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Effectiveness of Utilizing Graphic Organizers in Improving Conceptual Understanding towards Operations of Fractions among Teachers

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Fraction is the most abundant and most complicated topics in mathematics and also prerequisite to successful operations in major mathematical processes. The goal of the study is to look into the effectiveness of utilizing graphic organizers in improving the conceptual understanding towards operations of fractions and its relationship with attitude towards graphic organizers. The study implemented quasi-experimental design particularly Solomon Four-Group design. A total of one hundred sixteen subjects (N = 116) from the College of Teacher Education, Tarlac State University, Philippines used in the study. The study sought to find out whether there was a difference in post instructional conceptual understanding when learners undergone to graphic organizers. Descriptive statistics and inferential statistics were used for data analysis. The findings revealed that when learners are exposed to graphic organizers, their scores and level of conceptual understanding are improved ($F = 13.477$, $p < 0.01$). Graphic organizers is more effective in solving problems towards operations of fractions than using the traditional method. The study established that graphic organizers is an effective approach in improving the conceptual understanding and thus mathematics teachers ought to integrate in their teaching. A Pearson r correlation showed that the relationship between attitude and conceptual understanding is not significant for the first treatment, and significant for the second treatment.

Keywords: graphic organizers, conceptual understanding, Solomon four group design, fractions, mathematics education

INTRODUCTION

Most learners see mathematics as a challenging subject because of its disagreeable teaching approach, which makes it challenging to follow instructions, grasp the subject, recall its equations and methods for solving problems, and, most importantly, remember the term and the concept itself. Through this, learners start to decline the opportunity to

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learn mathematics that will lead to the disliking of the subject. Mathematics is indeed a challenging yet a helpful subject.

One of the challenging topics in Mathematics that most learners refused to appreciate is the concept of fractions. Fractions involve challenging-to-learn and challenging-to-teach concepts that present pedagogical challenges to the Mathematics education community. In layman's term, according to study.com a fraction simply indicates how many components of a whole there are. A fraction may be identified by the slash (vinculum) that is placed between the two integers (numerator and denominator).

With regards to the number of learners who didn't appreciate the beauty of Mathematics. An article published by the Times of India in 2015 titled "The importance of maths in everyday life" said that Mathematics set our lives in order and prevents chaos. Mathematics is everywhere, whatever you do, and wherever you go its presence will always be there. You can't live without Mathematics.

"Seeing the links between ideas and methods, and being able to apply mathematical principles in a variety of contexts" is what conceptual knowledge entails. (Wong & Evans (2008) as cited in de Guzman & Mallari, 2013). Conceptual understanding is like a first line of defense when it comes in your battle towards mathematics, this helps you to decode and understand deep abstract concepts in mathematics. In his report titled "Conceptual Understanding of Fraction and Decimals" in (2004). Taris Washington stated that "Fractions are one of the most challenging math concepts for learners to understand." (Berry and Nyman (2003) as cited in Yatim et al, 2022) revealed that learner obtained meaningful learning through relationships and connections. Through the help of conceptual understanding learners used this to see connections, and relationships in order to successfully deal and answer whatever mathematical problems that may face.

As this world continues to evolve, new researches, methodologies and interventions are developed just to cater the growing number of learners specifically the 21st century learners. Since Mathematics is less appreciated most especially the concept of fractions, many of the concepts is still abstract and very often learners find it challenging to comprehend. Educators' biggest challenge is how to make the subject matter more interesting, exciting, and appealing to the learners. Bringing about the best and desired learning outcomes, instructional materials must select base on its effectiveness.

Method of instruction plays a vital role in the learners' academic achievement, there is a must and need in developing teaching strategies that will elevate, upgrade, and advance the standards of instruction. In answer to this, strategies and techniques used in teaching are proposed by the Department of Education (DepEd). One of these is the graphic organizers. Graphic organizers are spatial displays that employ lines, arrows, and diverse patterns to illustrate information and concepts' connections. (Darch & Carnine (1986) as cited in Condidorio, 2010). Over the last twenty-five years, there has been a sharp increase in study on graphic organizers and their influence on the learning process. In the study of (Tavsanli, Ulger, and Kaldirim, 2018), (Cala, 2019), and (Abdullaeva, 2020), shared similar results where utilization of GO revealed a useful, effective, and

significant effect. Ideally, GO helps the learners to see the fractional parts visually, also the concept of fractions registered twice– verbal and non-verbal, through this the abstractness of the fraction concepts lessens and has two opportunity to be learned. Because they emphasize essential concepts and terminology, as well as the links between them, graphic organizers assist learners focus on what is important (Bromley, DeVitis, & Modlo, 1995), they provide the tools for critical and creative thinking.

