



"Abot Kamay and Pagsasanay": Effectiveness of Tactual Learning Kit as a Localized Manipulative Instructional Material in Grade 1 Mathematics

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ABSTRACT

Mathematics and numeracy are the foundations of critical thinking, creative thinking, spatial thinking, and problem-solving skills for learners to become effective citizens of the world. The development of innovative learning materials to cater to learners at the foundation stage is necessary in the teaching-learning process, especially in the time of the pandemic. This study endeavored to assess the effectiveness of the developed Tactual Learning Kit (TLK) as a Localized Instructional Material in Teaching Addition for Grade 1 Mathematics. The study used a quasi-pre-test-post-test-experimental research design. The development of the TLK as instructional material employed the use of the ADDIE Model. The learning material was piloted at Viga Elementary School, a multigrade school in the municipality of Lasam, Philippines. The participants of the study were the nine (9) systematically sampled Grade 1 pupils and the four (4) teacher-evaluators of Viga Elementary School. Results showed that the TLK as a learning material in Grade 1 Mathematics enhanced the cognitive performance of students, as shown with a large gain effect size. However, the attitude of the respondents before and after the use of TLK did not show a significant difference, but it still had a medium-sized gain effect. In like manner, the test of relationship using Spearman's rho coefficient revealed that the respondents' mathematics post-test attitude is not associated with their post-test performance when using the TLK. Hence, future studies should look into the possibility of investigating this effect with the inclusion of other variables. Finally, according to the teacher-evaluators, the TLK was highly appropriate, acceptable, useful, and durable for Grade 1 students to learn the addition. For wider adoption and utilization, its enhancement and improvement were offered in order to upgrade the overall quality of the developed learning material.

Keywords: *development; experiential learning; tactual learning kit; utilization*

INTRODUCTION

The COVID-19 pandemic is a devastating health crisis that the world is presently experiencing. Many countries closed their schools (Child, 2020; Haeck & Lefebvre, 2020; Ogunode, 2020). As of now, teaching and assessment have never been the same as some schools have switched to online and flexible learning modalities. These effects of the pandemic will not just be in a short-term manner but have long-term effects (Burgess & Sievertsen, 2020). It is also a pressing concern that during the pandemic, building a foundation for mathematical literacy became challenging as teachers were not able to teach the learners face-to-face (Ancheta & Ancheta, 2020). Modular learning was implemented through DepEd Order 032, s. 2020, Guidelines on the Engagement of Services of Learning Support Aides to Reinforce the Implementation of the Basic Education Learning Continuity Plan in Time of COVID-19 Pandemic, to ensure the uninterrupted delivery of basic education services to learners and the community during the COVID-19 pandemic. Among the concerns raised in the implementation of this modular mode of learning is that teachers were not able to have personal interaction with pupils in teaching (Agaton & Cueto, 2021). Moreso, that children's academic performance may not be properly monitored and assisted as their parents may be busy with their jobs to provide for the needs of their families (Dewi & Wajdi, 2021; Lase et al., 2021). This situation also resulted in a lack of motivation among children, as they were isolated and confined at home, and they had a hard time learning different subjects, especially mathematics (Fortuna et al., 2020).

Challenges of Mathematics Instruction in the Philippines

Mathematics and numeracy are the foundations of critical thinking, creative thinking, spatial thinking, and problem-solving skills of learners to become effective citizens of the world. Filipino learners fell behind other countries in an international assessment. The Philippines has only scored 297 in mathematics, which is considered "significantly lower" than any other country that

participated (Magsambol, 2019). Learning mathematics as a subject is a very important foundation for young learners. How they learn mathematics at an early age will significantly affect their mathematical skills and performance as they grow up (Hodaová & Nocar, 2016; Nylund-Gibson, 2017). According to Guhl (2019), early childhood learning creates a foundation that is essential for more complex math concepts and vocational training in the future. Reflecting on the previous statement, it can be inferred that early mathematics learning affects future careers and decision-making. But sadly, many learners fail to have an interest in and good performance in learning mathematics (Yeh et al., 2019). They do not find joy in learning mathematics and do not know its significance in life (Azmidar et al., 2017; Dowker et al., 2019; Larkin & Jorgensen, 2016). In the Basic Education Curriculum (BEC) of the Philippines, mathematics is considered a difficult subject to be learned by pupils (Lanante, 2019). Pupils hate the subject, as teachers frequently use rote memorization as a teaching strategy for different topics (Shrestha et al., 2021). As an outcome, many students do not learn, resulting in poor mathematical abilities (Omotayo & Adeleke, 2017). This problem is already worsened by the pandemic as teachers do not have the opportunity to teach and motivate students to learn mathematics face-to-face (Moorhouse, 2020, SettedeSouza, 2020). Context of the Study Viga Elementary School is one of the multi-grade schools in the Lasam East District in the Municipality of Lasam, and adopted flexible learning as its modality during COVID 19. According to Naparan & Castaneda (2021), in the Philippines, the most common problems in multigrade classrooms are: preparation and planning of daily lessons; the inadequacy of instructional materials; classroom management and supervision; familiarity with different schemes in teaching multigrade classes; and the application of teaching methodology in real teaching-learning.

