is manipulation of the teaching aids. The usage of some common objects such as coins, chips, or even stones can also support the students to learn the fundamental operations and other areas of mathematics.

More so, manipulatives are meaningful for learning only with respect to learners` activities and thinking. Learning manipulative's physicality is less significant, what's more essential is its comprehensive and well-planned application that leads to a meaningful education process (Sarama & Clements, 2016). Another research stated that there will also be a novel and actual learning experiences that are the key factors in promoting a more efficient understanding in their tasks and greater enjoyment from the learning process (Cockett & Kilgour, 2015).

But, the use of traditional teaching method could not be dispelled outright as there were actual accounts of preference and assuring experiences by those students, too, from the control group. What was not vividly mentioned from the preceding sections is their concentration on the teaching dynamics and fluidity of discussion, where they can follow step-by-step the chalk and talk of their teachers. Their comprehension of the geometrical concepts, even if the figures are drawn only on the board, has been so high such that they can fascinatingly preempt the continuing sketch or marking and next possible query of their teacher. Similar to the experimental group, the students from the control group likewise voiced out that the traditional teaching permits them to take down notes, increase their critical analysis of the illustrative examples, as well as better recall of the concepts and principles being explained by their teachers. They, too, feel that they all have the opportunities to interact with their teacher, who right then and there will answer their clarificatory questions relevant to the topic.

According to a study, Canadian traditionalists argue that students necessitate automatic recall of mathematical facts to manage information overload in their brains. With the traditional teaching method, students can perhaps easily transfer a prior knowledge which should be reinforced with the usual academic exercises and drills (Tularam & Machisella, 2018). By such knowledge transfer, other students would have an equal opportunity to think and analyze the given information for its possible interactions among the other students or to their teacher. This contention of the latter authors narrate a parallel scene with the previous sharing of the control group, thus, it says so. Other studies emphasize how the more important factor with such teaching method is the teacher – being the lecturer (Jackson, 2014). Corollary to this, another study discusses that in a traditional teaching method, interaction so much there is between the students and their teachers (Bidaki, 2013). Thus, it makes the scholastic sessions more engaging and meaningful that will eventually end up to having a satisfactory performance. Empirical analyses pointed on the effects of traditional teaching, where it has a positive effect on the overall test scores as a result of students' increasing learning and competencies (Bietenbeck, 2014). Furthermore, another study disclosed that the higher test scores acquired by the students were correlated with those teachers who spend more time lecturing the intended lessons (Schwerdt & Wuppermann, 2011).

Indeed, the Academic partnership review (2011) has found out that albeit there is evidence to support the claim that an alternative teaching ushers a better performance among students, there are equally many research investigations likewise that divulge little or no significant disparity noted between these two methods. It is apparent here that one method could not outperform the other as there are other factors to deal with in terms of the students' performance or achievements on a particular discipline – including math.

4. Conclusions and Recommendations

Pertinent to such aim to look into the outcomes that utilized a traditional chalk-board method or with the integration of manipulatives, scientific results showed that the control and experimental groups have both achieved a significant mean gain, respectively, from the inferences of their pretests and posttests which implied that neither one or the other outperforms the other. Hence, the results of the current study traverses from the previous findings which pointed out that the inclusion of manipulatives during the delivery of instruction has not totally impacted the concept building of these students particularly in geometry. The teaching method, which integrates these manipulatives, could not absolutely well claim of its assertion that it is better than the traditional teaching as presented by the Academic partnership review (2011). Again, the latter review disclosed that there is meager or no significant difference between these two methods. Nonetheless, utilization of such manipulatives could deliver and introduce various concepts in mathematics in a novel and innovative approach where learners are able to experientially grasp the key to unlock their understanding in said learning discipline. In fact, direct sharing from these research subjects from the post-evaluation shed lights that there were other reasons which caused the increase and decrease of their performance specifically for the experimental group. Their prior knowledge, study orientation, cognitive abilities, distinct individual intelligence, and many other forms. By this condition, it is proposed that further studies shall be made to technically factor out these and other confounding variables that will, at least, holistically influence the instruction which considers the incorporation of learning manipulatives.

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