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Improving Mathematics Learning Outcomes Using Concrete Props in Grade V Elementary School Students

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Abstract: Topics in learning mathematics are generally abstract in nature, while elementary school-age children think concretely. This makes a teacher must be able to manage learning mathematics well. The purpose of this study is to describe through concrete props in learning the material of the nets of simple space buildings can improve student learning outcomes. The method used is descriptive method with the form of research, namely classroom action research with 2 cycles. The research was conducted in class V at a elementary school in Hanoi City, Vietnam. The number of respondents consisted of 129 students consisting of 58 male students and 71 female students. Based on the first cycle, student learning completeness was only 37.21%. This achievement is classified as low. Based on reflection, cycle II made improvements in planning and in implementing learning. In cycle II there was an increase, where classical learning completeness became 96.89%. This shows that the use of concrete teaching aids in math learning can improve students' learning outcomes.

Keywords: *mathematics, elementary students, concrete props, learning outcomes*

INTRODUCTION

Ideally a professional teacher should be able to carry out the curriculum well. Teachers are expected to have expertise in creating an effective and efficient learning atmosphere in achieving the learning objectives set by the national curriculum (Forsström, 2019; Francis et al., 2019). Mathematics is a subject that has its own character. Mathematics is abstract, while elementary school age children think concretely. This makes a teacher must be able to manage mathematics learning well, learning techniques, application of learning approaches and methods, as well as the use of media that is adapted to the character of students and teaching materials (Erbilgin, 2019; Kaufmann & Ryve, 2022; Russo et al., 2020). The teacher must be able to bridge the abstract nature of mathematics so that it is easy for elementary school children to study. The benchmark for success is the achievement of learning objectives.

In fact, in learning mathematics there is a situation where students are still difficult to accept the material being taught. Mathematics is perceived as boring, uninteresting and difficult to understand. Learning is always centered on the teacher (Clarke & Roche, 2018). In line with this; With the mathematics learning method above, the researcher reflects that so far mathematics learning in elementary schools has been dominated by the lecture method, and students are only listeners. The

media used was only in the form of pictures on a blackboard. Student learning outcomes were also very low. In the first semester alone, only 20% of the fifth grade students at observed elementary school scored above their passing grade (score 5). Achievement of minimum completeness or passing grade and the average value of mathematics is always low. Even though Vietnam national curriculum implies classical completeness of at least 85%. Seeing the situation above, it is deemed necessary to make improvements in learning, namely actions in the form of changes in teaching methods and the use of concrete teaching aids. Barron et al. (2015) states that learning is a business process carried out by individuals to obtain a change in behavior as a result of individual experiences interacting with their environment.

Student success in learning can be seen from the assessment of the learning outcomes themselves. Rakoczy et al. (2019) defines the assessment of learning outcomes as a process of giving value to the learning outcomes achieved by students with certain criteria. Learning outcomes assessment tools, in the form of tests, both objective tests or descriptive tests. Assessment is intended to determine whether learning objectives have been achieved, the basis for reflection and the basis for documenting learning outcomes as reports. Associated with the characteristics of elementary school children, Jean Peaget with the Theory of Child Mental Development in Babakr et al. (2019) divides the stages of children's thinking skills into four stages, namely the sensory-motor stage (from birth to age 2 years), the initial operational stage/ preoperative (2 to 7 years old), concrete operational/operational stage (7 or 12 years old) and formal operational/formal operational stage (11 years and over).

This is in line with Connor et al. (2018), Marwiang et al. (2014), and Olsson & Granberg (2022) that in the learning process children should be given the opportunity to manipulate objects or teaching aids that are specifically designed and can be manipulated by students in understanding a mathematical concept. Through the props he examines, the child will see firsthand how the regularity and structural patterns are contained in the object he is paying attention to. The teacher's role in organizing the lesson, (a) needs to understand the structure of the subject, (b) the importance of active learning so that a person can discover concepts as a basis for understanding correctly, (c) the importance of the value of inductive thinking. Thus, in order for learning to develop children's intellectual skills in learning some knowledge (for example a mathematical concept), the subject matter needs to be presented by paying attention to the stage of cognitive development/knowledge of the child so that this knowledge can be internalized in the person's mind (cognitive structure). The internalization process will occur in earnest (which means the learning process occurs optimally) if the knowledge learned is studied in three stages, namely the enactive stage model, the iconic model and the symbolic stage model.