As a result of an assessment conducted in Viga Elementary School before the conduct of this study and as confirmed by the school head, addition was one of the

least mastered competencies for Grade 1 pupils. Specifically, on the competency of visualizing and adding the following numbers using appropriate techniques: a) Two one-digit numbers that add up to 18. This is a basic math skill that students need to learn before they can move on to more complicated operations. In this kind of educational setting, where one teacher is teaching two grade-levels, the provision of supplementary teaching materials for students to master basic operations in mathematics learning is necessary. Availability of instructional material and proper allotment of time for the learning processes of learners should be ensured, particularly with the onslaught of the pandemic where learners were isolated, affecting their physical and social wellbeing. This prompted the researcher to design and develop a Tactual Learning Kit (TLK) in teaching addition for Grade 1 and ultimately assess its effectiveness in enhancing mathematical attitude and performance.

Tactual Learning Material as an Intervention and Theories Underpin the Development and Utilization of Tactual Learning Kit (TLK) in the Primary Grades

Tactual learning is multisensory learning where learners are given the opportunity through hands-on experience. This type of learning style suggests that learners need to learn by touching, feeling, and moving. As such, movement and manipulatives will help learners be physically engaged in the teaching-learning process. Hence, it is necessary to create tactile learning environments to conduct effective simulations. The educator must employ various levels of realism and tools to fulfill the demands of the students in order to provide them with a successful learning experience through simulations (Yilmaz & Dilek, 2018). Sensoriality and tactual experience appear to be important in learning because they help students comprehend things and build meaningful material interactions (Parisi et al., 2017). As a result, it demonstrates the need for teachers to cater to the needs of students, particularly in a tactual manner. The Tactual Learning Kit (TLK) offers learners the opportunity to learn through concrete experience with

the use of their sense of touch. Hence, this study is anchored on the Kolb's Experiential Learning Model and Piaget's theory of cognitive development. These theories emphasized learning through realistic and meaningful interactions, stressing "hands-on learning." In which case, fresh experiences give the drive for the formation of new ideas (McLeod, 2017). In this study, it developed and implemented an instructional learning material, specifically the Tactual Learning Kit (TLK), employing the ADDIE Model (Analysis, Design, Develop, Implement, and Evaluate), chosen to be a guide in developing the material. The ADDIE model is a well-known method utilized by instructional designers and training developers in the past. Analyze, Design, Create, Implement, and Evaluate are the five stages. When creating instructional materials, this is the notion of offering continual or formative feedback. This strategy is meant to save time and money by finding problems while they can still be fixed (Culatta, 2021). Furthermore, as it is common that most of the Grade 1 students fall under the age of 7, they may be considered at the pre-operational stage (2-7 years) in the cognitive development theory of Jean Piaget. According to this point, the way the world looks, rather than the way the world is, influences a child's thinking. It hasn't developed the ability to think critically yet (to solve problems) (McLeod, 2020). So, it could be assumed that Grade 1 students might not be able to learn directly from the direct teaching method. To help them learn, they might need extra support, such as concrete materials. The Tactual Learning Kit (TLK), developed by the researcher, offers direct experiential learning as students would have the opportunity to learn by doing and working with concrete things. In addition, McLeod (2017) found that effective learning occurs when a person goes through a four-step loop: (1) experiences a concrete experience, (2) experiences that experience, Observe and reflect, (3) form abstract concepts (analysis) and generalizations (conclusions), and (4) use these abstract concepts and generalizations to test hypotheses in future scenarios. leading to a new experience.

Objectives of the Study

This study determined the effectiveness of the TLK on grade 1 pupils' performance in mathematics. Specifically, this study sought to: (1) determine the pupils' attitudinal levels in mathematics learning; (2) determine the pre-test performance of the Grade 1 pupils in Math before using the TLK; (3) describe the post-test performance of the Grade 1 pupils in Math after using TLK; (4) Determine the significant difference in the pre-and-post attitude of Grade 1 Math students before and after using the TLK; (5) Determine the significant difference in the pre-test and post-test performance of Grade 1 Math students before and after using the TLK; (6) Ascertain the significant relationship between pupils' mathematics attitudes and performance on the utilization of TLK; (7) Incorporate teacher and expert evaluations and

recommendations to improve the TLK; (8-8).) Propose an enrichment plan based on the findings of this study.

