JTAM (Jurnal Teori dan Aplikasi Matematika)
http://journal.ummat.ac.id/index.php/jtam
p-ISSN 2597-7512 | e-ISSN 2614-1175
Vol. 7, No. 4, October 2023, pp. 1054-1065

Enhancing the Ability of 'Spatial Nets' through Outdoor Learning-Based on Traditional Game 'Baju Simi'

Yumiati[1], Saleh Haji[2], Melisa Antasari[3]
[1]University of Terbuka, Indonesia
[2]University of Bengkulu, Indonesia
[3]SDN 98 Kaur Bengkulu, Indonesia
yumi@ecampus.ut.ac.id[1], salehhaji25@gmail.com[2], melisaantasari21@gmail.com[3]

Article History:
Received : 08-07-2023
Revised : 31-08-2023
Accepted : 19-09-2023
Online : 09-10-2023

Keywords:
'Baju Simi' traditional game;
Geometry;
Spatial Nets.

ABSTRACT

Traditional games are rooted in a regional culture with educational values that are important for future generations. These educational values, among others, contain various mathematical concepts (geometry). This study aims to improve students' Spatial Nets ability through the outdoor learning-based traditional game 'Baju Simi.' The type of research used is classroom action research. The research subjects were 20 students of class VI Sekolah Dasar Negeri 98 Kaur, Bengkulu. The study was conducted in the Even Semester 2022/2023. The instrument used is a test on 'Spatial Nets' with as many as ten essay questions. In addition, it also uses questionnaire instruments, observation guidelines, and interview guidelines. Data were analyzed qualitatively. The results obtained are as follows: (1) In Cycle 1, there was an increase in the ability of 'spatial nets' by 0.21 with low pre-test and post-test scores of 45 and 56.5, respectively; and (2) In Cycle 2, there was an increase in the ability of 'spatial nets' by 0.36 with an average pre-test and post-test score of 53 and 70.25 respectively. As many as 92% of students can understand the meaning of space-building nets correctly. 87% and 82% of students can precisely define the webs of cubes and blocks. This study implies that traditional games can be used as a medium and source of learning mathematics (geometry) in elementary schools so that students are highly motivated (4.2 on a scale of 5) in learning mathematics (geometry).

https://doi.org/10.31764/jtam.v7i4.16411

A. INTRODUCTION

The Spatial Nets material is taught to grade VI elementary school students. This material is included in the geometry unit, a field of mathematics that studies point, lines, flat shapes, building space, sizes and angles, and others (Asghar et al., 2023). Spatial nets are one of the geometrical geometric concepts. Flat shapes are part of spatial shapes (Guzel & Sener, 2009). The spatial nets in the form of flat shapes originate from spatial shapes.

The concept of spatial nets is still problematic for grade VI students of State Elementary School 98 Kaur Bengkulu. This information is obtained from the results of initial reflection through observation and interviews with teachers about the process of learning mathematics. A general description of the problems faced by teachers in the learning process in the classroom includes: (1) The learning process in the classroom is still dominated by teachers so that students become passive; (2) Learning activities are still not associated with application in everyday life so that students do not know the meaning and benefits of the material they learn;

(3) The use of learning media is still rare and not optimally used by teachers during the learning process, so almost all students admit that they often find it difficult to understand the subject of mathematics explained by the teacher; and (4) Only 2 students achieved completion of the daily test results related to spatial nets.

Students need help with spatial nets because they need help determining the flat build that forms a spatial building. Similarly, students have difficulty stringing together flat buildings that form the shape of space (Yanik, 2014). The spatial concept of students still needs to be stronger Tommasi et al. (2012), and the learning carried out by teachers has yet to succeed in showing building space as something concrete and less interesting learning carried out by teachers (Gargrish et al., 2020).