Weinhandl et al. (2022) mentions visual aids can bridge abstract mathematical concepts with concrete situations. (Abbas & Zakaria, 2018; Alshatri et al., 2019; Harefa et al., 2022) which define props as objects that function to demonstrate a meaning or understanding of the object. Demonstrating is an activity to make/visualize an understanding so that verbalism does not occur. Learning media are all things (tools, objects, methods, procedures) that function as intermediaries for delivering messages in the learning communication process. The intermediary is the delivery of messages from the source of the message (teacher) to the recipient of the message (students) in learning activities. Learning resources are all things (including teaching aids and learning media) that function as a place where subject matter is obtained for learning. What is meant by geometric shape is a form of object that has a place or space in it, and has a closed side that surrounds it. Shape space has three dimensions, namely length, width and height. Meanwhile, the side that surrounds the shape of the space is a flat shape. The model and the number of sides that define the shape determine the name of the shape of the shape. The simple geometric materials studied in fifth grade elementary school include cubes, blocks, rectangular pyramids, triangular pyramids, balls, cylinders, and cones. Based on the description above, the researcher is

interested in conducting research on improving mathematics learning outcomes using concrete teaching aids for fifth grade elementary school students.

METHOD

This research was conducted based on an classroom action research model. According to Kunlasomboon et al. (2015) and Vogelzang & Admiraal (2017), classroom action research is an examination of activities that are deliberately raised and occur in a class. The research aims to overcome the problems faced by teachers so as to improve results. This research includes collaborative research, because it involves peers, namely serving as observers. In this type of research, at least it is carried out in 2 cycles. Each cycle includes planning, acting, observation, and reflection.

At the acting stage, the researcher carried out the learning according to the plan that had been formulated. Every planned learning step is observed and the data is collected. Likewise the learning outcomes data, namely the results of the evaluation at the end of learning. This is intended to determine the increase in learning outcomes from one cycle to the next. The observation stage (observation) is one of the most effective data/fact collection techniques for studying a system. The actual observation stage coincides with the implementation stage of the action, namely observing the learning process activities and learning outcomes. In observing the learning process, researchers were assisted by good collaborators regarding teacher activities during the learning process. In the reflection stage, namely the stage of discussing the results of observations made with collaborators. Various problems that arose during the implementation of the actions were identified and analyzed. The results of problem identification and analysis are sought and solutions are determined for improvement in the next cycle. Student learning outcomes are compared with predetermined performance indicators. If not satisfactory then proceed to the next cycle.

The subjects of this study were teachers as researchers and fifth grade students at an elementary school in Hanoi City, Vietnam, which consisted of 129 students consisting of 58 male students and 71 female students. The research was carried out for 6 months or one semester, namely in the second semester starting from January to June 2022. In January is used to prepare proposals. Compiling a proposal takes one month. In February is used to develop research instruments. The preparation of the research instrument lasted for 2 weeks, namely the first and second weeks. In the third week of April, cycle 1 and the fourth week of cycle 2. The data collected in a study are all forms of information, observations, and facts that will support the research objectives. These data can be obtained through observation and documentation of learning outcomes. Observation techniques are carried out by researchers to collect data about the positive and negative impacts of the actions taken. By using observation sheets carried out directly by the teacher to obtain research data about the level of student learning outcomes in class.

The documentation used in this study is the value of student learning outcomes in mathematics learning geometric nets using concrete objects as media. The data collection tool is a measuring tool used to obtain objective data characteristics. In this study, researchers used research instruments, namely observation sheets for teachers and document student learning outcomes. This analysis is calculated using simple statistics, namely:

- To analyze the data on sub-problems 1 and 2 (how teacher's ability to design and implement learning). The researcher sums up the scores obtained by the teacher, which is then divided by the performance indicators of the teachers in the class so that the average formative test can be formulated in Eq.1

$$\text{Average score} = \frac{\text{Total score}}{\text{Total indicator}} \tag{1}$$

- To analyze data on sub-problem 2 (how is the teacher's ability to carry out learning) The researcher sums up the scores obtained by the teacher, which is then divided by the performance indicators of the teachers in the class so that the average formative test can be formulated in Eq 2.

$$\text{Average score} = \frac{\text{Total score}}{\text{Total indicator}} \tag{2}$$

- To assess student learning outcomes, there are two categories of learning completeness, namely individually and classically. Based on the instructions for implementing the curriculum teaching and learning, namely a student has completed learning if he has achieved a score of 5, the class is called complete learning if there are 85% in the class who have achieved an absorption power of more than or equal to 6. To calculate the percentage of learning completeness used the following in Eq. 3.

$$\text{Learning outcomes} = \frac{\text{Total number of passed students}}{\text{Total number of students}} \tag{3}$$

