Development of Adobe Flash-Based Learning Media Based on Cooperative Learning to Improve Spatial Ability and Student Learning Independence Public Elementary School 066650 Medan

Suci Insyani[1], Edi Syahputra[2], Mulyono[3]

{insyanisuci@gmail.com[1], edisyahputra01.es@gmail.com[2], mulyono_mat@yahoo.com[3] }

[1,2,3] Postgraduate Basic Education Study Program, Universitas Negeri Medan, Indonesia

Abstract. The goals of this study are to: 1) Describe the validity, practicality, and efficacy of learning media helped by Adobe Flash that is based on cooperative learning created on cubes and blocks; 2) Determine whether or if there is a relationship between these three factors; and 3) 2) Describe the increase in students' spatial abilities and spatial dimensions as a result of being taught with Adobe Flash-assisted learning media that is based on cooperative learning that has been developed. 3) Describe the increase in students' ability to learn independently as a result of using Adobe Flash-assisted learning media that is based on cooperative learning that has been developed. The SD Negeri 06650 Medan was the location of this study's execution. The thirty children who were enrolled in fifth grade at SD Negeri 06650 Medan during the 2021/2022 school year served as the research participants for this study. The Thiagarajan model was the basis for this study approach, which is a research development. The findings demonstrated that: 1) Adobe Flash-assisted learning media based on cooperative learning to improve students' spatial abilities and learning independence had met the valid, practical, and effective criteria; 2) The improvement of students' spatial abilities using cooperative-based learning media that has been developed is seen from the average N-gain value in trial I and trial II, which are 0.5 and 0.8, respectively, which are in the medium and high categories. These results indicate that the criteria have been met. 3) The development of learning media that is helped by Adobe Flash and is based on cooperative learning has led to an increase in the level of autonomy with which students approach their academic pursuits, as measured from trial I to trial II..

Keywords : Media Development, Cooperative, Spatial Ability, Independent Learning

1. Introduction

Students are provided with the opportunity to cultivate their potential and abilities as candidates in social life through the medium of active learning and learning that takes place within the context of a decent education. According to Regulation Number 68 of 2013 issued by the Minister of Education and Culture of Indonesia, the purpose of education is to "prepare Indonesian people to have the ability to live as individuals and citizens who are faithful, productive, creative and innovative, and effective and are able to contribute to the life of society, nation, state, and society." This regulation states that the goal of education is to "prepare

ICoSTA 2022, November 01-02, Medan, Indonesia

DOI 10.4108/eai.1-11-2022.2326168

Indonesian people to have the ability to live as individuals and citizens who are faithful, productive, creative and innovative, and global culture and society

Learning mathematical concepts is one approach that can be employed to accomplish the goals set forth by the Curriculum for 2013. The rise of modern technology is in large part due to the widespread use of mathematics, which is a vital field of study (Ernest, 2015). Mathematics is a subject that has proven to be beneficial for students, as it has resulted in the opening of a plethora of doors leading to excellent employment options and has helped students make more informed decisions that would assist them in resolving issues that (National Research Council, 1989).

Students typically find learning geometry to be one of the most challenging aspects of the study of mathematics. There are a lot of pupils who don't get it right when it comes to grasping the concepts, the rationale, and how to solve problems involving geometric shapes (Imdad et al; 2014). According to the findings of the PISA study that was conducted in 2012, the spatial content knowledge of Indonesian students, specifically their knowledge of space and shape, is lacking. According to the National Center for Education Statistics in the United States of America (2014), Indonesian students were only able to answer 69.2% (the average for the OECD is 25.8%) of the questions at level one, 19.8% (the average for the OECD is 22.3%) of the questions at level two, 7.8% (the average for the OECD is 22.2%) of the questions at level three, and almost 0% (the mean for the OECD is 29.7%) of the questions It is possible to draw the conclusion from these facts that the capability of students in Indonesia, particularly students in primary school, is still inadequate in terms of understanding the material that constitutes building space.

The evidence clearly demonstrates that the vast majority of children who start their formal education in elementary school have significant mathematical knowledge gaps (Rubin, 2014). The problem is that pupils do not understand the content completely or in its completeness, which leads to poor mathematical learning outcomes, particularly in building space classes. According to the findings that were published in the Journal of Learning and Individual Differences by Furguson (2015), who conducted the research, there is a close connection between spatial ability and the learning outcomes of spatial geometry. Furthermore, poor spatial ability has a significant impact on the amount of math anxiety that students experience. Tosto, Hanscombe, Harworth, Davis, Petrill, Dale, Malykh, and Kovas (2014) also stated the same thing, which is that a good spatial ability strongly supports students' mathematical achievement, particularly on topics that emphasize the development of technological, scientific, and mechanical skills. This was also communicated by Tosto, Hanscombe, Harworth, Davis, Petrill, Dale, Malykh, and Kovas (2014). A conclusion that can be drawn from this explanation is that in order to better studying mathematics, especially building space, spatial abilities, specifically abilities connected to space, images, and visual components, must be developed. This conclusion can be drawn because this explanation was given.

