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The effect of concrete object media assisted by bruner's theory on learning outcomes on measurement material for students in elementary school

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ABSTRACT

Many elementary school students have difficulty in understanding the concept of nonstandard weight measurement because learning is delivered abstractly and does not involve concrete experience. This has an impact on the low mathematics learning outcomes of students, especially in first grade elementary school. This study aims to analyze the effect of using concrete objects media with the help of Bruner's theory on student learning outcomes in nonstandard weight measurement material. The research method used was an experiment with a *true experimental* design, involving two groups: experimental (with concrete media) and control (conventional learning), each consisting of 5 randomly selected students. The results showed a significant increase in posttest results in the experimental group with an average score of 98.00 compared to the control group which only reached 78.00. Concrete media, such as clothes hangers, proved to help students understand the concept of weight through direct experience, in accordance with the cognitive stages of children according to Bruner's theory. The conclusion of this study is that the use of concrete media based on Bruner's theory is effective in improving students' understanding and learning outcomes in learning mathematics at elementary school.

INTRODUCTION

Education is a process designed to help students develop their potential optimally through a structured learning process. The success of education is highly dependent on the effectiveness of the learning process in the classroom, especially at the basic education level which is the initial foundation for students' cognitive development (Zahroh et al., 2024; Peng & Kievit, 2020; Darling-Hammond et al., 2020). Therefore, it is important for teachers to continue to innovate in creating active and fun learning strategies so that students are fully involved in the learning process.

Mathematics is one of the essential subjects in the primary school curriculum because it has an important role in shaping the ability to think logically, systematically, and critically (Irwan et al., 2024; Olivares et al., 2021; Celik & Ozdemir, 2020). However, many students at the

elementary school level have difficulty in understanding mathematical concepts due to the delivery of material that is too abstract and less contextualized (Reyes et al., 2019; Nurlaily et al., 2019; Yildiz, 2020). One of the most challenging materials is nonstandard weight measurement, as it requires proper conceptual understanding and good manipulative skills.

Nonstandard weight measurement material is usually taught in first grade by using simple measuring instruments that do not have standard units, such as stones, marbles, or other everyday objects. The characteristics of nonstandard measuring instruments are measurement results that can vary depending on their use (Tjalla et al., 2023; Falentina et al., 2024; Wulandari et al., 2022). This concept is often difficult for students to understand if the learning is delivered verbally without visual and manipulative support. Therefore, concrete learning media is needed to help students understand the concept of measurement in a more real and fun way.

Based on the results of brief observations made by researchers during math learning activities in class I, it appears that most students have difficulty in understanding the concept of weight comparison. When the teacher gave the task of comparing two objects, such as a pencil and a pencil case, many students only guessed without making direct observations or experiments. Some students seemed confused about which object was heavier, even after holding or lifting the object. In addition, when asked to explain the reason for their choice, most students were unable to give a logical explanation or mention the characteristics of the weight of the objects being compared. The activity of comparing weight is often done verbally by the teacher without any tools, so students do not get visual or kinesthetic experiences that support understanding.

One solution to overcome difficulties in understanding weight measurement material is to use concrete object media, such as clothes hangers, which can function as measurement props. Concrete object media provide direct learning experiences through manipulative activities that are in accordance with the stages of students' cognitive development (Byrne et al., 2023; Nasution et al., 2024; Carbonneau & Marley, 2015). The advantages of learning media include helping students understand abstract concepts through real experiences, increasing interest in learning, and creating active and meaningful learning (Shoimah et al., 2021; Puspitarini & Hanif, 2019; Gan et al., 2015). However, there are also shortcomings in the use of learning media, such as limited media availability in schools and challenges in implementing it in large classes (Annisa et al., 2023; Sarker et al., 2019).

The effectiveness of using concrete media will be more optimal if it is associated with Bruner's Learning Theory, which emphasizes the importance of three stages of representation in learning, namely enactive (direct action), iconic (use of images or models), and symbolic (use of symbols and language) (Maringanti & Sahu, 2024; Kallia & Cutts, 2023). Bruner argues that students will more easily understand concepts if they are actively involved in the learning process through discovery and exploration. Therefore, the application of concrete media in mathematics learning is in line with the discovery-based learning approach that supports students' logical and critical thinking development (Jatisunda et al., 2020; Chase & Abrahamson, 2018).