Learners frequently struggle with learning from books and lectures because material is usually arranged in blocks or lines that prevent essential links between ideas. Learners who utilize graphic organizers in the classroom have the capacity to use them independently as study aids for taking notes, planning, presenting, and reviewing (Dunston, 1992) and see mathematical concepts applied in their daily life (Steppler, 2020).

In the study of Harris Chaiklin (2011), he defined attitude as a verbal expression and behavior. Attitude also affects a person's way of thinking (Torres, 2019). This simply means that attitude can make a person worse or better depending on the external and internal influences. It either destroys learners or boosts the learners' interest and makes their journey more meaningful. (Syah, 2018), (Wangzom & Chalermnirundorn, 2019), (Syafizal, 2020), and (Chanshi & Daka, 2020) noted in their studies that there is a positive impact of the utilization of GO in their attitude. Attitude plays an important role towards a success in Mathematics endeavours. Having a positive attitude towards the usage of graphic organizers make the learners more interested, adds enjoyment, and give them drive to do more and discover and create their own graphic organizers. In other words, graphic organizers may help students learn both inside and outside of the classroom. This organizer may also be used to assist students in improving and developing their research and problem-solving abilities. Learners are taught how to plan their study and investigation of a topic, enhancing their capacity to learn and think for themselves.

Furthermore, graphic organizers are viewed as a significant and helpful instructional aid due to their ability to organize thoughts and knowledge while also improving understanding of new material (McKnight, 2010). A study on using the GO and animation revealed a significant difference in the learning outcomes of students (Oginni, 2021). As a result, learners of all ages benefit from graphic organizers and visual symbols in subject-related tasks (Dye, 2000).

For as long as there are educators, there will be an enthusiastic search for superior instructional techniques. Taguine's (2014) study states that graphic organizers are not new they are commonly used in some schools and in other subjects but rarely in Mathematics. Through this study, graphic organizer was used and introduced to educators and learners who were not familiar with this method. The researcher aimed to determine the effects of utilizing graphic organizers in improving conceptual understanding towards operations of fractions among pre-service teachers of the Tarlac State University, Philippines during the second semester of academic year 2020-2021. This study was an attempt to prove the effectiveness of graphic organizers in improving conceptual understanding towards operations of fractions.

METHOD

Research Design

This study used quasi-experimental design in particular Solomon's four group research design. The Solomon four-group design is the marriage of the pretest–posttest design and the posttest-only design; two groups served as treatment groups and two groups served as control groups (Martella, Nelson, Morgan, & Marchand-Martella, 2013). Solomon's four group design was chosen to measure the effect of the utilization of graphic organizer as intervention versus the traditional teaching on the operations of fractions, while controlling for the potential effects of a pretest. According to Shuttleworth (2009) p.92 as cited by Muchiri1, Barchok & Kathuri (2015), "the design allows the researcher to exert complete control over the variables and to check the influence of pretest on the results." Also it increases the internal validity, easy to implement the document methodology, and assesses the pre-test sensitization. Solomon Four group design is as follow:

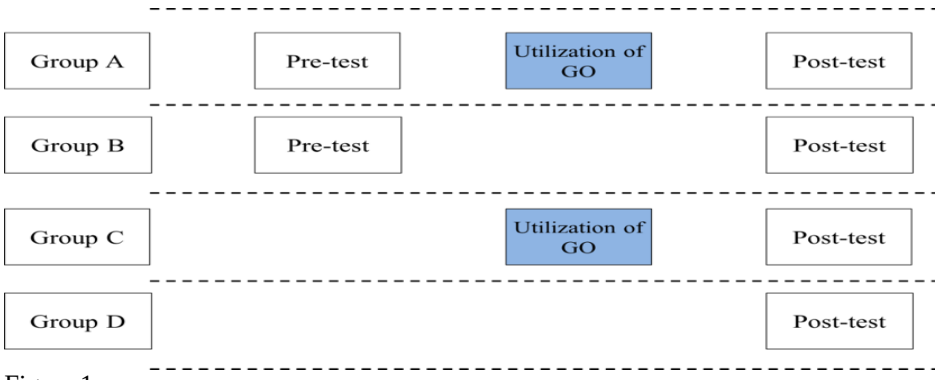

Figure 1
The Solomon's four group design

Subjects of the Study

The subjects of the study were the pre-service teachers specifically the first-year education students who are taking up Bachelor of Elementary Education (BEEd) in Tarlac State University, Philippines. Two sections were used in the study, BEEd 1-A composed of 56 students, and BEEd 1-B composed of 60 students. Each section was divided into 2 equal groups. All in all, this study had four set of groups, two treatment groups having 58 learners and two control groups having 58 learners, leading to 116 as total subjects for this study.