The problem of students' low geometry skills in the concept of spatial nets is a challenge for researchers in the field of mathematics education. Overcoming this cannot be separated from the problem of learning geometry, which fails to make learning exciting and more concrete (Kurtuluş & Uygan, 2010). So, it is necessary to learn mathematics that uses traditional games to build and increase students' understanding of spatial nets. Inherited from previous generalizations, traditional games contain good values and wisdom that benefit society (Iswinarti, 2017). The learning is a mathematics learning that uses the traditional Bengkulu game 'baju simi.' Games can build students' basic arithmetic knowledge and skills (Lin, 2022).

The game 'Baju Simi,' also called the engklek, is a traditional game in Indonesia (Badrullah, 2020). According to Setiyadi et al. (2018), 'baju simi' game can develop two-dimensional material skills (flat wake) in elementary schools. This research wants to develop other mathematical concepts in the Baju Simi game through the material 'spatial nets' at SDN 98 Kaur, Bengkulu. Spatial nets are mathematical concepts (geometry) related to a shape or way of presenting a spatial building into a flat building, which, when put back together, will become the original spatial shape (Sobel, 2003).

The traditional Baju Simi game uses the image of Baju Simi on the floor. The shape of the Baju Simi image can consist of 7 (seven) squares in the shape of a quadrilateral. Players consist of 2 or more people. Because the image of some clothes is in the form of illuminated square boxes, and some are in the form of circles, it is suspected that this game can help students understand geometry material, especially the concept of 'webs build space.' Some studies say that learning by using games can improve learning outcomes. Nugraha et al. (2018) mentioned that social learning using traditional Indonesian games can develop social skills in elementary schools. Meanwhile, Simanjuntak & Tambunan (2021) argue that the crank game as a medium for learning mathematics helps students understand mathematical concepts.

The formulation of the problem in this study is how to improve the ability of students 'Spatial Nets through outdoor learning based on the traditional game 'Baju Simi.' This research aims to improve students 'Spatial Nets skills through mathematics learning based on the traditional game 'Baju Simi.' The urgency of this research is to utilize traditional games in learning mathematics (geometry) to improve the ability to understand mathematical concepts. Traditional games can motivate students to learn math. In addition, traditional games can be used as a medium and source of learning mathematics.

B. METHODS

This type of research is classroom action research. The research was conducted in the Even Semester 2022/2023. The research subjects were 20 students of class VI Sekolah Dasar Negeri 98 Kaur, Bengkulu. The stages of class action research consist of planning, implementation, observation, and reflection, which are illustrated as shown in Figure 1.

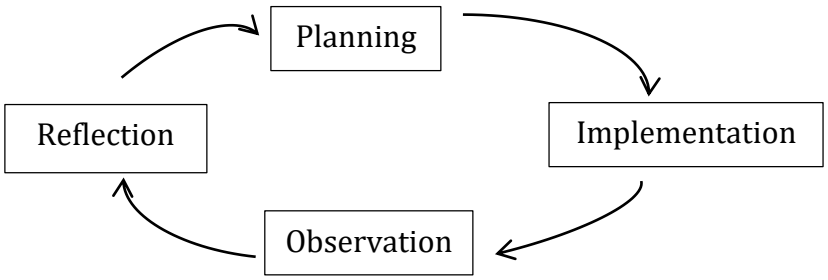

Figure 1. Stages in Action Research

The first step is planning the actions to be taken to improve the ability of the students' spatial nets. Activities include formulating problems, setting goals, designing lesson plans, and choosing learning methods or strategies. Taking action is the application of a lesson plan that has been prepared. The teacher teaches about spatial nets using outdoor learning math based on the traditional game "Baju Simi." At the observation stage, the teacher closely observes how students interact with the learning material, whether they are active, whether there are certain obstacles, and so on. This observational data is analyzed to identify whether there are any positive changes in learning and how the lesson plan can be improved. In the reflection stage, the teacher analyzes the data that has been collected during the observation stage and compares them with the goals that have been set.

The instrument used in this study is a test of 'spatial nets' with as many as ten essay questions, five questions of medium difficulty, two difficult questions, and three easy questions. In addition, questionnaire instruments, observation guidelines and interview guidelines are used. Observation is carried out to determine whether there are obstacles in the learning process and to determine student activeness and response. Interviews were used to deepen students' knowledge of spatial nets. Meanwhile, a questionnaire was used to determine motivation in mathematics using outdoor learning based on the traditional game Baju Simi.

