The Effects of Kit TT 2 Innovation on Year One Pupils' Addition and Subtraction Performance

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Abstract: Home-based teaching and learning (*PdPr*) has been commenced by the Ministry of Education Malaysia during the Covid-19 pandemic in the world. Pupils lack of Mathematics manipulative concrete teaching aids at home. The shortage of hands-on activities limited their ability to learn abstract concepts of addition and subtraction concretely. Failure of pupils to master these skills will affect their future Mathematics study. Therefore, this quantitative study employed a quasi-experimental with non-equivalent pre-test and post-test control group design. This study aims to examine the effects of KIT TT 2 on addition and subtraction performance between two Year One classes at a school in the state of Malacca. The experimental group of pupils was exposed to project-based *PdPr* with KIT TT 2 to help them master addition and subtraction skills over two weeks. A no-treatment control group exposed to *PdPr* with online classes' material was adopted. Data were analyzed by using descriptive and inferential statistics of one-way MANCOVA. The study showed a significant difference in combined addition and subtraction performance between the experimental and the control group. Pupils who used KIT TT 2 had higher addition and subtraction performance compared to pupils who use online classes' material. The findings served as an implication towards stakeholders in terms of implementation of diversifying teaching methods and supporting material in teaching and learning addition and subtraction skills during *PdPr*.

Keywords: Addition, KIT TT 2, Mathematics, Quasi-experimental design, Subtraction.

INTRODUCTION

Mathematics is one of the important subjects where the mastery and excellence of mathematics is the foundation of a developed country. Thus, it is vital to ensure every pupils master basic counting skills since primary school level. The objective of Malaysia's primary school mathematics education is to shape and develop numbers concept and the basics of counting among Malaysia's pupils (Ministry of Education Malaysia, 2016). The National Council of Teachers of Mathematics (2014) also stated that basic counting skills such as addition and subtraction skills are the foundation for constructing competence and fluency in mathematics. Nevertheless, there are still many pupils who do not master addition and subtraction skills well at the primary school level (Ariffin et al., 2018; Nazatul Akma & Siti Mistima, 2017; Wilmot, 2018).

Pupils' mathematics performance in Malaysia is still at a worrying level. Through the statistics reported, pupils in Malaysia recorded a lower score than the OECD average in mathematics performance at international level (The Organisation for Economic Co-operation and Development, 2019). Besides, 16.87% of pupils failed in mathematics subject in Primary School Performance Test, *UPSR* 2019 at the national level (Ministry of Education Malaysia, 2019). It is the second-highest subject where the number of candidates failed in *UPSR* 2019. These statistics showed that Malaysia's mathematics quality and performance are still at an unsatisfactory level.

According to OECD report (2019), Malaysia is reported to face material shortage compared to the OECD average. Besides, home-based teaching and learning have been commenced by the Ministry of Education Malaysia during the Covid-19 pandemic in the world (Ministry of Education Malaysia, 2021). This has resulted in pupils lack of mathematics manipulative concrete teaching aids at home. Teaching aids in school are also inadequate to distribute to pupils during the Movement Control Order enforced by the government of Malaysia. Lack of hands-on activities limited their ability to learn abstract concepts of addition and subtraction concretely.

Conceptual understanding is essential for pupils to develop their mathematics abilities (Sari et al., 2020). Zulnaidi and Zamri (2017) found out that pupils' mathematics performance can be improved by conceptual understanding only, procedural fluency only, or from conceptual understanding to procedural fluency. The National Council of Teachers of Mathematics (2014) also stated that effective mathematics teaching should focus on both conceptual understanding and procedural fluency. Nevertheless, Ghazali and Zakaria (2011) discovered that Malaysia's pupils have high level of the procedural fluency, but they have low level of conceptual understanding.