MATERIALS AND METHODS

Research Design

Fundamentally, the researcher employed the one-shot-pre-test-post-test-experimental research design, which is commonly used in the setting of teaching and learning. As shown in Figure 1, the research design framework the pre-treatment phase, treatment phase, and post-treatment phase the use of quasi-experimental research design is regarded as a rigorous research methodology that is ideal for evaluating the influence of educational interventions on student achievement and behavior (Longva & Foss, 2018).

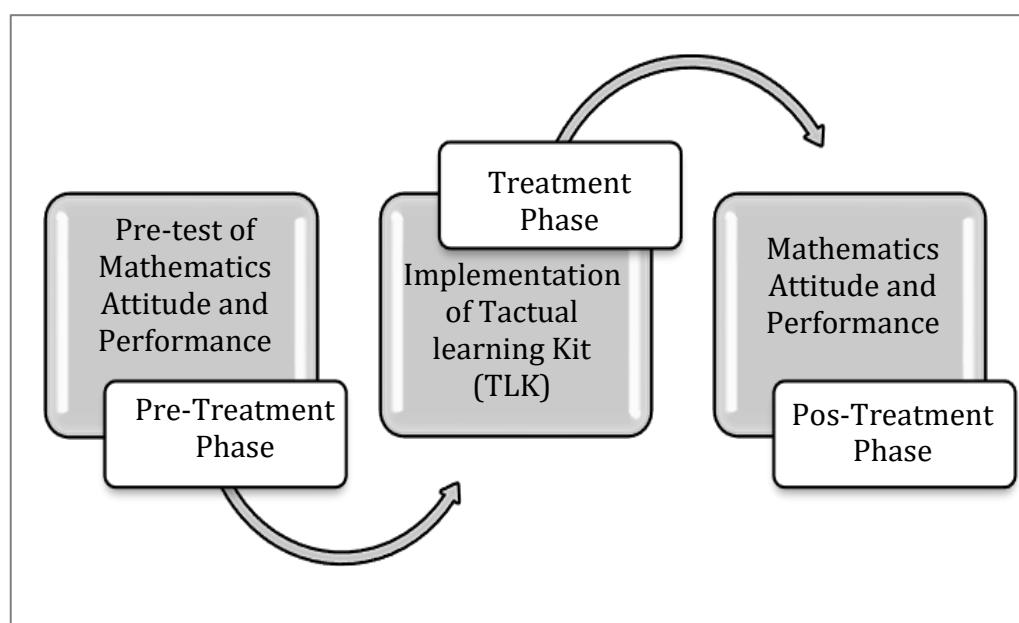


Figure. 1. Research Framework of one-shot-pre-test-post- test-experimental research

In this design, it measured the progress of the pupils' attitudes and performances before and after the intervention of TLK was applied.

Finally, this study also employed a descriptive-qualitative design. Descriptive analyses are valuable when determining whether an intervention is needed and how to design a needed intervention to be most effective (Loeb et al., 2017). The method was used to

indicate the insights of the teachers on the intervention, which is the TLK, and the improvements that are needed. Moreover, a qualitative approach is well-suited for addressing topics or concerns that would be difficult, if not impossible, to study using more structured, less flexible quantitative research methodologies (Roller & Lavrakas, 2015). The approach was used to categorize and interpret the data gathered from the comments and

suggestions of the teacher-respondents for the development of TLK.

Sampling Technique

The respondents in the study involved 13 individuals that were composed of the following: nine (9) Grade 1 pupils, which included four males and five females; and all the teachers of Viga Elementary School, involving four (4) teachers, which included one male and three females. A systematic sampling technique was employed in selecting the 9 pupil-respondents, considering that the study was conducted during the COVID-19 with strict Inter-Agency Task Force (IATF) protocols. This sampling method is good for this study because it is easy to use and has good internal and external validity, it is simple to design, and is easy to check (Acharya et al., 2013).

Research Instruments

This study employed two sets of research instruments to measure the attitude and performance of the participants namely the pre-test-post-test attitude questionnaire and the pre-test-post-test addition questionnaire.