The motivation questionnaire consisted of five positive statements and five negative statements about the traditional game of Baju Simi in mathematics learning outside the classroom. Interviews were conducted with three students, each with high, medium, and low abilities. Before use, the instruments were validated by five experts: three mathematics education experts and two mathematics education practitioners. The data were analyzed quantitatively and qualitatively. Statistical analysis to determine the increase in students' ability to understand the concept of spatial nets used the t-test and N-Gain. This classroom action research hypothesizes that outdoor learning mathematics using the traditional game 'Baju Simi' can improve the ability of students' spatial nets. The indicator of learning success using classical learning completeness is 75% of students at least get a score of 70.

C. RESULT AND DISCUSSION

1. Result

This research aims to improve the ability of spatial nets through outdoor learning based on traditional Baju Simi. This class action research is carried out through 2 (two) cycles. For each cycle, students are given pre-test and post-test. The result is as shown in Figure 2.

Figure 2. Student Pre-test and Post-test Results in Cycle 1

Figure 2 shows that posts on cycle 1 are higher than pre-test. This means that there is an increase in students' grades. To see if the increase is significant, it is tested statistically with the following results, as shown in Table 1.

Table 1. Test Results of the Difference between Pre-test and Post-test in Cycle 1

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Cycle_1	Equal variances assumed	-2.930	38	.006	-11.50000	3.92529	-19.44633	-3.55367

As shown in Table 1, there was a significant increase from the pre-test to the post-test in cycle 1. However, if you look at the average post-test of 56.5, it shows that the indicator of learning success has yet to be achieved classically, namely an average value of at least 70. Therefore, the second cycle is still carried out. The results of the second cycle are shown in Figure 3.

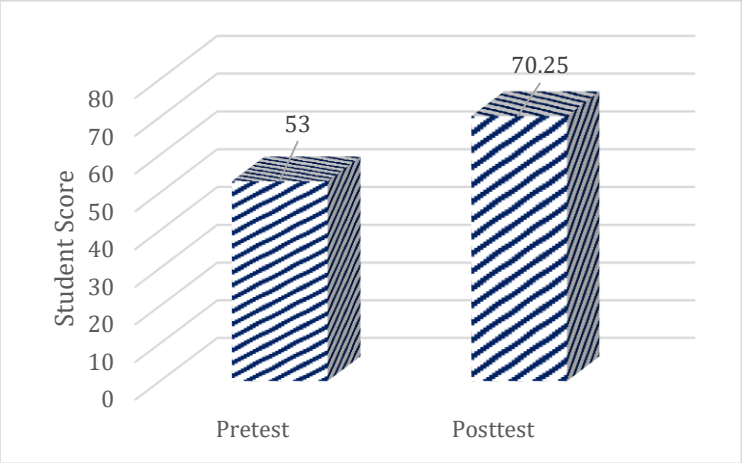

Figure 3. Student Pre-test and Post-test Results in Cycle 2

The increase in value from the pre-test to the post-test also occurs in cycle 2, as shown in Figure 3. Statistical tests to see whether the increase is significant or not are presented in the following Table 2.

Table 2. Test Results of the Difference between Pre-test and Post-test in Cycle 2

		t-test for Equality of Means						
							95% Confidence Interval of the Difference	
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Cycle_2	Equal variances assumed	-6.306	38	.000	-17.25000	2.73561	-22.78795	-11.71205

The increase in values from the pre-test to the post-test in cycle 2 is very significant, as presented in Table 2. The level of significance in cycle 2 is better than in cycle 1. To presents the comparison results between cycles one and two are presented in Table 3.