The National Council of Teachers of Mathematics (2000) has determined spatial structure to be one of the content standards in learning mathematics because the objective of learning to construct spatial structures is to train students to develop spatial thinking and intuition skills. Developing spatial sensing and abilities is very useful in understanding relations and properties in spatial structures to solve mathematical problems and everyday life problems (National Research Council, 2006).

The ability to think about the shape, arrangement, and change of a particular object in the room as it is rotated, moved, or viewed from a different point of view is what is meant by the term "spatial ability" (Hergarty, 2010). Even while spatial perception, spatial visualization, geographic orientation, spatial rotation, and spatial interactions are the most important aspects

of spatial thinking, there are many more (National Research Council, 2006). When it comes to teaching students about spatial structures, particularly about shapes like cubes, blocks, pyramids, or prisms, the majority of educators place an emphasis on supplying information on the number of edges, fields, and other information that is learned by rote. It should not come as a surprise that some students believe that the side of the cube in the picture that they are looking at is in the shape of a parallelogram or a rhombus. Some of these students have even estimated the size of the angle of the cube that should be 90 degrees (Ozerem, 2012)

Therefore, we require an appropriate learning activity in order to be able to leave students' spatial abilities, and teachers need to construct meaningful learning that is accompanied with activities that use spatial object props in order to sharpen students' spatial abilities (Noviani and Syahputra, 2017). Using different types of learning material has been suggested in a number of studies as a way to help students improve their spatial abilities. Nevertheless, the utilization of real items or models is not sufficient on its own. The use of computer-based media as a three-dimensional virtual model is more promising since not only is it simple to use from a learning perspective, but also the incorporation of technology into the educational setting is in line with the digital era (Konstantopoulos, 2016).

In classroom learning, The cooperative learning model is one of the various learning methods that can be utilized. According to Eggen and Kauchak (1996), the cooperative learning model is a method of instruction that places students in groups in which they work together toward the accomplishment of shared objectives. The cooperative learning model is a learning model that is currently commonly utilized to solve challenges encountered by teachers in engaging pupils who cannot work with others who do not care about others. This approach was developed as a solution to the problem of students not caring about others. Students will be encouraged to collaborate with one another in group activities such as discussions and peer teaching if this learning style is used.

Computer-based learning media can encourage improved learning independence, also known as self-regulated learning, in addition to spatial ability. This is one of the many benefits of using such media. students (Winnie, 2010; Nussabaumer, 2015). (Winnie, 2010; Nussabaumer, 2015). If students are given the opportunity to use media as a visualization of abstract concepts and are allowed to explore without limits, then this will grow their awareness that learning is not only the teacher teaching in front of them, but also exploring with media. This is because the role of technology in the current digital era allows students to explore without limits. This makes it possible for them to spur independent learning.

The findings of the diagnostic test that the researcher administered to 35 students and the interview with the fifth grade teacher of UPT SD NEGERI 066650 provided a general description of the low spatial ability and independence of students' mathematics learning. These findings are related to the spatial ability and independence of students' mathematics learning. The diagnostic test was administered by the researcher.

Likewise with the independence of students in learning mathematics, the information obtained from the results of interviews with Mrs. Sumiati, S.Pd, a fifth grade teacher is very difficult to be independent in learning mathematics. Abstract mathematics lessons make students confused to understand it, so there is no other way than cheating, relying on friends who are smart if there is homework, and indifferent to lessons because they think that when the exam will be able to see the work of friends.

The results of observations by researchers at UPT SD Negeri 066650 also confirmed the complaints of teachers facing varied student behavior. Of course this is also not absolutely the student's fault without any desire to improve the quality of teaching by the teacher. Teachers who teach without any media will make it It might be challenging for students to grasp the

concepts underlying mathematics. After being confirmed with the school, it turns out that math teachers at school rarely use the media. The limitations of many media and their use which is quite complicated are the main reasons. Therefore, based on the overall description of the background, the author is interested in conducting research related to learning media, spatial abilities and students' mathematics learning independence, entitled "Development of Adobe Flash-Assisted Learning Media Based on Cooperative Learning to Improve Spatial Ability and Learning Independence of Class V UPT SD Students. Country 066650 Medan Cityt.