Table 1
Distribution of the subjects of the study

		Number of the Subjects
Treatment Group	Group A (T1)	28
	Group C (T2)	30
Control Group	Group B (C1)	30
	Group D (C2)	28
Total		116

Legend: T1 – first treatment group
T2 – second treatment group
C1 – first control group
C2 – second control group

Data Collection

Probability sampling in particular total enumeration sampling was used in choosing the subjects. Total enumeration sampling is a type of purposive sampling where the researcher chose to examine the whole population that have a particular set of characteristics and it helped also the researchers to potentially draw a much more complete picture and greatly reduced assumptions (Crossman, 2018 as cited in Glen, 2021).

The results were obtained from the learners' pretest, posttest, and attitudinal questionnaire outputs and evaluated by descriptive analysis, independent sample t-test, paired sample t-test, analysis of variance (ANOVA), and Pearson r correlation using the Statistical Package for Social Sciences (SPSS) version 20 software package in finding the mean scores.

Descriptive statistics such as frequency, mean, and standard deviation were used to determine the pre-service elementary teachers' pre and post instructional conceptual understanding towards operations of fractions and attitude towards graphic organizers.

A paired sample t-test was used to determine if the pre instructional conceptual understanding of learners towards operations of fractions were significantly different from their post instructional conceptual understanding towards operations of fractions. A significance level of $p<0.05$ was used in the statistics. Only the overall mean of the attitude and per cluster of the subjects was compared. Also, description was made to interpret the general attitude of the subjects towards graphic organizers with 1.00 – 1.75 as Strongly Disagree, 1.76 – 2.50 as Disagree, 2.51 – 3.21 as Agree, and 3.26 – 4.00 as Strongly Agree.

To determine and find out the significant effect of the intervention among and between the pre-service teachers' instructional conceptual understanding towards operations of fractions analysis of variance (ANOVA) was performed.

Finally, Pearson r bivariate correlation was used to determine the relationship between the attitude and conceptual understanding

Instruments

This study utilized two instruments namely the pretest and posttest questionnaires, and the attitudinal questionnaire.

The first instrument was the pretest and posttest questionnaires that consist of 20 items. The pre-test questionnaire was given to the subjects specifically two from the groups namely first treatment group- T1 and first control group- C1 to answer the questions about the operations of fractions. The content validity of the test was checked and validated by the experts from the Central Luzon State University, Philippines, College of Science- Department of Mathematics and Physics who have an intensive and sophisticated training in the field of Mathematics Education.

The second instrument was an attitudinal questionnaire designed to measure their attitude, in terms of liking, valuing, and confidence towards graphic organizers. This attitudinal questionnaire solely focused on the subjects' attitude in terms of liking the use of graphic organizers, how much they value the graphic organizers, and their confidence in utilizing the graphic organizers. The questionnaire is adapted from Al-Mutawah & Fateel (2017) as cited in Torres (2019) which measured the same parameters and contained 20 items. Al-Mutawah & Fateel (2017), and Torres (2019) attitudinal questionnaires have a Chronbach's Alpha reliability test results value of 0.629 and 0.66, respectively, both an acceptable values.

FINDINGS AND DISCUSSION

This part presents the findings of the analysis of the data obtained. It includes the pre and post instructional conceptual understanding towards operations of fractions, attitude towards graphic organizers, difference on the post instructional conceptual understanding among and between the four groups, difference between pre and post-instructional conceptual understanding of first treatment group and first control group, and correlation between attitude and conceptual understanding towards operations of fractions of first and second treatment groups.

Pre Instructional Conceptual Understanding towards Operations of Fractions

In order to assess the students' knowledge towards operations of fractions prior to the intervention, an analysis of the students' pre instructional scores was performed. The mean and standard deviation as well as the classifications of pre instructional scores for first treatment group (T1) and first control group (C1) are presented in Table 1.