Table 3. Comparison of Value Gains in Cycle 1 and Cycle 2

	Average			Sig. (2-tailed)	Total Exhaustiveness		
	Pre-test	Post-test	N-Gain		Exhausti-veness	Inexhaus-liveness	% Exhaus-tiveness
Cycle 1	45	56.5	0.21	0.006	5	15	25
Cycle 2	53	70.25	0.36	0.000	15	5	75

Table 3 shows that all students' pre-test, post-test, N-gain, and completion scores were higher in cycle 2. The significance of the increase from the pre-test to the post-test is better in cycle two than in cycle 1. Likewise, the number of students who completed was much more in cycle two than in cycle 1. The increase in students' scores from pre-test to post-test was in the low category in cycle one and the medium category in cycle 2. Table 3 shows that the average score of students in cycle 2, 70.25, has reached the minimum completion of learning. The number of students who completed 15 people (75%) and those who did not complete five (25%). Thus, this research is stopped until cycle two because the learning success indicators have been achieved.

92% of students can understand the meaning of spatial nets correctly. The spatial nets are in the form of cube nets, blocks, tubes, and pyramids. As many as 87% and 82% of students could correctly determine the webs of cubes and blocks, respectively. A motivational questionnaire about outdoor learning using traditional Baju Simi games consisting of 5 positive statements and five negative statements using the Likert scale can reveal student learning motivation of 4.2 (scale 5). This shows that students are very motivated to learn mathematics (geometry) on spatial nets material in elementary schools.

2. Discussion

Outdoor learning is learning outside the classroom, in the field, or locations far from school (Widiasworo, 2017). Outdoor learning is also an activity that can enhance students' physical development and skills based on their abilities and can enhance their creative talents. In addition, outdoor learning facilitates areas that support social development and provides opportunities for students to be with others in the community (Priyadi & Yumiati, 2021). Outdoor learning using traditional Baju Simi games is a learning activity outside the classroom by utilizing traditional games as a medium and source of learning mathematics (geometry).

Baju Simi games, in addition to using pictures as Simi shirt models, also use pieces or small plates to be thrown into boxes contained in Baju Simi. Two or more people can play the game. The player who throws the pieces first is done by lottery. Gundu is thrown into the first box on the Baju Simi (box number 1). After that, with a 1-foot jump to the part of the boxes without mounds. On two adjacent boxes, use two legs until all the boxes have been stepped on. The player must pass through the entire field to the farthest end of the Baju Simi and return similarly. Players must stop in front of the box containing the player's pieces and then jump over the field, carry the pieces to the first field, and so on (Mulyasari, 2020). Next, the player throws the pieces into square number two and plays by the same rules as previously described. The activity is repeated until the player places the pieces on the largest number. After the player makes it through square one to the last, the player then throws pieces from the direction of square one. However, when throwing the pieces, the player must face backward. If the pieces land on a box, the box will get a star from the player. The box that gets stars must be kept from other players. The player with the most stars wins this game (Sari & Switania, 2021).

Some violations that cause players to "die" are 1) Slabs are thrown outside the box or are at the grid boundary, 2) players step on the boundary line, and 3) players set foot incorrectly. The "dead" player will stop playing, and the turn is given to another player. Learning mathematics using traditional baju simi games uses it as a medium and source of learning mathematics (geometry). Game movements and baju simi drawings are used as concrete media that can show mathematical concepts (geometry) in these two aspects. Take a look at the following Baju Simi game picture (Figure 4).

Figure 4. Baju Simi Games

Some mathematical concepts (geometry) contained in the movement and drawing of Baju Simi games are as follows. Foot movement shows the concept of transformation, which is a reflection from one standing position to a standing position in another place. In addition to the concept of rotation, a player must rotate facing toward the place of origin after he reaches the last square. Baju Simi game drawings show several mathematical concepts (geometry), such as concepts about angles, lines, rectangles, squares, trapezoids, and circles. One of the images from the Baju Simi game is a red cross made up of 7 rectangular units, as shown in Figure 5.