RESULTS AND DISCUSSION

From the results of this research, three groups of data were obtained, namely data from observations in designing learning, data from observations in carrying out learning, and data on student learning outcomes. This research activity was carried out in 2 cycles based on the results of reflection on cycle 1 and cycle 2. The teacher's ability to design learning using concrete teaching aids in the material of spatial nets is as follows: In the aspect of formulating learning objectives, in cycle 1 it gets an average score of 2.67 and the average score in cycle 2 increases to 4.00 . The selection and organization aspects got an average score of 3.00 in cycle 1 and 4.00 in cycle 2. In terms of selecting learning resources, the average score in cycle 1 was 2.86 and the average score in cycle 2 was 3. 29. The designed learning scenarios got an average score of 2.15 in cycle 1 and 3.17 in cycle 2. In terms of designing learning outcome assessments for both cycle 1 and cycle 2, both scored 3.67, as shown in Table 1.

Table 1. The results of the observation of the teacher's ability to design learning in cycles 1 and 2.

No.	Observed aspects	Cycle 1	Cycle 2
1	Formulation of learning objectives	2.67	4.00
2	Selection and organization of teaching materials	3.00	4.00
3	Selection of learning resources/learning media	2.86	3.29
4	Scenarios/learning activities	2.50	3.17
5	Assessment of learning outcomes	3.67	3.67

As for the observation of the ability to implement learning related to pre-learning aspects, opening lessons, core activities, and closing learning. In general, the scores obtained by the researcher are as follows: pre-learning with an average score of 3.00 in cycle 1 and an average score of 4.00 in cycle 2. The implementation of opening lessons gets an average score of 2.00 in cycle 1 increases to 4.00 in cycle 2. For core learning activities the average score in cycle 1 was 2.83 to 3.59 in cycle 2. In closing cycle 1 learning got an average score of 2.00 to 3.67 in cycle 2. So the total score for the implementation of learning activities in cycle 1 is 2.46 and in cycle 2 it increases to 3.82. More details can be seen in Table 2.

Researchers hope that by using teaching aids the results obtained classically must be satisfactory. If seen in general, children who usually get high scores, the results are consistent with the value of this learning outcome, and vice versa. The evaluation results showed that only 48 (37.21%) students obtained

a minimum score of 5. Following are details of completeness in the implementation of cycle I shown in Table 3. The class completeness value is measured by the number of students who are able to achieve a minimum score of 5, at least 85% of the total number of students in the class. In this cycle 2, the evaluation results showed that 96.89% of students had obtained a minimum score of 75. These results show that the number of students who reached the passing grade increased significantly compared to cycle 1.

Table 2. The results of the observation of the teacher's ability to carry out learning in cycles 1 and 2.

No.	Observed aspects	Cycle 1	Cycle 2
1	Pre-learning	3.00	4.00
2	Starting the learning	2.00	4.00
3	Core learning activities		
	a) Mastery of learning materials	3.00	3.75
	b) Approach/learning strategy	2.83	3.67
	c) Utilization of media/learning resources	2.75	3.75
	d) Learning that triggers and maintains student engagement	3.40	4.00
	e) Special abilities of learning in elementary school	2.00	3.00
	f) Assessment of learning outcomes	2.50	3.00
	g) Assessment of language use	3.33	4.00
4	Closing	2.00	3.67

Table 3. The results of student learning evaluations in cycles 1 and 2.

No.	Observed aspects	Cycle 1	Cycle 2
1	The number of students who scored >= 5	48	125
2	The number of students who scored < 5	81	4

Noting the results of cycle 1 reflection there are still many shortcomings in carrying out their duties as a teacher. In the planning stage, an error occurred in the formulation of learning objectives, namely the author did not include the method/use of teaching aids. This was due to the previous researcher's ignorance of the requirements for the formulation of learning objectives. However, the selection and organization of teaching materials is good. It just needs to be continuously improved. The problem for researchers is the large number of students and the varying characteristics of students. Likewise with the props that were prepared, most of them were too small, the number was small. The props available are not sufficient for students to use to demonstrate geometric nets (Taleb et al., 2015; Verbruggen et al., 2021). In the design of learning steps the researcher thought that students could easily carry out work steps. So that the student's work steps are not too focused. The division of student groups is good because it pays attention to the balance of students' abilities in each group. Researchers believe that in this way each group can work well together. In designing the assessment of the learning outcomes of researchers based on the curiosity of researchers about student achievements related to learning objectives, namely determining nets of blocks and cubes. Designing the assessment of learning outcomes is good, only the weakness is that the pictures on the test questions are not perfect. Disproportionate cube images and beam images do not vary.