A. Pre-test-Post-test Attitude Questionnaire (10 items).

Since this research study sought the effectiveness of the TLK on the attitude of pupils towards mathematics thus, attitude questionnaires were developed to gather data. The questionnaire included 10 statements on the learners' attitude towards math written in Ilocano which is applicable for a Grade 1 pupil to answer. All suggestions on the validity and applicability were accepted and applied by the researcher. Cronbach's alpha was high for the attitude tested ($=0.773$). Thus, the survey questionnaire's reliability revealed a credible Cronbach's alpha.

Pre-test-Post-test Addition Questionnaire (15 items). As to determine the effectiveness of the TLK on the Mathematics Performance of the Grade 1 Pupils, Pre-test-Post-test Addition Questionnaires were utilized. It included 15 items in addition. The instrument was also validated by the math teacher and adviser of the Grade 1 Pupils giving their suggestions for improvement for one

hour. All suggestions were accepted and applied by the researcher. The conculcated Cronbach's alpha ($=0.877$). Thus, the reliability of the survey questionnaire was determined to be credible.

Evaluation Sheet. For the developmental aspect, an evaluation sheet was administered to the teacher respondents in order to gather their insights, including their comments and suggestions on the intervention that was used. The sheet also included the letter of permission in allowing the researcher to gather the insights of the teacher respondents on the TLK. Additionally, for the qualitative aspect, a portion of the sheet was provided for the respondents' comments and suggestions for improvement of the TLK. Cronbach's alpha was high for the evaluation conducted ($=0.727$). Thus, the reliability of the survey questionnaire was assessed to be credible. All instruments that were used to gather data were validated and approved by the research professor and by the Head Teacher of Viga Elementary School before administering. Their corrections and suggestions were considered in the revision of the instruments for the next stage of validation.

Data Gathering Procedure

This study was conducted within four months, starting from March to July 2021. The following procedures have been undertaken by the researcher to facilitate the data collection process: First, within the month of April, the researcher asked permission from the school head and from the adviser of the Grade 1 Pupil Respondents of the said school. Second, after receiving the permission of the authorities mentioned, on May 24, 2022, the researcher went house-to-house to distribute letters of consent to be signed by the respondents' parents to comply with the data privacy act and ethical consideration of this research study. Third, when permission was finally granted, the researcher finally administered the research instruments to the pupil respondents at the same time. The participants took 15 minutes to answer each of the pre-test questionnaires. They then used the TLK intervention

for an hour with the researcher's guide. Finally, they took 15 minutes to answer each of the post-test questionnaires.

On June 2, 2022, the evaluation sheet was distributed to be answered by the teacher respondents to assess the TLK for one hour. After the evaluation, an interview was conducted with the teacher participants to gather their comments and suggestions regarding the TLK. Lastly, the data gathered was subjected to tabulation, organization, data cleaning, and appropriate statistical analysis with a statistician's aid. The researcher also conducted orientations for the participants of this study. The researcher rigorously followed the ethical research considerations. Finally, result analysis, interpretation, and report writing were done within the months of June and July.

Analysis of the Data/ Statistical treatment

Descriptive statistics, which include frequency, mean, and standard deviation, were utilized to score and interpret the obtained data. For the inferential statistics, paired sample t-test was used to ascertain the significant differences in mathematics performance and attitude before and after the pupils used the intervention. The dependent sample t-test was selected as it signifies the difference between two mean scores and a direction of change (Statistics Solutions, 2021). To test the relationship between pupils' mathematics learning attitude and achievement scores on the utilization of TLK, the Spearman's rho was utilized. Cohen's d effect was also utilized to determine the effect size between the means of the pre and post-test results. This metric is generated by dividing the difference between the means of two groups by their weighted pooled standard deviations (Larner, 2014).

As a result, statistical errors for hypothesis testing and drawing conclusions using the p value will be avoided, which has been one of the calculations was observed to ascertain the effects of the intervention, and the test of common problems in quasi-experimental research in education. In this study, effect size normality on the Pre-

Post Attitude and Performance of the Respondents was computed.

Effect Size Calculation

The effectiveness of TLK as a learning material in enhancing the attitude and performance of the respondents was calculated using the Cohen's d effect. Cohen's d effect sizes less than 0.2 as minor, between 0.2 and 0.5 as medium, and greater than 0.5 as big. The use of G power analysis ascertained the effect size of the intervention, TLK, before and after its implementation.

Table 1. Test of Normality for the Pre-test and Post-test Attitude (Wilcoxon Signed Rank Test)

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-Test	.395	9	.000	.691	9	.001
Post-Test	.385	9	.000	.663	9	.001

a. Lilliefors Significance Correction

This indicates that the use of paired sample t-test and the use of p value to draw conclusion is valid. It can be inferred from the data that the performance test of the respondents was normally distributed, hence, it is therefore feasible to determine that there is higher accuracy of the computed data.