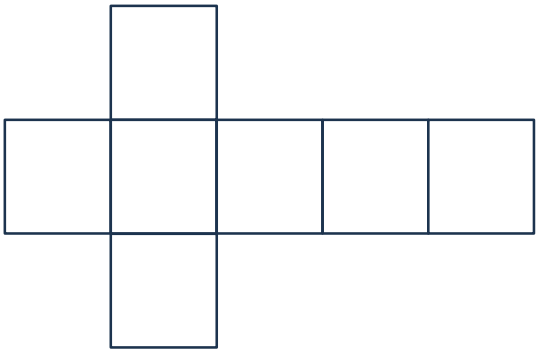

Figure 5. Baju Simi Game Picture in the Shape of a Red Cross

The picture of the Baju Simi game is formed into a room as shown in Figure 6.

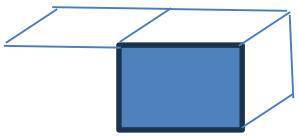

Figure 6. Beam with a Rectangular Plane

Furthermore, removing a rectangle will be obtained by building a beam, as shown in Figure 7.

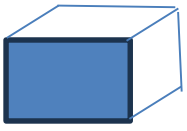

Figure 7. Beam After Discarding Rectangular Plane

The beam in Figure 8, when split, the following beam spatial nets will be obtained.

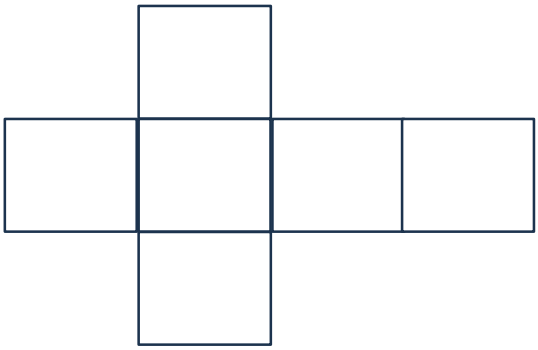

Figure 8. Spatial Nets of Blocks

The Baju Simi image model used is modified according to the material of the spatial nets. In cycle 1, the Baju Simi model uses cube or block nets, as shown in Figure 9 and Figure 10.

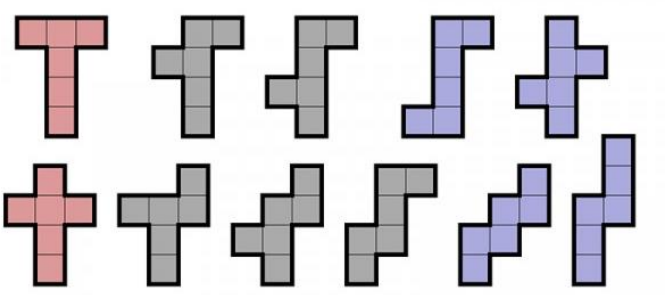

Figure 9. Spatial Nets of Cube

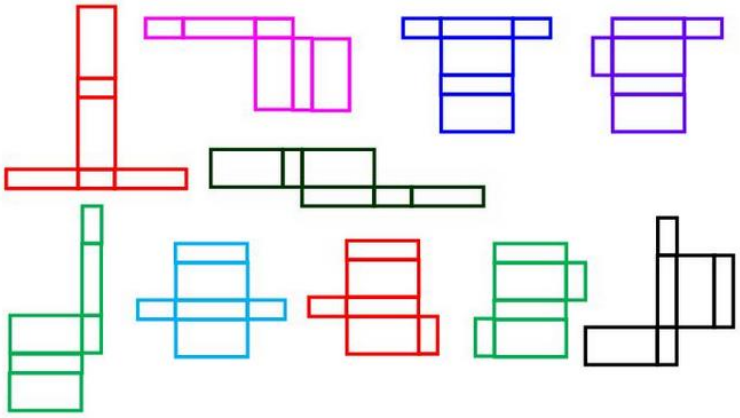

Figure 10. Spatial Nets of Beam

Meanwhile, in cycle 2, the Baju Simi model was modified using prism and pyramid mesh models (Figures 11 and Figure 12).