In the use of learning media, in this case cube and block teaching aids, researchers have done well. Weaknesses that arise occur in the limited number of props. Learning that takes place already involves students well, where students are quite active in learning. In the context of developing problem-solving skills and the application of learning mathematics, researchers have not realized the importance of this. Researchers focus on the introduction of the material alone. Likewise in the context of developing

communication skills in learning mathematics, researchers admit that learning has not given students the opportunity to have communication skills.

In cycle 2, the formulation of learning objectives already paid attention to aspects of conformity with learning objectives and paid attention to the elements of audience, behaviors, conditions, and degrees with learning activities (Ellis et al., 2020; Harefa et al., 2019; Trust & Prestridge, 2021). In selecting and organizing teaching materials, researchers have really adjusted to the learning objectives, student character, time systematics and time allocation optimally. Selection of teaching sources, researchers still use previous teaching resources. The props prepared in cycle 2 were more and more enlarged in size. This is to make it easier for students to carry out work activities to find the requested geometric nets. In this cycle 2 learning scenario, several things have changed for the better, namely allowing researchers to carry out intensive guidance to students. Students are more focused in carrying out learning activities. In terms of assessing learning outcomes, researchers provide pictures that are proportional and questions that are more varied and contextual. In line with the planning stage, the learning implementation stage also experienced significant changes. In pre-learning class conditions are getting better prepared. The warmth in the greeting is very pronounced. The class atmosphere is more enthusiastic. With situations like this starting learning is even easier. When apperception and delivery of learning objectives the interaction of researchers and students is so enjoyable. In the core activities in cycle 2, the researcher believes that learning activities are better than cycle 1. The researcher prepares complete teaching aids for cylinders, cones, triangular pyramids, rectangular pyramids, triangular prisms and rectangular prisms. Researchers also link learning with everyday life problems. Shiva enthusiastically carries out the given work steps accompanied by intensive guidance. Student work results were quite satisfactory. Of the six groups that presented their work, almost all were good, namely being able to find the requested nets.

CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that the mathematics learning outcomes of fifth grade elementary school students in Hanoi City, Vietnam on the concept of simple spatial grids can be improved through the use of concrete visual aids in learning. Other teachers would be able to apply learning media because it can improve student learning outcomes, especially in mathematics on the subject of simple geometric nets. (2) A teacher should have the principle of being ready to accept input and criticism for improvement in learning activities. (3). Elementary schools also need to consider the use of media in learning as an alternative in improving the quality and willingness of students in mathematics.

REFERENCES

Abbas, N., & Zakaria, P. (2018). The Implementation of Mathematics Props-based Learning on Geometry Concept. *Journal of Physics: Conference Series*, *1028*, 012157. https://doi.org/10.1088/1742-6596/1028/1/012157

Alshatri, S. H. H., Wakil, K., Jamal, K., & Bakhtyar, R. (2019). Teaching Aids Effectiveness in Learning Mathematics. *International Journal of Educational Research Review*, 448–453. https://doi.org/10.24331/ijere.573949

Babakr, Z. H., Mohamedamin, P., & Kakamad, K. (2019). Piaget's Cognitive Developmental Theory: Critical Review. *Education Quarterly Reviews*, *2*(3). https://doi.org/10.31014/aior.1993.02.03.84

Barron, A. B., Hebets, E. A., Cleland, T. A., Fitzpatrick, C. L., Hauber, M. E., & Stevens, J. R. (2015).

Embracing multiple definitions of learning. *Trends in Neurosciences*, *38*(7), 405–407. https://doi.org/10.1016/j.tins.2015.04.008

Clarke, D., & Roche, A. (2018). Using contextualized tasks to engage students in meaningful and worthwhile mathematics learning. *The Journal of Mathematical Behavior*, *51*, 95–108. https://doi.org/10.1016/j.jmathb.2017.11.006

Connor, C. M., Mazzocco, M. M. M., Kurz, T., Crowe, E. C., Tighe, E. L., Wood, T. S., & Morrison, F. J. (2018). Using assessment to individualize early mathematics instruction. *Journal of School Psychology*, *66*, 97–113. https://doi.org/10.1016/j.jsp.2017.04.005

Ellis, N. J., Alonzo, D., & Nguyen, H. T. M. (2020). Elements of a quality pre-service teacher mentor: A literature review. *Teaching and Teacher Education*, *92*, 103072. https://doi.org/10.1016/j.tate.2020.103072