2. Method

This study is a development study with the goal of creating a project in the form of learning media based on Adobe Flash CS 6 with the intention of enhancing the spatial abilities of students as well as their level of independence. The Four-D Models are the development model that was utilized in this research to develop various learning tools.

2.1 Research time and location..

This research was conducted at UPT SD Negeri 066650 Medan Kota, which was carried out on fifth grade students. This research took place between March and April 2022.

2.2 Research Subjects and Objects

Students in the fifth grade from SD Negeri 066650 Medan Kota, of which there were a total of thirty students, served as the research subjects for this study. The learning medium of mathematics helped by Adobe Flash CS 6 on cube and block material that is utilized to improve students' spatial skills and independence in their mathematics learning is the focus of the research.

2.3 Research procedure

The research and development model known as "4-D" is broken down into its four primary stages, which are defined as "define," "design," "develop," and "disseminate." According to Trianto (2013), the four-stage development model known as "4-D" can be modified to become "4-P," which stands for definition, design, development, and deployment. The application of the primary steps in the study is not only based on the original version, but it is also adapted to the qualities of the topic as well as the origin of the examinee.

Define

The stage known as "define" is the stage at which the learning requirements are determined and defined. This stage of the process is known as the define stage, and it is comprised of five primary steps. These steps are as follows: student analysis (also known as learner analysis), media needs analysis, concept analysis (also known as concept analysis), and formulation of learning objectives (also known as specifying instructional objectives).

Design

During the design stage, the focus is on the creation of learning media. At this point, there are four steps that need to be taken, and they are as follows: (1) Creating a story board, which

entails making sketches or screen images in the form of pages and frames, followed by selecting colors, types of writing, storylines, and also selecting appropriate animations; (2) Creating a script, which entails writing the script; and (3) Selecting appropriate animations. (2) the arrangement of the material in the learning medium, which includes the layout that will be utilized, (3) Constructing learning scenarios, which specify the sequence in which information will be presented; (4) Constructing learning knowledge structures, which refer to information that is displayed with the assistance of learning media created with Adobe Flash CS6.

Develop

At this point in the process, the goal is to produce high-quality learning materials that have been improved based on the feedback received from knowledgeable individuals (validators) and the results of field tests. Researchers are responsible for carrying out this stage of development, during which the designed learning medium is analyzed, tested, developed, evaluated, and revised.

Disseminate

One of the last steps in the development process is called the disseminate or dissemination process. The purpose of the distribution stage is to promote the development product in order to increase the likelihood that it will be accepted by users, whether those users be individuals, groups, or systems. It is possible to disseminate this information to other classes with the objective of determining whether or not the utilization of various forms of media enhances the learning process.

3. Result

Multimedia Construction Expert Validation Results
Validation for multimedia construction experts on improving one's spatial abilities through the use of learning media supported by Adobe Flash and assisted by cooperative learning and learning independence of fifth grade students of UPT SD Negeri 066650 Meda City. The validation results are in the form of an assessment score against guidelines and information, program performance, and systematics, aesthetics and design principles as follows:

Table 1. Percentage of Assessment Results of Multimedia Construction Experts

Evaluator	Media Aspect	Guide and Information	Program Performance	Systematics, Aesthetics and Principles of Design	Total	Mean Score and Rating
1	Total Score	14	43	109	166	4,36
	Total Score	3	10	25	38	Worthy
2	Total Score	15	47	114	176	4,63
	Total Score	3	10	25	38	Worthy
Total Skor		29	90	223	342	
Mean Skor		4,83	4,5	4,46	4,47	
Evaluation		Very Worthy	Very Worthy	Very Worthy	Very Worthy	

3.1 Analysis of Students' Spatial Ability Improvement in Trial I

Assessment of student learning outcomes is done by conducting multiple choice tests. The average pretest and posttest scores were obtained from the students' spatial ability, while the gain value was obtained from the increase in the students' spatial abilities.

Table 2. Pretest, Posttest and N-Gain Data for Increasing Students' Spatial Ability

No	**Pretest Score**	***Posttest score***	***Gain Score***
1	35	70	0,5
2	45	75	0,5
3	30	70	0,5
4	50	80	0,6
5	40	70	0,5
6	30	50	0,2
7	45	75	0,5
8	50	80	0,6
9	40	75	0,5
10	30	60	0,4
11	45	75	0,5
12	40	70	0,5
13	55	80	0,6
14	35	50	0,2
15	45	80	0,6
16	35	70	0,5
17	40	75	0,5
18	30	70	0,5
19	40	65	0,4
20	45	75	0,5
21	40	60	0,3
22	45	75	0,5
23	35	50	0,2
24	45	75	0,5
25	50	75	0,5
26	40	70	0,5
27	50	75	0,5
28	35	75	0,6
29	30	70	0,5
30	45	75	0,5
Average	40	70	0,5