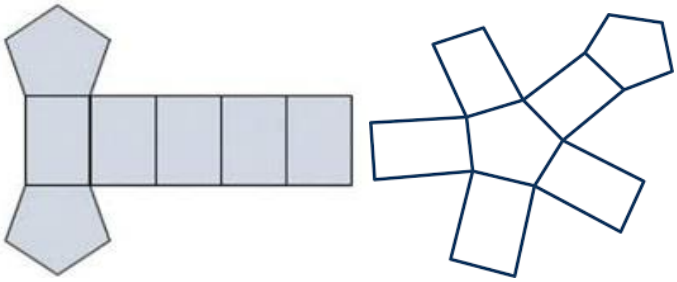

Figure 11. Pentagonal Prism Nets

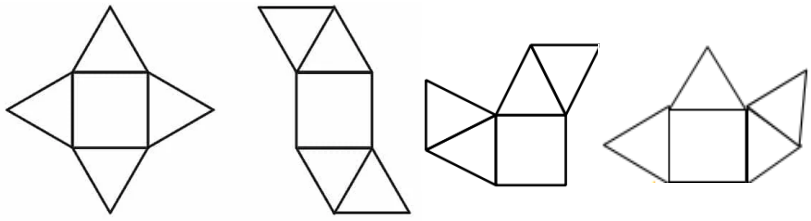

Figure 12. Quadrilateral Pyramid Nets

The use of traditional Baju Simi is done through outdoor learning. The teacher delivers general explanations of learning objectives and how to conduct the game in the classroom. The division of groups is carried out in the classroom, and the group is chosen by the teacher heterogeneously. After that, the students went out of class to play games. Before, during, and after the game, the students discussed the traditional game of Baju Simi related to the material 'spatial nets' with the teacher's guidance. After finishing the game, the students returned to the classroom. Then, the teacher guides and solidifies the material of the spatial nets related to the traditional game of Baju Simi. Students conclude understanding and forms of spatial nets through teacher guidance. Learning mathematics outside the classroom provides a new atmosphere; students are free to be creative and active, accompanied by a pleasant taste (Yumiati et al., 2023).

Students are very active in the game process in cycle one because this game is a game that students usually do every day. However, some students still need help understanding the game even though it has been explained repeatedly. The classroom conditions are crowded; the teacher is overwhelmed to calm the students so that it is manageable. The problems that occur in cycle 1 are (1) Students still do not understand the relationship between the material learned and the Baju Simi game; (2) There are still many students who think that the game practice activities are just for playing; (3) Crowded classroom conditioning due to students being excited in the game; (4) Students are still confused in determining the square and rectangular area formulas and are often confused when doing exercises; and (6) There are still students who are passive in the learning process. In cycle 2, the group structure changes based on the closeness between students and student activity. The teacher asks all students to be active in the group and prepare a full report on the results of their group discussion. The Baju Simi models used are prism nets and pyramids, as shown in Figure 13.

Figure 13. Baju Simi Game on Cycle 2

In the second cycle, the students have begun to be orderly, and the group discussion is also going well. Students are very enthusiastic about determining whether the Baju Simi model they use includes prism nets or pyramids. The end of cycle two is given a problem if another form of Baju Simi game image follows. Then, students are asked to determine the shape of the space formed from the nets. As many as 92% of students can answer correctly, that is, build a tube room. Among the 8% of students who answered incorrectly, it is said that the nets could not form any space. The ability to understand the students' nets is built through the form of simple clothes that can form a tube room. Aribowo et al. (2019) suggest that traditional Indonesian games can develop students' knowledge and skills. From the interviews, students did not think that the Baju Simi model they used turned out to be a form of spatial nets. Interviews were conducted on 3 (three) students in the high (student A), medium (student B), and low (student C) groups. The following is a student's statement based on the interview results.

Student A: "Baju Simi games are exciting and fun, making thinking to determine strategies to defeat opponents. It turns out that the drawing model game is a web of building space."

Student B: "Outdoor learning is fun enough that there is a new atmosphere in learning. This game helped me; when I started playing, I understood the material of spatial nets."

Student C: "It is strange, Mom, just this time; I know this game can be used to study. Studying outside the mother often is fun. If I am mom today, understand tomorrow forgot again. So when playing, a little bit connected with the game and the material."