Table 2. Test of Normality for the Pre-test and Post-test Performance scores of the respondents

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre	.183	9	.200*	.966	9	.855
Post	.241	9	.139	.896	9	.232

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Finally, in Table 2, the Test of Normality of the post-performance and post-attitude scores of the respondents is presented. The data shows that the post-performance scores of the respondents were normally distributed while their attitude showed no normality. Hence, the Spearman's Rho was utilized to test the relationship between pupils' mathematics learning attitude and achievement scores on the utilization of TLK to measure the strength of relationship among the variables.

Table 3. Test of Normality for the Pre-test and Post-test

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre	.241	9	.139	.896	9	.232
Post	.385	9	.000	.663	9	.001
a. Lilliefors Significance Correction						

The pre-test and post-test achievement scores were analysed using the descriptive scales of Outstanding to Very Low with 15 points as the highest score. Consequently, to analyse and interpret the attitudes of the participants before and after their utilization of the TLK, and the evaluation of the teacher- respondents on the appropriateness, acceptability, and durability of the material the Likert scale of 1 as the lowest and 5 as the highest was used. was used. Lastly, for the analysis of qualitative data, which are the comments and suggestions of the teacher-respondents on the TLK, thematic analysis was used.

Test of Normality on the Pre-Post Attitude and Performance of the Respondents

As to the test of normality, the Kolmogorov- Smirnov Test (KS Test) was used to test the pre and post attitude variables. In this study, the use of KS test will provide a reliable calculation of data to efficiently determine if the pre-post attitude and performance of the students may significantly differ from each other before and after the utilization of TLK.

As presented in Table 1, it shows the Test of Normality for the Pre-test and Post-test Attitude are not normally distributed. Hence, the use of Wilcoxon Signed Rank Test was employed to avoid possible statistical errors and generalization.

Looking at the test of Normality for the Pre-test and Post-test Performance, Table 2 shows that there is a normal distribution of the performance of the respondents signifying that the assumption to use the test of difference is valid to manifest normality of data.

Ethical Considerations

This study was guided by the following research ethics consideration. First, a letter of approval was given to the

research professor, to the Head Teacher of the Viga Elementary School, and to the adviser of the Grade 1 Pupils. Second, parental consent was given to the parents or guardians of the Grade 1 students. Third, the researcher conducted an orientation about the purposes of the study before the administration of instruments. And lastly, to abide by the data privacy act, the privacy of the respondents was observed by not mentioning names. Before the gathering process, the researcher sought approval of the barangay officials with strict compliance to the IATF protocols.

RESULTS AND DISCUSSION

Description of the Developed Tactual Learning Kit (TLK) as Instructional Learning Material

To address the concern of teaching mathematics using TLK during the COVID-19 pandemic, the researcher followed the ADDIE Model (Analysis, Design, Development, Implementation, and Evaluation) of instructional design as a generic process of developing an instructional learning material.

Having five phases of development, in the Analysis phase, the IM designer analyzes the present knowledge, attitudes, and skills of the pupils in learning mathematics with the difficulties and challenges brought by COVID 19. Having limited student-teacher interaction with the implementation of modular instruction, particularly in mathematics, prompted the researcher to venture on the design of TLK. Figure 1 and Figure 2 show the actual image of the TLK.

During the design phase, the researcher considered self-corrective, self-manipulative, innovative, and locally produced instructional materials. In this part, the researcher designed the TLK as a learning material to be accessible and interactive for learners. Considering the COVID-19 caused significant isolation among the learners, and the need for them to have a tactual learning kit will allow them to have a multi-sensory learning perspective in addition. The TLK is made up of the following locally available materials: recycled ice cream boxes, popsicles, and recycled plastic cups.



Figure. 2. Design of the TLK made up of recyclable and locally available materials



Figure. 3. The TLK with the learning materials and tools

Consequently, the development phase allowed the researcher to create the prototype of the TLK following the learning objectives and content in Mathematics Grade 1 for addition.

The TLK is a portable box composed of different learning materials on addition, including addition cups, popsicle sticks, and dice.

All of the materials in the kit can be touched, which is important for the learning of Grade 1 pupils. As to the implementation phase, the researcher scheduled home visitation with the pupils in strict compliance with the IATF protocols.