Research on the use of concrete media in learning mathematics has been widely conducted and shows positive results on elementary school students' concept understanding. The study by

Saputro et al (2021) shows that the use of concrete props can increase student motivation and learning outcomes in measurement material. Similarly, Dewanti's research (2024) revealed that concrete media can help students understand the concept of non-standard weight through direct experience. On the other hand, the application of Bruner's theory in mathematics learning has also been proven effective in supporting students' cognitive development stages, especially in the enactive and iconic stages (Wibowo & Firdaus, 2024). However, there are still few studies that specifically examine the combination of concrete media and Bruner's theory in the context of nonstandard weight measurement materials in the lower grades of elementary school. Therefore, this study aims to fill the void by presenting an innovative approach that can enrich mathematics learning strategies at the primary level.

The urgency of this research lies in the low understanding of elementary school students of the concept of non-standard weight measurement due to learning methods that are still dominantly abstract and do not involve concrete experiences. Students' disinterest in mathematics is a serious challenge for teachers in achieving meaningful learning goals. Therefore, an innovative approach is needed that is able to bridge between abstract concepts and students' real understanding, one of which is through the use of concrete objects with the help of Bruner's theory. This research is important to provide alternative learning solutions that are not only effective in improving learning outcomes, but also relevant to students' cognitive development. The contribution of this research is to provide an applicable learning model based on cognitive psychology theory, which can be used as a reference by teachers, educational practitioners, and other researchers in developing mathematics learning strategies that are more contextual and student-centered.

METHOD

This research uses a quantitative approach which is defined as a research method based on the philosophy of positivism. This means that this method is usually used to examine certain populations or samples. The quantitative approach is an approach that focuses on analyzing numeric data (numbers) processed using statistical methods (Sugiyono, 2019). This research design consists of two randomly selected small groups, namely the experimental group and the control group. The two small groups were then given a *pretest* (the same test) which measured the students' initial abilities. The experimental group received special treatment, namely the use of learning media in the form of concrete objects (clothes hangers) while the control group did not receive special treatment (conventional learning). Then, both small groups were given a *posttest*. Then it can only be known whether the learning media in the form of concrete objects (clothes hangers) have better value results or not.

The population involved in this study were grade 1 elementary school students who attended private lessons in Surabaya. The researcher took a sample of 5 students as the experimental group (using concrete media) and 5 more students as the control group (conventional learning). The

researcher took a small number of samples because the population in Surabaya private lessons only has a small number.

Data collection will be analyzed by researchers descriptively. Descriptive statistical analysis is useful for describing and describing research data, including the amount of data, maximum value, minimum value, average value, and so on. Data analysis was carried out using SPSS 25.0 to test normality, homogeneity, and hypotheses. The normality test was conducted to determine whether the research data was normally distributed or not. Data normality testing was carried out with the *Kolmogorov-Smirnov* test using the SPSS 25.0 statistical analysis program. The homogeneity test was carried out by testing the data between the experimental group and the control group, which aims to determine the similarity between the two populations to be studied. Hypothesis testing is used to facilitate calculations and determine the effect of using concrete objects in improving student learning outcomes on the material of measuring the weight of objects, using the *SPSS 25.0 for windows* application.

RESULTS

Researchers conducted validity tests on test questions, namely *pretest* questions and *posttest questions.* The researcher then conducted a reliability test on each question using SPSS 25.0. First, researchers tested the pretest question and obtained an SPSS reliability test score of 0.845. When compared with the r table value of a total of 10 data with a significant 0.05, the r table value is 0.632. Since r count is 0.845 > 0.632, then we can conclude that the question is reliable. Then, researchers tested the posttest questions and obtained an SPSS reliability test score of 0.900. When compared with the r table value with a significant value of 0.05 and the amount of data is 10, the r table value is 0.632. So that obtained r count 0.900> 0.632, it can be concluded that the question is reliable. The pretest results of the experimental and control groups are presented in Table 1 below.