Past study showed that pupils from preschools in Malaysia misunderstood the knowledge of mathematics, lack of mechanical skills, and memorize steps to complete operations (Priyadarshini et al., 2019). This shows that teachers in Malaysia tend to focus on steps to obtain answers without understanding the rationale to the answers (Parwines & Noornia, 2019; Somasundram et al., 2018; Tarzimah & Thamby, 2010). Thus, pupils who completed the mathematics operation do not guarantee their understanding of the concepts of mathematics (Chinnappan & Munirah, 2018).

Failure of pupils to master addition and subtraction skills will affect their future mathematics study. Therefore, KIT TT 2 innovation has been developed to overcome the problems stated above. KIT TT 2 focuses on manipulative techniques, hands-on learning and active involvement of the pupils in learning addition and subtraction skills during *PdPr*. Besides, conceptual understanding and procedural fluency are focused simultaneously during the use of KIT TT 2. Pupils are given the chance to investigate, differentiate and synthesis the concept and procedural between addition and subtraction. Indirectly, it will develop pupils' number sense in mathematics (Clements & Sarama, 2014).

Purpose

The purpose of this study is to examine the effects of KIT TT 2 on addition and subtraction performance among Year One pupils (age 7) at a government-funded school in Malacca, Malaysia.

Research Questions

1. Are there statistically significant differences between experimental and control groups on the combined addition and subtraction performance after controlling for pre-test scores?
2. Are there statistically significant differences between experimental and control groups on the addition performance after controlling for pre-test scores?
3. Are there statistically significant differences between experimental and control groups

on the subtraction performance after controlling for pre-test scores?

MATERIALS AND METHODS

This research employed a quasi-experimental with non-equivalent pre-test and post-test control group design. This research involved inferential statistical analysis to test the hypothesis (Cresswell, 2009). The quasi-experimental study design was used based on unequal groups and did not involve the selection of a completely randomized study sample (Fraenkel & Wallen, 2008). It is applied when it involved research on testing the effectiveness of teaching aids in situations that cannot be used in true experiments (Chua, 2006). Thus, this research design is suitable to be used in this study. Most of the samples already exist in certain circumstances and situations to test the effectiveness of KIT TT 2 on pupils' addition and subtraction performance.

The study was conducted in one government-funded school in the state of Malacca, Malaysia. In this school, there were five mix-ability classrooms for Year One pupils. Year One pupils were assigned randomly to five classrooms by the school administrator early of the year. One classroom was chosen to be the control group, while the other one was chosen to be the experimental group. All pupils did not have much exposure to mathematics. Movement Control Order empowered by the Malaysian government had impacted their mathematics study in their preschool. Moreover, Year One pupils were made compulsory to take part in the one-month orientation program organized by the school during early of the year. In addition, home-based teaching and learning had commenced since 17 May 2021. Pupils lack of mathematics manipulative concrete teaching aids at home. Lack of hands-on activities limited their ability to learn abstract concepts of addition and subtraction concretely. Thus, this had resulted in their poor mathematics performance in school.

The quasi-experimental design has an advantage to control the threats to internal validity (Noraini, 2011). To control the history effect, this study was conducted in two weeks to avoid other factors which will affect the accuracy of the study over time. The maturation effect was controlled by selecting pupils of the same age. All the pupils were seven years old, study in Year One and attending the same school. The researcher chose two out of five classes in the school. Both classes are similar in terms of the number of pupils. Besides, all pupils were randomly assigned to each class by the school administrator during early of the year to form mix-ability classrooms.

The experimental group of pupils was exposed to project-based *PdPr* with KIT TT 2 to help them master addition and subtraction skills. They were taught to build their own KIT TT 2 based on the template given. A no-treatment control group exposed to *PdPr* with online classes' material was adopted. Both groups were taught addition and subtraction within 100 without regrouping and with regrouping over two weeks of home-based teaching and learning. After two weeks of intervention, pupils from both groups were given a post-test to evaluate the effectiveness of the KIT TT 2 compared to the online classes' material. Table 1 below showed the Research Framework of this study.