He personally went house-to-house to meet with the target respondents to let them know and use the TLK. The said materials have different mechanics of utilization. Its mechanics of utilization are as follows:

A. Mechanics of Utilization in its Addition Cups

1. The learner writes two numbers to be added. Each number should be written above each cup;
2. The learner then inserts balls in each cup with the same amount as the written numbers on the top of each cup;
3. Lastly, the learner gathers all the balls in the box and count them. The result will be the sum of the addition that was written.

B. Mechanics of utilization in its Popsicle sticks

1. The learner writes two numbers to be added;
2. The learner then forms two sets of popsicle sticks. Each set should have the number of popsicle sticks in accordance with the two written numbers;
3. Lastly, the learner gathers all the popsicle sticks and count it. The result will be the sum of the addition that was written.

C. Mechanics of utilization of its Dice Ground

1. The learner rolls each dice in each given space;
2. The learner then writes down the number that is represented in each dice;
3. Lastly, the learners get the sum by adding the two numbers.

Finally, the evaluation phase of the model involves diagnostic, formative, and summative evaluation, specifically the pre-test-post-test assessment of the attitude and performance of the pupils. In this phase, the researcher also requested the teachers to rate the TLK to assess its appropriateness, durability, acceptability, and usefulness. Evaluation studies of instructional materials to improve instruction at the basic education level are few, particularly in the advent of the COVID-19 pandemic. In an attempt by the researcher to provide an insightful and multisensory learning experience for the pupils, the development of TLK as a learning material can supplement their learning process. Hence, this study becomes necessary in the provision of an effective IM for grade 1 pupils to improve their level of proficiency, particularly on the basic foundation of mathematics.

Pre and Post Attitude of the Respondents towards Mathematics**Table 4.** Pupils' Attitudinal Level in Mathematics Learning

Statement	Pre-test			Post-test		
	Mean	SD	Interpretation	Mean	SD	Interpretation
1. Math is my favorite subject.	5.00	0.00	Highly Favorable	4.88	0.33	Highly Favorable
2. I am good at math.	4.88	0.33	Highly Favorable	4.88	0.33	Highly Favorable
3. I know how to add.	5.00	0.00	Highly Favorable	5.00	0.00	Highly Favorable
4. I know how to count.	4.88	0.33	Highly Favorable	5.00	0.00	Highly Favorable
5. It is not hard to learn Math.	4.88	0.333	Highly Favorable	5.00	0.00	Highly Favorable
6. I want to learn more about Math.	5.00	0.00	Highly Favorable	5.00	0.00	Highly Favorable
7. I will not forget what I learned about Math.	4.88	0.33	Highly Favorable	4.66	0.50	Highly Favorable
8. I learn a lot of things in Math.	4.44	1.01	Highly Favorable	4.88	0.33	Highly Favorable
9. I am not nervous about learning Math.	4.55	0.72	Highly Favorable	4.88	0.33	Highly Favorable
10. It is easy for me to learn Math.	4.78	0.441	Highly Favorable	4.77	0.66	Highly Favorable
Grand Mean	4.83	0.25	Highly Favorable	4.90	0.17	Highly Favorable

Legend: 4.20-5.00- Highly Favorable; 3.40-4.19- Favorable; 2.60-3.39- Neutral; 1.80-2.59- Unfavorable; 1.00- 1.79- Highly Unfavorable

Table 4 shows the pre and post-attitude of the respondents to mathematics. The pupils' attitude pre-test resulted in a mean of 4.83, indicating a highly favorable attitude. The pupils' post-test mean, on the other hand, was 4.9, which is also regarded as highly favorable. This could mean that the respondents have a positive outlook towards learning math in their homes. The findings of

this study are similar to that of Awofala et al.'s (2020) study, wherein they ascertained students' perceptions regarding mathematics homeschooling during the COVID-19 pandemic era. It was found that pupils demonstrated a favorable attitude towards mathematics homeschooling during the COVID-19 pandemic.

Table 5. Pupils' Performance in Mathematics Learning

Performance	Pre-test			Post-test		
	ScoreRange	f	%	ScoreRange	f	%
Outstanding	15-13	2	22.22	15-13	2	22.22
Good	12-10	3	33.33	12-10	6	66.66
Fair	9-7	2	22.22	9-7	1	11.11
Low	6-4	1	11.11	6-4	0	0.00
Very Low	3-0	1	11.11	3-0	0	0.00
	Total	9	100	Total	9	100
Mean	9.11			11.78		
SD	3.72			2.44		
Interpretation	Fair			Good		

Test of Difference and Effect Size of TLK on the Pre and Post Attitude Scores of the Respondents**Table 6.** Difference between the Pre-test and Post-test Attitude Scores of the respondents

Attitude	Mean	SD	Mean Diff	t-value	df	p
Pre-test	4.83	0.26	-0.067	-1.789	8	0.111 ns
Post-test	4.9	0.17				

*= significant at 0.05 level; ns= not significant at 0.05level

As presented in Table 6 is the test of difference on the pre-test and post-test attitude scores of the respondents. The p-value (.111) for the attitude scores is greater than the 0.05 significant level. Hence, the pre-test and post-test attitude scores of respondents who were involved in the utilization of the TLK had no significant change. Based

on the results, it can be inferred that the participants were happy and comfortable in learning mathematics inside their homes and with the guidance of their parents.