Table 1. Pretest Results

Experiment		**Control**	
Name	**Value**	**Name**	**Value**
Nabila	60	Naufal	50
Halima	50	Isyam	40
Zahra	60	Kayla	30
Nisa	80	Rendi	70
Faris	90	Abizar	80

Based on the data in Table 1. *Pretest* results in the experimental group (using concrete media) amounted to 5 students who obtained a minimum score of 50 and a maximum score of 90. Then in the control group pretest results (conventional learning) consisted of 5 students who obtained the lowest score was 30 and the highest score was 80. After getting the *pretest* results, the researcher gave treatment and conducted a *posttest* to obtain data on student learning outcomes. The *posttest* results of the experimental group and control group are shown in Table 2 below.

Table 2. Posttest Results

Experiment		**Control**	
Name	**Value**	**Name**	**Value**
Nabila	90	Naufal	60
Halima	100	Isyam	80
Zahra	100	Kayla	70
Nisa	100	Rendi	80
Faris	100	Abizar	100

Based on the data in Table 2. *Posttest* results of the experimental group (using concrete media) amounted to 5 students whose lowest score was 90, and the highest score was 100. Then in the control group *pretest* results (conventional learning) amounted to 5 students whose lowest score was 60 and the highest score was 100. Based on the results of the data obtained, the researchers then conducted descriptive statistical tests which are presented in Table 3 below.

Table 3. Descriptive Stastistic

	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Experiment Pre-Test	5	50	90	68.00	16.432
Experiment Post-Test	5	90	100	98.00	4.472
Control Pre-Test	5	30	80	54.00	20.736
Control Post-Test	5	60	100	78.00	14.832
Valid N (listwise)	5				

In Table 3, it can be seen that the average *pretest* scores of the experimental group and control group were 68.00 and 54.00, respectively. While the average posttest of the experimental group and control group was 98.00 and 78.00 respectively. By using the results from Table 3 above, the normality test, homogeneity test, and hypothesis test can be carried out to analyze the data on students' mathematics learning outcomes. Normality test was conducted to determine the normality of data distribution. Based on the results of calculations using SPSS 25.0, the data are obtained in Table 4 below.

Table 4. Normality Test

	Class	**Kolmogorov-Smirnov[a]**			**Shapiro-Wilk**		
		Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Student Learning Outcomes	Experiment Pre-Test	.287	5	.200*	.914	5	.490
	Experiment Post-Test	.473	5	.001	.552	5	.000
	Control Pre-Test	.180	5	.200*	.952	5	.754
	Control Post-Test	.246	5	.200*	.956	5	.777

Based on the data in table 4, the posttest value in the experimental group obtained a significance of 0.001 <0.05. It can be said that the increase in student learning outcomes by using concrete object media (clothes hangers) is not normally distributed. Meanwhile, the posttest value

of the control group obtained a significance of 0.200> 0.05. This means that the increase in student learning outcomes using conventional learning methods is normally distributed.

The next step, researchers conducted a homogeneity test to determine the homogeneity of the sample from the population. Based on the results of the *homogeneity of variance test* using SPSS 25.0 in the experimental and control groups as follows:

Table 5. Homogeneity Test

		Levene Statistic	**df1**	**df2**	**Sig.**
Student Learning Outcomes	Based on Mean	2.817	1	8	.132
	Based on Median	2.667	1	8	.141
	Based on Median and with adjusted df	2.667	1	5.538	.158
	Based on trimmed mean	2.993	1	8	.122

Table 5 explains that the significant value of 0.132> 0.05, so it can be concluded that the variance of the Post-test data of the experimental group and the *Posttest* data of the control group is the same (homogeneous). After conducting the homogeneity test, then the researcher continued the hypothesis test to determine the effectiveness of using concrete media (clothes hangers) in improving student learning outcomes on the material of measuring the weight of non-standard objects in first grade elementary school. The following are the results of hypothesis testing using SPSS 25.0:

Table 6. Hypothesis Test *(Independent Sample Test)*

		Levene's Test for Equality of Variances		**t-test for Equality of Means**						
		F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
									Lower	**Upper**
Student Learning Outcomes	Equal variances assumed	2.817	.132	5.774	8	.000	20.000	3.464	12.012	27.988
	Equal variances not assumed			5.774	4.721	.003	20.000	3.464	10.935	29.065

The results of data analysis in Table 6 show that the significant value of 0.000 is smaller than the significance of 0.05 (0.000 <0.05), it can be concluded that the hypothesis (H_1)is accepted with the significance level used is 5%. This means that the use of concrete media (clothes hangers) in improving student learning outcomes on the material of measuring the weight of non-standard objects has a good value to be used in first grade elementary school in terms of students' math learning outcomes.