Results in Table 1 shows that mean score for T1 and C1 for the pre instructional were 36.64 and 38.03, respectively out of a maximum score of 100 points. For the pretest of T1, out of 28 students, 1 scored satisfactorily, and 1 scored fair, both are 3.57%, and the remaining 26 from the group scored poor, and that was 92.86%. For the pretest of C1, out of 30 students, 30 or all students in the group scored poor having a 100%. The mean score for the two groups were bad. The results suggested that students' conceptual

understanding was poor. Due to the pandemic where everything is virtual, this added an extra challenge to the students where there's screen barrier and their attention is not solely focused on the lessons unlike in face-to-face setting. Also, this can be attributed to the fact that testing was done before teaching the topics under study. Low score in pretest was tantamount to poor conceptual understanding or background on the topics. Fraction is simple but a challenging topic in Mathematics. Study of Bruma & Guevara (2016) as cited in Diaz and Dio (2017) expressed similar results. It was found out that both the control and experimental groups performed poorly during the pretest.

Table 1
Classification of pre-instructional conceptual understanding of T1 and C1

Classification	Score Range	Pretest T1 $\bar{x} = 36.64$; SD = 15.82		Pretest C1 $\bar{x} = 38.03$; SD = 13.62	
		Frequency	Percentage	Frequency	Percentage
Outstanding	90-100	0	0	0	0
Very Satisfactorily	85-89	0	0	0	0
Satisfactorily	80-84	1	3.57	0	0
Fair	75-79	1	3.57	0	0
Poor	Below 75	26	92.86	30	100

Post Instructional Conceptual Understanding towards Operations of Fractions

Table 2 presents the post instructional mean scores and classifications towards operations of fractions among the four groups involved in the study

Results shows that out of 28 students from the posttest of T1, 2 scored very satisfactorily having a 7.14%. There were 26 students scored poor with 92.86%. For C1, out of 30 students, all in the group scored poor in the posttest and that was 100%. Posttest scores of T2 results shows that out of 30 students, 1 scored above very satisfactorily (3.33%), 1 scored satisfactorily (3.33%), 3 scored fair (10%), and 25 scored poor (83.33%). Lastly, for C2, out of 28 students, 28 from the group scored poor (100%). Control groups (C1 and C2) had mean scores of 39.20 and 47.93, respectively, and treatment groups (T1 and T2) had mean scores of 54.14 and 61.10, respectively out of a maximum score of 100 points. The treatment groups which were taught to utilize graphic organizers in solving operations of fractions problems had a higher mean score compared to control groups that were taught the traditional way of solving operations of fractions problems. Graphic organizers bridge the gap of abstraction, minimized the intensity and vagueness of the problem, and helped students decode easily what the problem is trying to imply. Making their own graphic organizers while solving made the learning meaningful for the information are coded twice and gave the students two opportunities in learning. Also, through the students' own graphic organizers, it minimizes cognitive load. Heavy cognitive load can have negative effects on tasks completion and retention and when

they kept on using it can become overloaded, and learning does not take place. So, graphic organizers help in reducing the loads. Hence, reducing cognitive load may increase learning. The present study was supported by the results of the study of Guevara (2016) as cited in Diaz and Dio (2017) where the study reported that both the control and experimental groups improved in their posttest performances.

Table 2
Classification of post instructional conceptual understanding of the four groups

Classification	Score Range	Posttest							
		T1		C1		T2		C2	
		f	%	f	%	f	%	f	%
Outstanding	90-100	0	0	0	0	0	0	0	0
Very Satisfactorily	85-89	2	7.14	0	0	1	3.33	0	0
Satisfactorily	80-84	0	0	0	0	1	3.33	0	0
Fair	75-79	0	0	0	0	3	10	0	0
Poor	Below 75	26	92.86	30	100	25	83.33	28	100
Mean		54.14		39.20		61.10		47.93	
Standard Deviation		13.15		15.28		13.84		12.90	

Attitude towards Graphic Organizers

One objective of the study was to determine the attitude of the first and second treatment groups after receiving instructions using graphic organizers. Table 3 and Table 4 presents the T1 and T2 attitudes in terms of liking graphic organizers, valuing graphic organizers, and confidence on graphic organizers.

Table 3 shows that the first treatment group's (T1) attitude towards graphic organizers had an overall mean of 2.97 and SD of 0.29 with a description of "agree". This implies that the group showed positive and favorable attitude towards graphic organizers.