Table 1. Research framework

Groups	Pre-test	Teaching method over two weeks	Post-test
Experimental Group	O	X_1	O_1
Control Group	O	X_2	O_1

Note. O = Pre-test experimental group/ control group,
X_1 = Project-based *PdPr* with KIT TT 2,
X_2 = *PdPr* with online classes' material,
O_1 =Post-test experimental group/ control group.

Instruments

In this study, two instruments were used for data collection which were Pre-test and Post-test. Items for both tests were adapted from Year One Mathematics Textbook. Both Pre-test and Post-test used the same items. They were only differed by the arrangement of the items. Face validation and content validation by experts were used to validate both instruments in this study. The service of one Expert Teacher (*Guru Cemerlang*) and one Primary School Achievement Test (*UPSR*) examiner were used to validate instruments in this study. Both experts claim 100% agreement based on the test specification table given. Thus, both instruments were valid to measure pupils' addition and subtraction performance within 100 without regrouping and with regrouping.

Both Pre-test and Post-test consist of 20 items to evaluate pupils' addition and subtraction performance. It consists of two sections, A and B. Section A consists of 10 items to evaluate pupils' addition performance. 5 items involved addition within 100 without regrouping, while 5 more items involved addition within 100 with regrouping. Section B also consisted of 10 items to evaluate pupils' subtraction performance. 5 items involved subtraction within 100 without regrouping, while 5 more items involved subtraction within 100 with regrouping. One correct answer will be awarded with one mark.

Both groups' scores were recorded and analyzed by using the Statistical Package for Social Sciences (SPSS) software. Researcher used both descriptive statistics and inferential statistics of one-way MANCOVA in this study to analyze the data. The null hypothesis testing was set at a 0.05 level of significance. When the p-value is greater than 0.05, the null hypothesis is failed to reject. When the p-value is lesser than 0.05, the null hypothesis is rejected.

KIT TT 2 Innovation

The main purpose of the KIT TT 2 innovation is to help pupils master addition and subtraction skills concretely while warranting their conceptual understanding and procedural fluency. In this study, pupils were given the chance to build their own teaching aids at home during home-based learning and teaching. Pupils were guided to understand the concept of addition and subtraction through KIT TT 2 and mastered procedural fluency simultaneously.

In this intervention, pupils were given a template of KIT TT 2 via Google Classroom. They printed the template and built their own KIT TT 2 based on the guideline given. KIT TT 2 consists of a number gear and a regrouping section. The conceptual understanding of addition and subtraction is based on increasing or decreasing quantity on the number line. The regrouping process happens in addition when the number gear moving greater than nine. Likewise, the regrouping process happens in subtraction when the number gear moving lesser than zero. With this, it would help pupils to learn addition and subtraction concretely while applying the same concept. The procedural steps for both addition and subtraction are also similar with the use of KIT TT 2. Besides, pupils did not expose to borrowing techniques in learning subtraction. The proposed procedural steps for subtraction are lesser and easier to memorize compared to the traditional method of subtraction. It gives advantages to pupils who are weak in mathematics as they use less working memory to learn subtraction. Learning mathematics would be interesting as they could master the addition and subtraction skills concretely compared to memorizing the procedural steps to find the answer only.

As the pupils were at the age of seven, they were at the Concrete Operational Stage. Piaget (1965) stated that this stage is a crucial turning point for a child to develop their cognitive. The use of hands-on activity with KIT TT 2 is important in enabling the pupils to learn addition and subtraction skills better. Thus, this innovation is created to helps pupils to build their own concrete teaching aids during home-based learning and teaching.

RESULTS AND DISCUSSION

Fifty-six Year One pupils from two mixed-ability classrooms at a government-funded school in the state of Malacca, Malaysia were involved in this study. Table 2 below showed the mean score and standard deviation of pupils' addition and subtraction performance in the experimental group and control group.