The average gain value is 0.5 with an interpretation in the medium category

3.2 Analysis of Students' Spatial Ability Improvement in Trial II

Students were given multiple choice questions in the second trial with different levels of difficulty, namely: easy, medium, and difficult. In general, the data analysis of increasing students' spatial ability in the posttest trial II can be seen as follows::

Table 3 Analysis of Students' Spatial Ability Improvement in Trial II

No	Score	Student scores	Criteria
1	17	85	Complete
2	19	95	Complete
3	18	90	Complete
4	20	100	Complete
5	19	95	Complete
6	17	85	Complete
7	18	90	Complete
8	20	100	Complete
9	19	95	Complete
10	15	75	Complete
11	19	95	Complete
12	18	90	Complete
13	19	95	Complete
14	16	80	Complete
15	19	95	Complete
16	18	90	Complete
17	19	95	Complete
18	18	90	Complete
19	17	85	Complete
20	19	95	Complete
21	16	80	Complete
22	18	90	Complete
23	17	85	Complete
24	19	95	Complete
25	19	95	Complete
26	18	90	Complete
27	20	100	Complete
28	18	90	Complete
29	19	95	Complete
30	18	90	Complete
Avreange		91	Complete
PKK		100%	Complete

From the analysis of increasing students' spatial abilities in the second trial, the percentage of classical completeness on the posttest is 100%, meeting the percentage of classical completeness that was required.

Table 4. Completeness Data on Learning Outcomes

No	Number Range	Frequency	Percentage	Criteria
1	70-100	30	100%	Complete
2	0-69	0	0%	Not Completed
Amount		30	100%	

It is possible to deduce, on the basis of the mastery data on the learning outcomes, that in the range of numbers 70-100 there are 30 students with a percentage of 100% being in the complete criteria and in the range 0-69 there are 0 students with a percentage of 0% being in the incomplete criteria.

3.3 Percentage of Student Learning Independence Questionnaire.

Table 5. Student Learning Independence Questionnaire

Criteria	Percentage (%)
Very strong	24
Strong	76
Weak	0
Very weak	0

Based on the table that the level of student learning independence is in the Very Strong (SK) and Strong (K) criteria and there are no Weak (l) or Very Weak (SL) criteria.:

Table 6. Percentage of Learning Independence Indicators

No	Learning Independence Indicator	Score	Criteria
1	Initiative and intrinsic learning motivation	62,93	Strong
2	Habits of diagnosing learning needs	63,51	Strong
3	Setting learning goals/targets	64,66	Strong
4	Monitor, organize, and control learning	63,79	Strong
5	Seeing adversity as a challenge	62,93	Strong
6	Utilize and look for relevant sources	59,05	Strong
7	Selecting, implementing learning strategies	62,50	Strong
8	Evaluating learning processes and outcomes	63,51	Strong
9	Self efficacy/self concept/self ability	61,70	Strong

The table reveals that the percentage of students' learning independence indicators falls somewhere in the range of 50% to 75%. This can be noticed by looking at the table. The indicators of a student's ability to learn independently are included in the Strong criteria, if they are interpreted correctly.

4. Discussion

The purpose of the research discussion is to provide a description of the findings of the research that have already been stated explicitly. These findings include the following: (1) knowing the validity, practicality, and effectiveness of Adobe Flash-assisted learning media based on cooperative learning developed on cube and block material for fifth grade students of UPT SD Negeri 066650 Medan City; (2) knowing the improvement of spatial ability and spatial dimensions of students who are taught using Adobe Flash-assisted learning media; and (3) knowing the improvement of spatial abilit.

4.1 Validity, Practicality, and Effectiveness of Learning Media.

Software to create learning media in this research is Adobe Fash CS6. According to Majidah, et al (2016: 96) Adobe Flash is software that can interpret various media, such as video, animation, images and sound to create the right visual presentation. The results of the assessment obtained from multimedia content/material experts obtained a mean score of 4.52 with very appropriate criteria for learning media that is helped by Adobe Flash and is based on cooperative independence, with the goal of improving the students' spatial abilities and their ability to learn independently.

The evaluation that was carried out by specialists in the field of multimedia building yielded the following results: a mean score of 4.47 with very practicable requirements for learning media helped by Adobe Flash, based on cooperative independence, to develop spatial abilities. and learning independence of fifth grade students UPT SD Negeri 066650 Medan City.