The function of traditional Baju Simi games as a medium and learning resource in mathematics learning can make it easier for students to understand mathematical concepts (geometry), such as the concepts of points, lines, angles, flat shapes, and transformations, namely reflection and rotation. Setiyadi et al. (2018) suggest that traditional games can be a learning resource on two-dimensional material (wake up flat) in elementary schools. As the results of this study, students are helped to understand the concept of webs of space objects through traditional Baju Simi games.

Increased student understanding of spatial nets can be caused by motivation to follow learning. The results of the motivation questionnaire showed a score of 4.2 on a scale of 5. This shows that using traditional Baju Simi games in outdoor learning and improving the ability to understand web-building space can motivate students to learn mathematics. Students feel happy playing games (Haji et al., 2022). They can express gestures while chatting with their

friends. (Aprinastuti, 2020) suggests that students are motivated to learn mathematics, which is done with traditional games. In addition, students enjoy the game. Like the interview results of student C, who found it strange that games can be used for learning. In addition, outdoor learning involves students finding connections between mathematics and real life (Crompton, 2015; Daher & Baya'a, 2012). Student A, in his interview, stated that it turns out that the Baju Simi game picture model is a web of building space.

D. CONCLUSION AND SUGGESTIONS

Learning mathematics outside the classroom using traditional Baju Simi can improve the ability to understand the concept of spatial nets for up to 2 cycles, with an increase of 0.36 in the medium category and an average score of 70.25. Learning success indicators have been achieved with the number of students who meet the achievement as much as 75%. As many as 92% of students can understand the meaning of spatial nets correctly. In addition, 87% and 82% of students can correctly determine the webs of cubes and blocks. The success of this learning is also shown by the high motivation of students in following learning, with a score of 4.2 (on a scale of 5). Applying Baju Simi games in outdoor learning on spatial nets has limitations. Not all spatial nets can be used as simple clothing models. Likewise, the number of samples is limited to only 20 students. Further research can be developed to test the understanding of transformation concepts or other geometric concepts in using Baju Simi games in outdoor learning with more classes and schools to be studied.

REFERENCES

Aprinastuti, C. (2020). Developing 21st Century Skills for Elementary School Students Grade 1 by Implementing Indonesian Traditional Games in Mathematic Learning. *Advances in Social Science, Education and Humanities Research, Volume 422*, 80–82.

Aribowo, D. S., Hidayah, T., & Rumini. (2019). The Effectiveness of Indonesian Traditional Games and Agility on Student's Gross Motor Skills in Elementary School Hj. Isriati Baiturrahman 2 Semarang. *Journal of Physical Education and Sports*, *8*(3), 281–287. https://doi.org/10.15294/jpes.v8i3.31273

Asghar, E., Ratti, A., & Tolio, T. (2023). An automated approach to reuse machining knowledge through 3D – CNN based classification of voxelized geometric features. *Procedia Computer Science*, *217*, 1209–1216. https://doi.org/10.1016/j.procs.2022.12.319

Badrullah. (2020). Pendekatan Etnomatematika dalam Peningkatan Kompetensi Dasar Pola Bilangan Bulat Siswa Sekolah Dasar. *Jurnal Sipatokkong BPSDM Sulsel*, *1*(2010), 123–135.

Crompton, H. (2015). Understanding angle and angle measure: A design-based research study using context aware ubiquitous learning. *International Journal for Technology in Mathematics Education*, *22*(1), 19–30. https://doi.org/10.1564/tme_v22.1.02

Daher, W., & Baya'a, N. (2012). Characteristics of middle school students learning actions in outdoor mathematical activities with the cellular phone. *Teaching Mathematics and Its Applications*, *31*(3), 133–152. https://doi.org/10.1093/teamat/hrr018

Gargrish, S., Mantri, A., & Kaur, D. P. (2020). Augmented reality-based learning environment to enhance teaching-learning experience in geometry education. *Procedia Computer Science*, *172*, 1039–1046. https://doi.org/10.1016/j.procs.2020.05.152

Guzel, N., & Sener, E. (2009). High School Students' Spatial Ability and Creativity in Geometry. *Procedia - Social and Behavioral Sciences*, *1*(1), 1763–1766. https://doi.org/10.1016/j.sbspro.2009.01.312

Haji, S., Yumiati, Y., & Zamzaili, Z. (2022). Basic Concepts and Values of Mathematics in Bengkulu Traditional Musical Instruments as Media and Resources for Learning Mathematics. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *6*(4), 1096. https://doi.org/10.31764/jtam.v6i4.10220

Iswinarti. (2017). *Permainan Tradisional: Prosedur dan Analisis Manfaat Psikologis*. Malang: UMM Press.