Table 2. Mean score and standard deviation of pupils' addition and subtraction performance

Variables	Group	N	Pre-test Mean	SD	Post-test Mean	SD
Addition score	Experimental	28	4.46	2.83	8.96	1.23
	Control	28	4.25	2.95	7.14	2.63
Subtraction score	Experimental	28	2.89	3.19	8.71	1.41
	Control	28	3.11	3.20	4.57	3.65

From Table 2, pupils in experiment group which were taught with KIT TT 2 had higher mean score in both addition performance (Mean = 8.96, SD = 1.23) and subtraction performance (Mean = 8.71, SD = 2.63), while the pupils in control group which were taught with online classes' material had lower mean score in both addition performance (Mean = 7.14, SD = 2.63) and subtraction performance (Mean = 4.57, SD = 3.65) in the post-test. In order to determine the observed effect, null hypothesis 1 was tested.

Ho1: There is no statistically significant difference between experimental and control groups on the combined addition and subtraction performance after controlling for pre-test scores.

This null hypothesis 1 above was tested using the one-way multivariate analysis of covariance (one-way MANCOVA) statistical technique at $p<.05$ significance. According to Dimitrov and Rumrill (2003), the pretest scores were used as a covariate in MANCOVA to remove systematic bias and decrease the error variance. In the other words, a one-way MANCOVA was used to compare the effectiveness of KIT TT 2 whilst controlling for pre-test scores in this study.

A total of 56 pupils were involved in the study. Both groups had equal number of pupils (N=28). Levene's test was not significant (p>.05) showed that equal variances could be assumed, but Box's M test was significant (p<.001) showed that the data did not have equality of covariance matrices. Thus, Pillai's Trace test was used in this study because of the violation of the homogeneity of variance-covariance assumption (Field, 2013). The result of the one-way MANCOVA was shown in Table 3.

Table 3. Multivariate tests of pupils' addition and subtraction performance

Effect		Value	F	df	Error df	Sig.	η^2
Group	Pillai's Trace	.56	32.27	2.0	51	.000	.33

There was a statistical difference between experimental and control groups on the combined addition and subtraction performance after controlling for pre-test scores, $F(2,51)=32.27$, $p<.05$; Pillai's Trace = .56, partial η^2 = .33. Thus, null hypothesis 1 is rejected. This indicated that pupils' combined addition and subtraction performance is significantly higher by using intervention KIT TT 2 than using online classes' material. Based on Cohen (1988), the effect size for MANCOVA was measured using partial eta square (η^2). The values of .01, .06, and .14 showed that there is a small, moderate, and large effects respectively. Thus, the effect size of KIT TT 2 was large (η^2 = .33).

Tests of between-subject effects were run to determine how addition and subtraction performance differ for the teaching method used. Table 4 below showed the tests of between-subject effects to test the null hypothesis 2 and 3 in this study.

Table 4. Tests of between-subject effects

Source	Variables	Type III Sum Square	df	Mean Square	F	Sig.	η^2
Addition Pre-test	Addition Post-test	43.97	1	43.97	24.68	.000	.322
Subtraction Pre-test	Subtraction Post-test	4.37	1	4.37	1.26	.267	.024
Group	Addition Post-test	32.83	1	32.83	18.42	.000	.262
	Subtraction Post-test	226.40	1	226.40	65.17	.000	.556

Ho2: There is no statistically significant difference between experimental and control groups on the addition performance after controlling for pre-test scores.

The F-value associated with the Addition Pre-test (Covariate) was significant, $F(1,55)=24.68$; $p<.05$. This showed that the pupils in both groups were statistically significant different in the addition performance level before the intervention.