These findings support the research undertaken by Badri et al. (2018) in which it was found out that home-related

factors on the happiness of children, such as how much fun one had with their family, how well family members got along, and how much time parents spent with their children positively affects their happiness in learning.

Computation of the Effect Size

Table 7. Effect Size of the Pre-test and Post-test Attitude Scores of the Respondents

	Mean	SD	Cohen's d	Interpretation
Pre-test	4.83	0.26	0.31	Medium
Post-test	4.90	0.17		

0.2 = small; 0.2 - 0.5 = medium; >0.5 = large

As seen from the Table 7, the pupils have improved their attitude towards mathematics from a mean score of 4.83 to 4.90, which results in an effect size of $d = 0.31$ which is considered to be a "medium" effect size. Even if the pre-test and post-test are both categorized as highly favorable attitudes, the computation of the effect size shows a medium effect of the intervention in the attitude of the pupils. A medium effect has some explanatory and practical use in the near run, making the material significant in improving the pupils' attitude (Funder & Ozer, 2019). Therefore, it can still be confirmed that the TLK is helpful to make the learners love math even more (Furner & Worrell, 2017; Kontas, 2016; Oymak & Ogan-Bekiroglu, 2021).

Test of Difference and Effect Size of TLK on the Pre and Post Performance Scores of the Respondents

Table 8. Difference between the Pre-test and Post-test Attitude Scores of the respondents

Attitude	Mean	SD	Mean Diff	t-value	df	p
Pre-test	9.11	3.72	-2.667	-2.562	8	0.034*
Post-test	11.78	2.44				

*= significant at 0.05 level; ns= not significant at 0.05level

The table 8 shows the difference between the pre- test and post-test attitude scores of the respondents. The p-value (.034) for the achievement scores is below the 0.05 significant level. Therefore, the pre-test and post- test performance scores of respondents who were involved in the utilization of the TLK changed significantly. According to the study's current findings, pupils improve their mathematical performance when they

utilize the TLK which includes different materials that support math learning. This is comparable to the study of Larbi & Mavis (2016) who discovered that students who were taught extensively through the use of manipulatives fared much better. This finding implies that in teaching young children to learn math, direct teaching method should not be the only focus of the teacher; instead, teachers should develop math manipulatives such as the TLK to assist pupils in learning topics, particularly in mathematics, in order to further develop pupils' mathematical performance in their early years.

Computation of the Effect Size

Table 9. Effect Size of the Pre-test and Post-test Attitude Scores of the Respondents

	Mean	SD	Cohen's d	Interpretation
Pre-test	9.11	3.72	0.85	Large
Post-test	11.78	2.44		

0.2 = small; 0.2 - 0.5 = medium; >0.5 = large

As seen from the Table 9, the pupils have improved their scores from a mean score of 9.11 to 11.78, which results in an effect size of $d = 0.85$ and considered to have a "large" effect size. According to Funder and Ozer (2019), a large effect size has the potential to be quite effective in both the short and long run. Hence, it can be concluded that the TLK had great help in boosting the cognitive performance of the pupil respondents.

Relationship between Pupils' Mathematics Attitude and Performance

Table 10. Relationship between pupils' mathematics Attitude and Performance

Variables	Mean	SD	N	Spearman's rho	P-value
Performance	11.78	2.438	9	0.237	0.542ns
Attitude	4.9	.1732	9		

The p-value of 0.54 in Table 10 indicates that there is no correlation. This suggests that pupils' attitudes toward mathematics are unrelated to their TLK performance results. This also means that whether the pupils have positive or negative feelings about mathematics, the respondents will get a nearly identical achievement

score. According to research, except for attitudes, other variables could have a relationship to the performance of the respondents, such as engagement (Lei et al., 2018), self-esteem (Farhan & Khan, 2015), and emotional intelligence (Garg et al., 2016). Despite the fact that the

study's findings revealed no substantial association between attitude and achievement, future researchers should look into the possibility of such a relationship. Other variables that this study was unable to investigate may be the cause for the non-significant result.