In terms of liking graphic organizers the group had a pooled mean of 3.34 and SD of 0.213 described as "strongly agree". This showed that majority in the group do like graphic organizers.

Second cluster was in terms of valuing graphic organizers. The group had a pooled mean of 3.17 and SD of 0.150 translated as "agree". This tells that majority in the group really do care and value graphic organizers.

In terms of confidence in graphic organizers, the group had a pooled mean of 2.64 and SD of 0.326 translated as "agree". This means that the group showed confidence in

graphic organizers. After the intervention the learners felt confident already in using the graphic organizers (Robson; Farooq& Shah (2008), as cited in Duque and Tan 2018).

Table 3
First treatment group's (T1) attitude mean scores towards graphic organizers

Statements	Mean	Standard Deviation	Description
Liking Graphic Organizers	3.34	0.213	Strongly Agree
Valuing Graphic Organizers	3.17	0.150	Agree
Confidence on Graphic Organizers	2.64	0.326	Agree
Overall Mean	*2.97*	*0.29*	*Agree*

Legend: * Statements that were reversely coded
1.00 – 1.75 = Strongly Disagree (SD)
1.76 – 2.50 = Disagree
2.51 – 3.25 = Agree
3.26 – 4.00 = Strongly Agree (SA)

Table 3 shows that the second treatment group's (T2) attitude towards graphic organizers had an overall mean of 2.71 and SD of 0.13 with a description of *"agree".* This implies that the group showed positive and favorable attitude towards graphic organizers.

In terms of liking graphic organizers the group had a pooled mean of 2.81 and SD of 0.178 described as *"agree"*. This showed that students in the group liked graphic organizers.

When it comes in valuing graphic organizers, the group had an overall mean of 2.84 and SD of 0.093 which translated as *"agree"*. The group really do valued graphic organizers.

The last cluster was in terms of confidence on graphic organizers. On this cluster, the group had an overall mean of 2.56 and SD of 0.094 which means *"agree".* This showed that the learners had an optimistic confidence in graphic organizers, after the intervention the learners felt confident in using the graphic organizers. Being equipped in GO boosted your confidence and confidence gives courage that is one of the ingredients of a successful endeavor. Similar results as reported in the study of Mann (2014) where he narrated that a quiet and shy-type student gradually is participating and giving answers. Through the use of GO as their study guides it was seen that GO helped in improving performance of the learners in class.

Table 4
Second treatment group's (T2) attitude mean scores towards graphic organizers

Statements	Mean	Standard Deviation	Description
Liking Graphic Organizers	2.81	0.178	Agree
Valuing Graphic Organizers	2.84	0.093	Agree
Confidence on Graphic Organizers	2.56	0.094	Agree
Overall Mean	*2.71*	*0.13*	*Agree*

Legend: * Statements that were reversely coded
1.00 – 1.75 = Strongly Disagree (SD)
1.76 – 2.50 = Disagree
2.51 – 3.25 = Agree
3.26 – 4.00 = Strongly Agree (SA)

Difference on the Post Instructional Conceptual Understanding among and between the Four Groups

This inquiry aimed to determine and differentiate the four groups. Table 5 presents the results of the analysis of variance (ANOVA). Descriptive statistics shows that the mean of first treatment group (T1) is 54.14 with an SD of 13.145, first control group (C1) mean is 39.20 with an SD of 15.284, second treatment group (T2) mean is 61.10 with an SD of 13.839, and second control group (C2) mean is 46.93 with an SD of 12.904. Levene's test shows that the data is homoscedastic, *($F = 0.308$, $p > 0.05$)*, indicating that there are no significant differences on the variance of the four groups. Thus, data were homogenous.

Analysis of Variance was performed to determine the effect of groupings to post instructional scores. Results show that groupings have significant main effect to the post instructional scores, *$F (3, 112)= 13.477$, $p < 0.05$*. Since the analysis is significant, post hoc was examined to determine which pair/s of means are different. The multiple comparison using Scheffe shows that the difference between T1 and T2 was not significant (*$p = 0.307$ which is $p > 0.05$)*, T1 and C2 was not significant (*$p = 0.424$ which is $p > 0.05$)*, and C1 and C2 was not significant (*$p = 0.307$ which is $p > 0.05$).* However, the difference between T1 and C1 was significant (*$p = 0.001$ which is $p < 0.05$)*, C1 and T2 is significant (*$p = 0.000$ which is $p < 0.05$)*, and T2 and C2 was significant (*$p = 0.006$ which is $p < 0.05$)*. Among the six pairs of means, three were found to be significantly different: T1 vs C1 between C1 vs T2 and between T2 vs C2.