The result in Table 4 showed that there was a statically significant effect of KIT TT 2 on pupils' addition performance, $F(1,55)=18.42$, $p<.05$; partial $\eta^2 =.262$. Therefore, null hypothesis 2 was rejected. This study showed that there is a differential effect of KIT TT 2 and online classes' material on pupils' addition performance. Based on Cohen (1988), the effect size of KIT TT 2 is high ($\eta^2 = .262$). In other words, KIT TT 2 has a large significant effect on pupils' addition scores compared to online classes' material.

Ho3: There is no statistically significant difference between experimental and control groups on the subtraction performance after controlling for pre-test scores.

The F-value associated with Subtraction Pre-test (Covariate) was not significant, $F(1,55)=4.37$; $p=.267$. This showed that the pupils in both groups were not statistically significant different in the subtraction performance level before the intervention.

The result in Table 4 showed that there was a statically significant effect of KIT TT 2 on pupils' subtraction performance, $F(1,55)=65.17$, $p<.05$; partial $\eta^2 = .556$. Therefore, null hypothesis 3 was rejected. This study showed that there is a differential effect of KIT TT 2 and online classes' material on pupils' subtraction performance. Based on Cohen (1988), the effect size of KIT TT 2 is large ($\eta^2 = .556$). In other words, KIT TT 2 has a large significant effect on pupils' subtraction scores compared to online classes' material.

The descriptive analysis in Table 2 showed that subtraction performance is much lower than addition performance in the control group. This study supports the fact that subtraction is harder than addition (Wilmot, 2018). This is because pupils need to use more memory capacity to solve subtraction problems with borrowing techniques (Kase et al., 2009).

KIT TT 2 was used to help pupils in mastering both addition and subtraction skills. In this intervention, pupils will then be able to learn conceptual understanding and procedural fluency simultaneously. This makes the innovation KIT TT 2 a success because traditionally, conceptual understanding and procedural fluency are introduced by phases (NCTM, 2014; Zulnaidi & Zamri, 2017). Thus, teachers tend to focus on the procedural fluency phase more without understanding the rationale for the answers (Parwines & Noornia, 2019; Somasundram et al., 2018). This has resulted in pupils mathematics ability is being less developed (Sari et al., 2020). Both conceptual understanding and procedural fluency are equally important in learning mathematics. Therefore, teachers cannot focus on procedural fluency only in order to train pupils to answer correctly in exam.

Besides, intervention KIT TT 2 is built on using the same number line concept for addition and subtraction. Based on Judith (2007), the concept of addition is increasing quantity on the number line, while subtraction is decreasing quantity on the number line. In the traditional method, regrouping techniques for addition and subtraction are different. To overcome the problem, KIT TT 2 introduces the same way of regrouping and get rid of the borrowing technique in subtraction. Thus, both skills do not differ too much in KIT TT 2 than the traditional method. Pupils do not need to use more memory capacity to memorize different procedural steps of addition and subtraction (Kase et al., 2009). In addition, pupils involve themselves in activities such as investigate, differentiate, and synthesis the concept and procedural between addition and subtraction by using KIT TT 2. They find out that addition and subtraction are inverse operations. These activities support the development of pupils' number sense in mathematics (Clements & Sarama, 2014).

The intervention KIT TT 2 is also helpful in the sense where it is a hands-on activity. Each pupil was provided with a template and they can build their mathematics teaching aid at home during Movement Control Order in Malaysia. This study also helps to reduce material shortage problems in Malaysia (OECD, 2019). Hands-on activities are significant as it helps them to learn better. The findings concur with the findings of Ekwueme et al. (2015). Pupils gain their knowledge by concrete experience through the hands-on approach. Thus, it could be concluded that the use of KIT TT 2 is useful in helping the pupils to master addition and subtraction skills through concrete experience and active involvement. Besides, the KIT TT 2 innovation also proposed another fun way of learning during home-based teaching and learning in Malaysia. Pupils no need to focus on their computers only to study.