DISCUSSION

The results showed that the use of concrete object media in the form of clothes hangers significantly improved student learning outcomes on nonstandard weight measurement material in first grade elementary school. This can be seen from the increase in the average posttest score of the experimental group which reached 98.00, compared to the control group which only reached 78.00. This finding is in line with the results of research by Kurniawati et al. (2021) which states that concrete media facilitates the learning process of students through direct experience, making it easier to understand mathematical concepts. In addition, Febrianti, Hayat & Wati (2024) also showed that the use of nonstandard measuring instruments in the form of concrete objects can increase student activeness and enthusiasm in learning. Research by Quigley (2021) supports these findings by stating that concrete media is very effective for elementary age students because it is in accordance with the stage of cognitive development of students.

The application of concrete objects in this study is also proven to be in line with Jerome Bruner's theory of cognitive development, especially in the enactive and iconic stages. Bruner explains that primary-age children more easily understand concepts through hands-on activities (enactive) and visual representations (iconic), before finally being able to understand symbols or numbers (Żądło-Treder, 2021). Research by Kim & Cho (2015) reinforces that concrete object-based learning helps students build deeper understanding through explorative activities. Moreover, this learning approach is in line with Bruner's discovery learning principle, where students gain understanding through the process of discovery and personal experience (Ouzzine, Erguig & Boudlal, 2022).

In terms of effectiveness, the results of hypothesis testing show that the use of concrete media has a significant effect on improving student learning outcomes with a significance value of 0.000 (<0.05). This finding supports the opinion of Rannikmae, Holbrook & Soobard (2020) which states that learning media can increase students' attention, motivation, and overall understanding. Agrawal & Morin (2016) also stated that concrete media can help overcome the gap between abstract concepts and students' real experiences. In this study, this was proven when students were more enthusiastic and easily understood the weight measurement activities through direct practice using clothes hangers. Even in students who previously had low pretest scores, there was a significant increase after participating in concrete media-based learning.

In addition to improving learning outcomes, the use of concrete media also contributed to increasing students' interest and engagement during the learning process. Based on observations and analyzed data, students who used concrete media showed higher interest than the group that followed conventional learning. This finding is in line with Turkay's (2016) study, which asserts that concrete media helps students understand concepts through direct experience, while increasing emotional and cognitive engagement. Similarly, Kusumadewi, Neolaka & Yasin (2020) stated that the use of real media makes learning more enjoyable and reduces students' level of verbalism in understanding mathematical concepts. In this context, concrete media acts as a bridge between the abstraction of material and the real world that is familiar to students.

Thus, this study makes a real contribution to the development of mathematics learning models in elementary schools, especially for materials that demand understanding of practical skills such as non-standard weight measurement. In addition to supporting Bruner's theory, the results of this study strengthen empirical evidence that the effective use of concrete media can improve learning outcomes and student motivation. Therefore, teachers are expected to be more creative in designing learning in accordance with the characteristics of student development and utilizing concrete media available in the surrounding environment. This research also opens space for further studies that can explore the use of concrete media in other mathematics materials or at different levels.

CONCLUSION

Based on the results of the study, it can be concluded that the use of concrete media with the help of Bruner's theory significantly improves student learning outcomes on nonstandard weight measurement material in grade I elementary school. This is indicated by an increase in the average posttest score in the experimental group using concrete media of 98.00**,** much higher than the control group which only obtained an average score of 78.00. In addition, the hypothesis test results show a significance value of 0.000 <0.05, which means there is a significant difference between the two groups. Concrete media such as clothes hangers proved to be effective in helping students understand the concept of weight through direct experience in accordance with the stage of cognitive development of children. The impact of this research shows that the combination of concrete media and Bruner's theory can be used as an alternative learning strategy that is applicable and effective, and can be adapted by teachers in improving the quality of mathematics learning at the basic education level.