T1 *(mean = 54.14)* and C1 *(mean = 39.20)* were found to be significant this mean that T1 was significantly higher than the C1. T1 and C1 both had pre-instructional test and post instructional test, this mean that by comparing the final post test results between the two groups it was found out that the intervention was effective. GO gives better

representation of works and leads to a more efficient and successful outcome. Therefore, graphic organizers aided students in improving their conceptual understanding.

T1 *(mean = 54.14)* and T2 *(mean = 61.10)* were found to be not significant, meaning both treatment groups were statistically the same. T1 and T2 were both underwent intervention and post instructional test, the only difference of the two groups was T1 had pre-instructional test. The comparison between T1 and T2 post instructional test showed and determined that there were no pre sensitization or the pre-test has no effects on T1, therefore the study was successful. GO served as a guide on how to start answering a problem solving, this simply mean that GO helped students to digest and break down problem solving and arranged it in an simpler and easy to understand manner. Being said by this, learning is within reach of the students who utilized GO as compared to a broader and complex way that traditional way offered. Thus, T1 and T2 both improved in their conceptual understanding through the help of graphic organizers.

T1 (*mean = 54.14*) and C2 *(mean = 47.93)* were found to be not significant. First treatment group who underwent pre-instructional test, intervention, and post instructional test were statistically the same to second control group who were undergone only to post instructional test. GO has deep processing of concepts, this simply mean that T1 who undergone and utilized graphic organizers performed better as compared to C2 even if they will improve the traditional way of teaching, performance of the C2 will not match the performance of T1.

C1 *(mean = 39.20)* and T2 *(mean = 61.10)* were found to be significant this mean that T2 was significantly higher than the C1. C1 had pre instructional test and post instructional test while T2 had intervention and post instructional test. By comparing their final post-test, results show that group who underwent to intervention was found to have a better performance as compared to the group who did not undergo to intervention. Graphic organizers helped in achieving higher order thinking skills (Quist, 1995). Higher Order Thinking skill is a concept introduced by the Americans where in it distinguishes critical thinking skills. Critical Thinking skills is a must have skill in order to have a smooth sailing journey in dealing problem solving. Having said this, possessing these two thinking skills may give a higher and intensive learning. Therefore, graphic organizers helped students in improving their conceptual understanding and seemed to be more effective as a tool in solving operations of fractions.

C1 *(mean = 39.20)* and C2 *(mean = 47.93)* were found to be not significant. C1 and C2 are both control groups who had post instructional test, the only difference of the two control groups was C1 had pre instructional test. By comparing their final post-test, results show that the pre-test itself did not affect behavior, independently of the intervention. Not significant result implies that the act of pre testing does not influence the overall results between the control groups. Hence, both control groups performed the same and statistically similar.

T2 *(mean = 61.10)* and C2 *(mean = 39.20)* were found to be significant. T2 and C2 both didn't have pre-instructional test and have post instructional test. T2 had undergone intervention while C2 did not. Comparison between T2 and C2 allowed the students to

determine if the actual act of pretesting influence the result. If the difference between the post instructional results of T2 and C2 was different from the T1 and C1, then it was assumed that the pre testing has had some effect on the results. As shown in the previous discussion, results of T1 and C1 were also significant this imply that T1 and C1, and T2 and C2 were statistically the same. Therefore, pretesting does not have effect in the results. Though GO for some students are confusing for the reason that they didn't know how to start and time consuming to draw, label, and make the GO pleasing to the eye. GO is utilized to enhance idea understanding and bridge the gap between previous knowledge and new information and as the results shown T2, a group who undergone intervention performed better than to C2 who does not undergone intervention. Thus, graphic organizers helped in improving conceptual understanding towards operations of fractions.

Performances of both the treatment groups and control groups did not have significant difference. This means that the subjects who underwent to the intervention which taught in utilizing graphic organizers in solving operations of fractions performed at the same higher level while the subjects who were taught traditional way of solving operations of fractions performed at the same lower level. Table 4 supports this when it showed in the mean that the two treatment groups (T1 and T2) got the first two highest mean and beyond half of the total score, while the mean of the two control groups (C1 and C2) were at below the half of the total score.