With the use of KIT TT 2, pupils would then be able to master both conceptual understanding and procedural fluency of addition and subtraction skills. This helps them to build a strong foundation as these skills will be used to learn multiplication and division in the future. Besides, addition and subtraction skills are also used across all of the topics in mathematics such as calculating money, time, length, and others. Thus, it is vital for pupils to have a strong foundation in both addition and subtraction skills well since Year One.

CONCLUSION

As a conclusion, the use of KIT TT 2 innovation is effective in helping Year One pupils in mastering both addition and subtraction skills. A suggestion would be that once the pupils have mastered both addition and subtraction skills, they could use the KIT TT 2 to learn multiplication and division skills. Future studies should be directed towards testing this innovation on pupils who are weak in mathematics such as dyscalculia pupils in order to identify it's effectiveness in other samples.

This study has implications for pupils, parents, teachers, and the Ministry of Education Malaysia on the implementation of different technique in teaching addition and subtraction skills. Parents' involvement should be enhanced to improve pupils' addition and subtraction performance at home. Teachers also need to acquire different teaching methods which are pupils-centered and use the most suitable method to help their pupils. Problems that pupils could not master addition and subtraction skills happened throughout the world. Ministry of Education Malaysia should improve mathematics curriculum that is consistent with the new technique to reach out and cater to different pupils' needs. There is no one-size-fits-all method in mathematics. Thus, this study is essential in increasing the addition and subtraction performance of pupils with different needs.

REFERENCES

[1]. Ariffin, A., Baisar, Z., Hamzah, N., Rubani, S.N.K. & Subramaniam, T. S. (2018). Kaedah Melukis Gambarajah: Satu Pendekatan Dalam Proses Penyelesaian Masalah Matematik. *Online Journal for TVET Practitioners.* https://publisher.uthm.edu.my/ojs/index.php/oj-tp/article/view/4811/2887.

[2]. Chinnappan, M., & Ghazali, M. (2018). Solution Of Word Problems By Malaysian Students: Insights From Analysis Of Representations. *Proceedings of the 41st Annual Conference of the*

Mathematics Education Research Group of Australasia, 226–233.

[3]. Chua, Y.P. (2006). *Kaedah Statistik Penyelidikan. Buku Satu: Kaedah Penyelidikan*. Kuala Lumpur: McGraw Hill.

[4]. Clements, D., & Sarama, J. (2014). *Learning And Teaching Early Math: The Learning Trajectories Approach.* New York, NY: Routledge.

[5]. Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences.* New York, NY: Routledge Academic.

[6]. Creswell, J.W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 3rd ed.* Thousand Oaks, CA: Sage.

[7]. Dimitrov, D. M., & Rumrill Jr, P. D. (2003). Pretest-posttest designs and measurement of change. *Work*, 20(2), 159-165.

[8]. Ekwueme, C. O., Ekon, E. E. & Ezenwa - Nebife, D. C. (2015). The Impact of Hands-On-Approach on Student Academic Performance in Basic Science and Mathematics. *Higher Education Studies*, 5(6), 47-51. http://dx.doi.org/10.5539/hes.v5n6p47.

[9]. Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics.* London: SAGE.

[10]. Fraenkel, J.R., & Wallen, N. E. (2008). *How To Design And Evaluate Research In Education.* 7th ed. Avenue of the Americas, NY: McGraw-Hill Higher Education.

[11]. Ghazali, N. H. C., & Zakaria, E. (2011). Students' procedural and conceptual understanding of mathematics. *Australian Journal of Basic and Applied Sciences,* 5(7), 684-691.

[12]. Judith, D. K. (2007). *Illustrated Maths Dictionary. 4th ed.* Melbourne: Pearson Australia Group Pty Ltd.

[13]. Kase, S.S.E., Ritter, F.E.F. & Schoelles, M. (2009). Serial Subtraction Errors Revealed. In *Proceedings of the 31st Annual Conference of the Cognitive Science Society (Vol. 31, No. 31),* pp 1551–1556.