REFERENCES

Agrawal, J., & Morin, L. L. (2016). Evidence-based practices: Applications of concrete representational abstract framework across math concepts for students with mathematics disabilities. *Learning Disabilities Research & Practice*, *31*(1), 34-44.

Annisa, M. N., Rifki, M., Taufiqurrochman, R., & Al Anshory, A. M. (2023). Learning Media Technology Based on Animated Video to Improve Students' Arabic Speaking Ability at Madrasah Ibtidaiyah Negeri 2 Gorontalo Regency. *Sustainable Journal*, *6*(2), 378-388.

Byrne, E. M., Jensen, H., Thomsen, B. S., & Ramchandani, P. G. (2023). Educational interventions involving physical manipulatives for improving children's learning and development: A scoping review. *Review of Education*, *11*(2), e3400.

Carbonneau, K. J., & Marley, S. C. (2015). Instructional guidance and realism of manipulatives influence preschool children's mathematics learning. *The Journal of Experimental Education*, *83*(4), 495-513.

Celik, H. C., & Ozdemir, F. (2020). Mathematical thinking as a predictor of critical thinking dispositions of pre-service mathematics teachers. *International Journal of Progressive Education*, *16*(4), 81-98.

Chase, K., & Abrahamson, D. (2018). Searching for buried treasure: uncovering discovery in discovery-based learning. *Instructional Science*, *46*, 11-33.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied developmental science*, *24*(2), 97-140.

Dewanti, S. S. (2024). Problem-Based Learning with Manipulative Media: Enhancing Elementary Students' Conceptual Understanding in Area and Volume. *Scientific Journal of Elementary School*, *8*(3), 487-499.

Falentina, A., Lesmana, E., Anggraeni, A. P., & Maharbid, D. A. (2024). Mathematics Learning in the Merdeka Curriculum on Time Measurement in Elementary Schools. *Elementary Journal: Journal of Elementary School Teacher Education*, *7*(1), 1-16.

Febrianti, R., Hayat, M. S., & Wati, C. E. (2024). Improving understanding of mathematical concepts through Realistic Mathematic Education assisted by concrete media for grade 1 elementary school students. *Journal of Professional Teacher Education*, *2*(2), 185-193.

Gan, B., Menkhoff, T., & Smith, R. (2015). Enhancing students' learning process through interactive digital media: New opportunities for collaborative learning. *Computers in Human Behavior*, *51*, 652-663.

Irwan, I., Arnadi, A., & Aslan, A. (2024). Developing critical thinking skills of primary school students through independent curriculum learning. *Indonesian Journal of Education (INJOE)*, *4*(3), 788-803.

Jatisunda, M. G., Suciawati, V., & Nahdi, D. S. (2020). Discovery learning with scaffolding to promote mathematical creative thinking ability and self-efficacy. *Al-Jabar: Journal of Mathematics Education*, *11*(2), 351-370.

Kallia, M., & Cutts, Q. (2023). Conceptual development in early-years computing education: a grounded cognition and action based conceptual framework. *Computer Science Education*, *33*(4), 485-511.

Kim, M. K., & Cho, M. K. (2015). Design and implementation of integrated instruction of mathematics and science in Korea. *EURASIA Journal of Mathematics, Science and Technology Education*, *11*(1), 3-15.

Kurniawati, I., Purwati, P., & Mardiana, T. (2021). The effect of outdoor learning method assisted by concrete objects media on math learning outcomes. *Borobudur Educational Review*, *1*(1), 30-41.

Kusumadewi, R. F., Neolaka, A., & Yasin, M. (2020). Improving the ability of understanding mathematical concepts through digital-based comics for elementary school students. *Al Ibtida: Journal of MI Teacher Education*, *7*(2), 280-294.

Maringanti, H. B., & Sahu, M. (2024). Cognitive Learning. In *Digital Skill Development for Industry 4.0* (pp. 15-32). Auerbach Publications.

Nasution, M. P., Sormin, D., Lubis, J. N., Wahyuni, S., Siregar, A. K., & Mahir, A. (2024). Harnessing Loose Part Media for Cognitive Development: Evaluating Its Effects on Early Mathematics Play Activities in Early Childhood Education. *Indonesian Journal on Learning and Advanced Education (IJOLAE)*, 254-268.