Therefore, even if the traditional method of solving the operations of fractions can improve the performance of learners is still the same and utilization of graphic organizers in solving operations of fractions produces and develops a favorable outcome. Hence, utilizing graphic organizers is more effective than the traditional method in developing the conceptual understanding of the pre-service teachers.

GO has promising results and increase the fraction performance of the learners. Utilizing GO yielded to a lesser confusing problem solving as compared to a more abstract in the traditional way of teaching way of solving. Hearing math specifically problem solving posed a scary feeling towards students, it made them nervous in worst mental blocked. Through utilization of GO these feelings lessened and sometimes eliminated. Furthermore, they aided in increasing creativity by allowing for greater flexibility in thinking and perception of information. They have cleared their thinking, helping them to solve their problems, to make decisions and take action, and to develop their memories and understanding (Krasnic, 2011 as cited in Kansızoğlu, 2017).

The study of Namasaka, Mondoh and Keraro as cited in Diaz and Dio, 2017 also revealed that there was a significant difference among the four groups in their study. The average of second treatment group (T2) *(Mean = 61.10, SD = 13.8)* was the highest.

Table 5
Difference on the post instructional conceptual understanding towards operations of fractions among the four groups after receiving instruction using graphic organizers and traditional way of teaching

Group	Mean	SD	df	F	P
T1 (n= 28)	$54.14_{a,b}$	13.145	3, 112	13.477	.000
C1 (n= 30)	39.20_{c}	15.284			
T2 (n= 30)	61.10_{a}	13.837			
C2 (n= 28)	$47.93_{b,c}$	12.904			

Note: Means with the same subscripts are not different using Scheffe post

Legend: T1- first treatment group with pre instructional test
T2- second treatment group without pre instructional test
C1- first control group with pre instructional test
C2- second control group without pre instructional test

Difference between Pre and Post Instructional Conceptual Understanding of First Treatment Group (T1) and First Control Group (C1)

Paired sample t-test was performed. Results shows below that the pre instructional test mean for T1 having 28 subjects was 36.64 and the SD was 15.819 while the post instructional test mean was 54.14 and SD was 13.5. The mean difference was -17.500. The computed t- statistics $(t_{27} = -6.801, p = 0.000)$ which is $p < 0.05$, even less than $p < 0.001$. While the pre instructional test mean for C1 having 30 subjects was 38.03 and the SD was 13.622 while the mean post instructional test was 39.20 and SD is 15.28. The mean difference was -1.167. The computed t- statistics $(t_{29} = -0.499, p = 0.621)$ which is $p > 0.05$.

This implies that the level of conceptual understanding of the subjects in T1 towards operations of fractions in the post-instructional was higher compared to their pre instructional test. This better performance was largely influenced by the treatment they had received. GO only highlighted the important concepts in the problem. Through this, other add-ons on the problems were eliminated making the learners enjoy and feel the light feeling on problem solving. Moreover, first treatment group who taught in utilizing graphic organizers in solving problems has significant difference as compared to first control group who was taught the traditional way. GO was more systematic, more enjoyable, and built students sense of fractions. This outcome showed match to the studies conducted by Taguines (2014), Uba, Oteikwu, Onwuka and Eniayekan (2017), Decin (2010), and Rusin (2003), where they firmly announced that GO provided a meaningful learning that aided students in improving their academic performances. Thus, graphic organizers seem to be effective in improving the conceptual understanding of the learners.

Table 6
Difference between the pre instructional and post instructional conceptual understanding of first treatment group and first control group

Group	Conceptual Understanding	Mean Difference	t	Standard Deviation	P
T1	Pre-Instructional-Post-Instructional	-17.500	-6.801	13.62	.000
C1		-1.167	-.499	12.79	.621

Correlation between Attitude and Conceptual Understanding towards Operations of Fractions of First and Second Treatment Groups (T1 and T2)

In finding the correlation between attitude and conceptual understanding of the subjects towards operations of fractions, only the overall mean of the attitude and post instructional conceptual understanding scores were used in the analysis.

Table 7 shows the result of the correlation between attitude and conceptual understanding towards graphic organizers. Based on the results, the relationship between attitude and conceptual understanding of the subjects towards graphic organizers was weak and not significant *($r = 0.241$, $p > 0.05$, for T1)*. This means that students from T1 who possessed a positive attitude towards the graphic organizers do not necessarily have high conceptual understanding. Same results in the study of Torres (2019) attitudes and conceptual understanding were not significantly correlated. He stated that non- diverse of respondents contributed to the result of the study.