4.2 Spatial Ability Enhancement.

The results of the first test showed an overall PKK value of 80% and an average posttest score of 70. The average gain value is 0.5 which is categorized as moderate because the gain is < 0.7. Furthermore, the second trial was conducted to obtain an average posttest score of 91 with a PKK value of 100%. The average gain value is 0.8 which is categorized as high because the gain value is 0.7. The results of students' assessments of their spatial abilities improved after they used learning media based on cooperative independence that was assisted by Adobe Flash. The findings of this study are consistent with previous research conducted by Nur Hadiyan Rizkiyanto (2018), who found that the learning media developed in the learning environments were more effective than those that were not process is very effective with the results of calculating the percentage of class completeness as much as 93%.

4.3 Improving Student Learning Independence

Student learning independence for each indicator is at a percentage of more than 59%. Independent learning of students with the highest percentage is found in the indicator of setting goals/targets, meaning that students are able to set targets for learning mathematics to help learn how to learn and make a schedule for learning mathematics to help achieve the targets that have been set. Then the low desire of students to avoid re-learning math material that has not been mastered, waiting for friends' help when experiencing difficulties and high desire to do assignments because they like it. This shows the independence of students' learning both for indicators of initiative and intrinsic learning motivation.

Independent Learning is one component that has the potential to influence the overall quality of the learning process. Because gaining independence enables students to perform all tasks to the best of their abilities without relying on the assistance of others, learning independence is essential. Students who have a high level of learning independence will work to the best of their abilities to complete any and all exercises or tasks that are assigned by the teacher. So that it will indirectly affect the quality of learning (Yanti, 2017).

5. Conclusion

The findings of this study's analysis and the discussion that followed them led to the formulation of a number of conclusions, which are as follows:

The development of learning media assisted by Adobe Flash that is based on cooperative learning is included in the valid category. This is because cooperative learning is valid. The practical criteria have been satisfied by the process of developing mathematical learning media assisted by Adobe Flash and based on cooperative learning.

In the first trial, the N-gain improvement in students' spatial abilities using Adobe Flash-based learning media based on cooperative learning on the cube and block material was in the medium category, but in the second trial, the N-gain improvement was in the high category. This indicates that the students' spatial abilities improved significantly. In terms of the spatial dimensions, the development of collaborative learning media assisted by Adobe Flash is based

on the predominating increase in the dimensions of visualization and rotation. The overall achievement of student learning independence through the use of Adobe Flash-assisted learning media, based on cooperative learning with cube and block material, received a score that falls within the Strong criteria.

References

[1] Hegarty, M. 2010. Components of Spatial Ability. Psychology of Learning and Motivation. Vol. 52. (Elsevier). Doi: 10.1016/S0079-7421(10)52007-3.

[2] Imdad, A,; Bhagawati,S., & Sarmah, J. 2014. Performance of Geometry among Secondary School Student of Bhurbandha CD Block of Morigaon District, Assam, India. International Journal of Innovative Reserch And Development. Vol. 3. Issue 111, November, Page 73-77.

[3] Kemendikbud. 2013. Modul: Pembelajaran Berbasis Kompetensi Mata Pelajaran Matematika(Peminatan). Jakarta: Kemendikbud Direktorat PSMA.

[4] Konstantopoulus, S. 2016. Separate But Corelated: The Latent Structure of Space And Mathematics Across Development. Journal of Experimental Psycology: General. Vol. 45, No. 9, 1206-1227, Doi:10.1037/xge000182.

[5] National Reserch Council. 1989. Every Body Counts. A Report to The Nation on The Future Mathematics Education. Washington DC: National Academy Press

[6] National Reserch Coucil. 2006. Learning to Think Spatially. Washington DC: The National Academy Press.

[7] NCTM. 2000. Priciples and Standard For School Mathematics. America: The National Council of Teacher of Mathematics Inc. United State of America.

[8] Noviani, J; Syahputra, E & Murad, A. 2017. The Effect of Realistic Mathematic Education (RME) in Improving Primary School Student' Spatial Ability In Subtopic Two Dimension Shape. Journal of Education and Prctice. Vol.8, No. 34. Page: 112-126

[9] Ozerem, A. 2012. Misconceptions in Geometry and Suggested Solution forSeventh Grade Student. Procedia-Sosial and Behavioral Sciences. Vol. 55, P: 720-729, Doi: 10.1016/j.sbspro.2012.09.557

[10] Rubin, R, J.; Marcelino, J.; Mortel, R. & Lapinid, M. R. C. 2014. Activity-Based Teaching of Integer Concept and its Operations. Presented Journal at the DLSU Reserch Congress. De La Salle University, Manila, Philipines. March 6-8, 2014.