Kurtuluş, A., & Uygan, C. (2010). The Effects of Google SketchUp Based Geometry Activities and Projects on Spatial Visualization Ability of Student Mathematics Teachers. *Procedia - Social and Behavioral Sciences*, *9*, 384–389. https://doi.org/10.1016/j.sbspro.2010.12.169

Lin, C. H. (2022). Developing mental number line games to improve young children's number knowledge and basic arithmetic skills. *Journal of Experimental Child Psychology*, *222*. https://doi.org/10.1016/j.jecp.2022.105479

Mulyasari, D. W. (2020). *Efektivitas Pembelajaran Etnomatematika "Permainan Engklek" terhadap Pemahaman Konsep Geometri dan Karakter Cinta Tanah Air Siswa Kelas 3 SDN 4 Sepanjang Glenmore*. Universitas Islam negeri Maulana Malik Ibrahim.

Nugraha, Y. A., Handoyo, E., & Sulistyorini, S. (2018). Traditional Game on The Social Skill of Students in The Social Science Learning of Elementary School Article Info. *Journal of Primary Education JPE*, *7*(2), 220–227. https://doi.org/10.15294/jpe.v7i2.23475

Priyadi, H. G., & Yumiati, Y. (2021). The Effect of Contextual Teaching and Learning (CTL) Model With Outdoor Approach Towards the Students' Ability of Mathematical Representation. *Education Quarterly Reviews*, *4*(3). https://doi.org/10.31014/aior.1993.04.03.352

Sari, N. H. M., & Switania, R. N. (2021). Eksplorasi Konsep Matematika dalam Permainan Tradisional Indonesia. *Seminar Nasional Pendidikan Matematika*, 75–82. https://www.tintapendidikanindonesia.com

Setiyadi, D., Zaenuri, Mulyono, & Dwidayati, N. K. (2018). The Traditional Games As A Means of Learning Resources Two Dimensional Figures In Primary School. *International Conference on Science and Education and Technology 2018 (ISET 2018)*, 99–103.

Simanjuntak, J., & Tambunan, H. (2021). Etnomatematika: Eksplorasi Permainan Engklek sebagai Media Pembelajaran Matematika (Etnomathematics: Exploration of Engklek Games As a Mathematics Learning Media). *Jurnal Curere*, *5*(2), 1. https://doi.org/10.36764/jc.v5i2.664

Sobel, M. A. (2003). *Mengajar Matematika*. Jakarta: Erlangga.

Tommasi, L., Chiandetti, C., Pecchia, T., Sovrano, V. A., & Vallortigara, G. (2012). From natural geometry to spatial cognition. In *Neuroscience and Biobehavioral Reviews* (Vol. 36, Issue 2, pp. 799–824). https://doi.org/10.1016/j.neubiorev.2011.12.007

Widiasworo, E. (2017). *Strategi dan Metode Mengajar di Luar Kelas (Outdoor Learning)*. Yogyakarta: Ar-Ruzz Media.

Yanik, H. B. (2014). Middle-school students' concept images of geometric translations. *Journal of Mathematical Behavior*, *36*, 33–50. https://doi.org/10.1016/j.jmathb.2014.08.001

Yumiati, Y., Haji, S., & Yulitasari, E. (2023). Improving Mathematics Learning Outcome Through Outdoor Learning Based on Ethnomathematics of Bengkulu's Traditional Game 'Gotri Ayo Gotri. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *7*(1), 23. https://doi.org/10.31764/jtam.v7i1.10189