Evaluation and Recommendations of Teacher Respondents on the TLK

Table 11. Evaluation of the TLK by the teacher- respondents

Criteria	Mean	SD	Interpretation
Appropriateness	4.00	0.00	Highly Appropriate
Acceptability	3.50	0.58	Highly Acceptable
Usefulness	4.00	0.00	Highly Useful
Durability	3.75	0.50	Highly Durable
Grand Mean	3.81	0.3	High

The Table 11 reflects that the TLK was rated highly appropriate ($M=4.00$, $sd=0.00$), highly acceptable ($M=3.50$, $sd=0.58$), highly useful ($M=4.00$, $sd=0.00$), and highly durable ($M=3.75$, $sd=0.50$). The results imply that: (1) The TLK has been carefully designed to accommodate the learners' various levels of apprehension, attentiveness, and readiness which makes it to be highly appropriate. (2) The highly acceptable use TLK was carefully constructed and tailored to meet the needs of pupils in learning addition. (3) The kit was thought to be highly useful in improving the learners' mathematical skills by the respondents. It was meticulously crafted to fulfill its objective. (4) Lastly, the kit was deemed by the teachers to be highly durable for children's independent and playful learning. For a self- learning kit such as the TLK to be properly and playfully utilized, it should be durable to support the nature and curiosity of children in learning.

Suggestions Offered to Improve the TLK

The teacher-evaluators' general remarks and suggestions serve as areas for improvement and enhancement of the teaching materials. The teacher- evaluators identified three areas for improvement: (1) appearance, (2) convenience of usage, and (3) durability. In terms of the appearance of the TLK, the evaluators suggested that the kit should be more colorful in order to attract the learners' interest more easily. For the convenience of usage, the

teachers recommended that there should be a container to hold the balls and popsicle sticks while utilizing the kit so that the materials, especially the balls, would not scatter around. Lastly, to make it last longer, it was suggested that the cups be attached to the box with a more durable material.

Based on the present findings of the study, learners enhanced their arithmetic ability with the use of the Tactual Learning Kit (TLK), which comprises a variety of math learning tools. This is similar to Kontas' (2016) research on the impact of manipulatives (concrete learning aids) on students' academic progress in mathematics. In comparison to the pre-test scores of the experiment group, a statistically significant increase in the achievement post-test scores of the manipulatives group was seen as a result of his research. Furthermore, Larbi and Mavis (2016) observed that students who were taught extensively using manipulatives performed much better. As a result, manipulatives have been shown to be a highly effective and promising means of teaching and learning algebra, as well as for strengthening students' cognitive processes when solving algebra problems. The findings on the effect size were also supported by studies. For example, the findings of Bouck and Park (2018) discovered that students' use of manipulatives in learning mathematics had a large impact size. Children have a deep understanding of the mathematics they are

learning when they are directed effectively in their use of manipulatives (Furner & Worrell, 2017).

CONCLUSIONS

The overall goal of this study was to determine the impact of the TLK on Grade 1 pupils' performance and attitude in mathematics. Based on the results of the study, the use of the TLK as a learning material in Grade 1 Mathematics, specifically addition, enhanced the cognitive performance of students, having a large effect size. As a result, when they learn with the TLK and overcome misconceptions about the subject, their performance can be greatly improved. While using the TLK did not significantly alter students' attitudes toward learning mathematics, it still had a medium effect size. Hence, it can still be confirmed that the TLK is helpful in making the learners love maths even more. Furthermore, students' attitudes towards mathematics learning were unrelated to their performance. According to the in-depth evaluation of the teacher-respondents of the material, the TLK is highly appropriate, highly acceptable, highly useful, and highly durable for the learning of Grade 1 pupils in mathematics. In the meantime, it was suggested that the TLK should be made better in the future in terms of how it looks, how easy it is to use, and how long it lasts.

RECOMMENDATIONS

From the conclusions of the study, the following is recommended: (1) Teachers should use hands-on learning tools like TLKs to better understand how useful they are in the primary grades, especially in schools with more than one grade level. (2) In the same way, teachers should think about using TLK in the classroom as an addition to traditional teaching methods to help students learn math in a way that is more significant, persistent, logical, and effective-productive. (3) The multisensory instructional materials should be tested using real experimental designs to find out how they affect the academic performance and motivation of elementary students.

Enrichment Plan Offered for Adoption and Utilization of the TLK

Based from the findings of the present study, the proposed enrichment plan is offered for the school to have better adoption and utilization of the TLK as a learning material in teaching addition for Grade 1 mathematics.

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