Nurlaily, V. A., Soegiyanto, H., & Usodo, B. (2019). Elementary School Teachers' Obstacles in the Implementation of Problem-Based Learning Model in Mathematics Learning. *Journal on Mathematics Education*, *10*(2), 229-238.

Olivares, D., Lupiáñez, J. L., & Segovia, I. (2021). Roles and characteristics of problem solving in the mathematics curriculum: a review. *International Journal of Mathematical Education in Science and Technology*, *52*(7), 1079-1096.

Ouzzine, A., Erguig, R., & Boudlal, A. (2022). Discovery-Based Teaching Methodology: A Framework for Quality Teaching and Learning. *Journal of Applied Language and Culture Studies*, *5*, 9-27.

Peng, P., & Kievit, R. A. (2020). The development of academic achievement and cognitive abilities: A bidirectional perspective. *Child development perspectives*, *14*(1), 15-20.

Puspitarini, Y. D., & Hanif, M. (2019). Using learning media to increase learning motivation in elementary school. *Anatolian Journal of Education*, *4*(2), 53-60.

Quigley, M. T. (2021). Concrete Materials in Primary Classrooms: Teachers' Beliefs and Practices about How and Why They Are Used. *Mathematics Teacher Education and Development*, *23*(2), 59-78.

Rannikmäe, M., Holbrook, J., & Soobard, R. (2020). Social Constructivism-Jerome Bruner. *Science education in theory and practice: An introductory guide to learning theory*, 259-275.

Reyes, J., Insorio, A. O., Ingreso, M. L. V., Hilario, F. F., & Gutierrez, C. R. (2019). Conception and application of contextualization in mathematics education. *International Journal of Educational Studies in Mathematics*, *6*(1), 1-18.

Saputro, K. A., Sari, C. K., & Winarsi, S. W. (2021). Utilization of concrete props to improve motivation and learning outcomes in elementary school mathematics. *Basicedu Journal*, *5*(4), 1735-1742.

Sarker, M. F. H., Al Mahmud, R., Islam, M. S., & Islam, M. K. (2019). Use of e-learning at higher educational institutions in Bangladesh: Opportunities and challenges. *Journal of Applied Research in Higher Education*, *11*(2), 210-223.

Shoimah, R. N., Syafi'aturrosyidah, M., & Hadya, S. (2021). The use of concrete learning media to increase learning activities and understanding of fraction concepts in Mathematics subjects for third grade students of MI Ma'arif Nu Sukodadi-Lamongan. *MIDA: Journal of Islamic Basic Education*, *4*(2), 1-18.

Sugiyono. (2019). Quantitative and Qualitative Research Methods and R&D. Bandung: ALFABETA.

Tjalla, A., Wahyuni, L. D., & Afriadi, B. (2023). *Construction of Measurement Tools in Education*. UNJ PRESS.

Türkay, S. (2016). The effects of whiteboard animations on retention and subjective experiences when learning advanced physics topics. *Computers & Education*, *98*, 102-114.

Wibowo, S., & Firdaus, F. M. (2024). Implementation of Bruner's Theory to Improve the Concept Understanding of Numbers. *Scientific Journal of Teacher Professional Education*, *7*(2), 306-319.

Wulandari, I., Alim, J. A., & Putra, M. J. A. (2022). Development of Video Animation of Length and Weight Measurement Materials for Grade II Elementary School Students. *Journal of Obsession: Journal of Early Childhood Education*, *6*(6), 7078-7092.

Yildiz Durak, H. (2020). The effects of using different tools in programming teaching of secondary school students on engagement, computational thinking and reflective thinking skills for problem solving. *Technology, Knowledge and Learning*, *25*(1), 179-195.

Żądło-Treder, J. (2021). Iconic and symbolic representation in early mathematics teaching. *Edukacja Elementarna w Teorii i Praktyce*, *16*(3 (61)), 11-25.

Zahroh, L., Susanti, M., Widayati, T. U., Yulita, H., & Ariyani, A. (2024). Analysis of Problem Based Learning Learning Models at the Primary Education Level. *Journal of Thematic Education in Primary Education*, *9*(2), 82-91.