Interestingly, moderate and significant results for T2 *($r = 0.459$, $p < 0.05$)*. This implies that, students who possess a positive attitude towards graphic organizer moderately have high conceptual understanding. In echo to the result of Humbert (2014) the use of graphic organizers gave positive feeling, drive and motivation in their work and learning. This shows that learners who used GO has better performance in writing and delivering information (Souisa, 2020). Also, Al-Mutawah & Fateel (2018) as cited in Torres (2019) reported a significant correlation between the learners' conceptual understanding and their attitude towards mathematics. Their study involved a much larger and diverse set of respondents, totaling to 624 respondents coming from different secondary grade levels and schools.

Table 7
Relationship between the first and second treatment groups' conceptual understanding towards operations of fractions and their attitude towards graphic organizers

Group	Correlation of Attitude and Conceptual Understanding	R value	P
T1	Attitude and Conceptual Understanding	.241	.306
T2		.459*	.042

*. Correlation is significant at the 0.05 level (2-tailed)

CONCLUSION

The study focused on testing the effectiveness of utilizing graphic organizers which are beneficial to the teaching-learning process. This study aimed to measure their usage in teaching Mathematics particularly to the operations of fractions among the Pre-Service Teachers of Tarlac State University, Philippines in improving their conceptual understanding. Attitudes of the subjects were also obtained to know how they relate towards graphic organizers. The Pre-Service Teachers focused only in utilizing area diagram and number line since graphic organizers have too many kinds and types. From the results, the implications of the study to educational teaching were drawn.

Purposely, only first year pre-service elementary teachers of the College of Teacher Education during second semester of academic year 2020-2021 were the scope of this inquiry.

Based on the findings, the following conclusions were drawn:

1. The pre-instructional conceptual understanding of the first-year elementary education students towards operations of fractions was below average or poor. First treatment group (T1) and first control group (C1) were similar or on the same level of conceptual understanding towards operations of fractions before the intervention was applied.
2. The post-instructional conceptual understanding of the first-year elementary education students towards operations of fractions had an improvement. In specific manner, the treatment groups (T1 and T2) scores exceeded the average level while the control groups (C1 and C2) remained on below average line.
3. Overall Attitude towards graphic organizers of first and second treatment group showed a favorable and positive insight especially in the cluster of liking graphic organizers, valuing graphic organizers, and confidence on graphic organizers.
4. The findings revealed that there was significant effect on the post instructional scores among and between the four groups. Further test performed and results showed that, utilization of graphic organizers is effective in improving conceptual understanding towards operations of fractions. Moreover, pretest sensitization has no effect in this study.
5. The findings revealed that group who underwent treatment had higher scores compared to those group who are taught in traditional way.
6. The relationship between the first treatment group's (T1) attitude towards graphic organizers and conceptual understanding towards operations of fractions of first year elementary education students were found to be not significant. This means that learners who showed a positive attitude towards graphic organizers will not certainly show a good conceptual understanding towards operations fractions. While in second treatment group's (T2) attitude and conceptual understanding found to be significant. This means that learners who showed a positive attitude towards graphic organizers will certainly show a good conceptual understanding towards operations fractions. This discrepancy between the treatment groups may

be caused by time and schedule of the study and volume of school requirements of the learners during the conduct of the study.

The researcher concluded that learners learn more and developed an improvement of the conceptual understanding towards operations of fractions utilizing graphic organizers. In this method, learners utilized graphic organizers specifically area diagram or number line in solving worded problems about operations of fractions. GO made easier the process specifically those students who were challenged. It also creates a meaningful learning and enjoyment to the learners because of the chance to do their own organizers than the traditional way. Involvement in graphic organizers, exhibited better retention and better performance.

RECCOMENDATIONS

This study revealed the effectiveness of utilizing graphic organizers in improving the conceptual understanding.

In order to see the success of utilization of Graphic organizers and obtaining its full effect and application, learners first need to be equipped in the basic and foundational concepts and topics such as fractions, numerator, denominator, proper fractions, improper fractions, similar fractions, dissimilar fractions, mixed fractions, equivalent fractions, and least common denominator. Mastery/ familiarity of the basic and foundational skills (as mentioned above) in fractions are recommended for better result.

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