[14]. Ministry of Education Malaysia. (2016). *Kurikulum Standard Sekolah Rendah (KSSR): Matematik Dokumen Standard Kurikulum dan Pentaksiran Tahun Dua.* Putrajaya: Bahagian Pembangunan Kurikulum.

[15]. Ministry of Education Malaysia. (2019). Pelaporan Pentaksiran Sekolah Rendah 2019. https://www.moe.gov.my/muat-turun/laporan-dan-statistik/lp/3056-pelaporan-pentaksiran-sekolah-rendah-2019/file.

[16]. Ministry of Education Malaysia. (2021). Manual Pengajaran dan Pembelajaran di Rumah Versi 2. https://www.moe.gov.my/pekeliling/4081-manual-pengajaran-dan-pembelajaran-versi-2-2-feb-2021-1/file.

[17]. National Council of Teachers of Mathematics. (2014). *Principles to Actions: Ensuring Mathematical Success For All.* Reston, VA: NCTM.

[18]. Nazatul Akma, M.N. & Siti Mistima, M. (2017, January). *Keberkesanan Kaedah Geng 10 Terhadap Kemahiran Penolakan Mengumpul Semula Dalam Kalangan Murid Tahun 3.* Paper presented at the Simposium Pendidikan diPeribadikan: Perspektif Risale-I Nur (*SORiN2017*), 503-508.

[19]. Noraini, I. (2011). *Penyelidikan dalam pendidikan*. Kuala Lumpur : McGraw Hill Education.

[20]. Parwines, Z. & Noornia, A. (2019, February). Is It Required To Remove Borrowing Techniques In Clearly Subtraction Operations In Elementary School? In *Journal of Physics: Conference Series (Vol. 1157, No. 4),* 042076. IOP Publishing.

[21]. Piaget, J. (1965). The stages of the intellectual development of the child. *Educational psychology in context: Readings for future teachers,* 63(4), 98-106.

[22]. Priyadarshini, M. Mong, S.K. & Gurnam, K.S. (2019). Addition Error Patterns Among the Preschool Children. *International Journal of Instruction,* 12(2), 115-132. https://doi.org/10.29333/iji.2019.1228a.

[23]. Sari, P., Hajizah, M. N., & Purwanto, S. (2020). The Neutralization on an Empty Number Line Model for Integer Additions and Subtractions: Is It Helpful?. *Journal on Mathematics Education,* 11(1), 1-16. http://doi.org/10.22342/jme.11.1.9781.1-16.

[24]. Somasundram, P., Sharifah Norul Akmar, S. Z., & Leong, K. E. (2018). Year Five Pupils' Understanding of Relationship Between Addition and Subtraction. *Journal of Research in Science Mathematics and Technology Education,* 1(2), 169–180. https://doi.org/10.31756/jrsmte.123.

[25]. Tarzimah, T., & Thamby Subahan, M. M. (2010). Students' Difficulties in Mathematics Problem-Solving: What Do They Say? *Procedia - Social and Behavioral Sciences*, 8(5), 142–151. https://doi.org/10.1016/j.sbspro.2010.12.020.

[26]. The Organisation for Economic Co-operation and Development. (2019). Programme For International Student Assessment (PISA) Results From Pisa 2018. https://www.oecd.org/pisa/publications/PISA2018_CN_MYS.pdf.

[27]. Wilmot, E. M. (2018). A comparative study of the effect of the methods of Decomposition and Base Complement Addition on Ghanaian children's performance on Compound Subtraction. *The Oguaa Educator,* 12(1), 28-52.

[28]. Zulnaidi, H., & Zamri, S. N. A. S. (2017). The effectiveness of the GeoGebra software: The intermediary role of procedural knowledge on students' conceptual knowledge and their performance in mathematics. *Eurasia Journal of Mathematics, Science and Technology Education,* 13(6), 2155-2180. https://doi.org/ 10.12973/eurasia.2017.01219a.