Erbilgin, E. (2019). Two mathematics teacher educators' efforts to improve teaching and learning processes: An action research study. *Teaching and Teacher Education*, *78*, 28–38. https://doi.org/10.1016/j.tate.2018.11.005

Forsström, S. E. (2019). Role of teachers in students' mathematics learning processes based on robotics integration. *Learning, Culture and Social Interaction*, *21*, 378–389. https://doi.org/10.1016/j.lcsi.2019.04.005

Francis, B., Hodgen, J., Craig, N., Taylor, B., Archer, L., Mazenod, A., Tereshchenko, A., & Connolly, P. (2019). Teacher 'quality' and attainment grouping: The role of within-school teacher deployment in social and educational inequality. *Teaching and Teacher Education*, *77*, 183–192. https://doi.org/10.1016/j.tate.2018.10.001

Harefa, E., Kristiyanto, W. H., & Rondonuwu, F. S. (2019). Visualization of Conduction Heat Transfer using Augmented Reality Technology. *Indian Journal of Science and Technology*, *12*(21), 1–6. https://doi.org/10.17485/ijst/2019/v12i21/139551

Harefa, E., Li, N., & Zhou, W. (2022). Application of laser-induced breakdown spectroscopy with a generalized regression neural network and LASSO-type methods for estimation of arsenic and chromium in soil. *Journal of Analytical Atomic Spectrometry*, *37*(6), 1340–1349. https://doi.org/10.1039/D2JA00060A

Kaufmann, O. T., & Ryve, A. (2022). Teachers' framing of students' difficulties in mathematics learning in collegial discussions. *Scandinavian Journal of Educational Research*, 1–17. https://doi.org/10.1080/00313831.2022.2115134

Kunlasomboon, N., Wongwanich, S., & Suwanmonkha, S. (2015). Research and Development of Classroom Action Research Process to Enhance School Learning. *Procedia - Social and Behavioral Sciences*, *171*, 1315–1324. https://doi.org/10.1016/j.sbspro.2015.01.248

Marwiang, M., Junpeng, P., & Nakorn, N. N. (2014). The Development of a Model for Mathematics Classroom Assessment: Collaborative Assessment Pyramid. *Procedia - Social and Behavioral Sciences*, *143*, 764–768. https://doi.org/10.1016/j.sbspro.2014.07.459

Olsson, J., & Granberg, C. (2022). Teacher-student interaction supporting students' creative mathematical reasoning during problem solving using Scratch. *Mathematical Thinking and Learning*, 1–28. https://doi.org/10.1080/10986065.2022.2105567

Rakoczy, K., Pinger, P., Hochweber, J., Klieme, E., Schütze, B., & Besser, M. (2019). Formative assessment in mathematics: Mediated by feedback's perceived usefulness and students' self-efficacy.

Learning and Instruction, *60*, 154–165. https://doi.org/10.1016/j.learninstruc.2018.01.004

Russo, J., Bobis, J., Downton, A., Hughes, S., Livy, S., McCormick, M., & Sullivan, P. (2020). Elementary teachers' beliefs on the role of struggle in the mathematics classroom. *The Journal of Mathematical Behavior*, *58*, 100774. https://doi.org/10.1016/j.jmathb.2020.100774

Taleb, Z., Ahmadi, A., & Musavi, M. (2015). The Effect of M-learning on Mathematics Learning. *Procedia - Social and Behavioral Sciences*, *171*, 83–89. https://doi.org/10.1016/j.sbspro.2015.01.092

Trust, T., & Prestridge, S. (2021). The interplay of five elements of influence on educators' PLN actions. *Teaching and Teacher Education*, *97*, 103195. https://doi.org/10.1016/j.tate.2020.103195

Verbruggen, S., Depaepe, F., & Torbeyns, J. (2021). Effectiveness of educational technology in early mathematics education: A systematic literature review. *International Journal of Child-Computer Interaction*, *27*, 100220. https://doi.org/10.1016/j.ijcci.2020.100220

Vogelzang, J., & Admiraal, W. F. (2017). Classroom action research on formative assessment in a context-based chemistry course. *Educational Action Research*, *25*(1), 155–166. https://doi.org/10.1080/09650792.2016.1177564

Weinhandl, R., Lavicza, Z., Houghton, T., & Hohenwarter, M. (2022). A look over students' shoulders when learning mathematics in home-schooling. *International Journal of Mathematical Education in Science and Technology*, *53*(11), 2879–2899. https://doi.org/10.1080/0020739X.2021.1912423