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Effect of Media Interactive and Spatial Intelligence on Mathematics Learning Outcomes

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Abstract

This study aims to obtain an overview of interactive and interactive ppt learning media (external factors) and high and low spatial intelligence (internal factors) on mathematics teaching results in Malang Ibtidaiyah madrasah/ elementary school. The affordable population is the entire regular first graders of the 2021/2022 school year consisting of 5 parallel classes with 120 students. Sampling from the people is done randomly regardless of the strata present in the population. The determination of practical classes and control classes is done by drawn two categories drawn in the existing class's research. This study was conducted on first graders divided into two groups: the group of students given treatment and the group that served as control. The results of students' spatial intelligence instruments determine groups with high spatial intelligence and groups with low spatial intelligence. The study results show no difference in mathematics learning results towards students given the treatment of learning between video tutorials and interactive powerpoint text. While students who have exceptional low Intelligence and high Intelligence, there are differences in learning outcomes.

Keywords
interactive video tutorials; interactive powerpoints; exceptional intelligence; learning media; math learning outcomes

I. Introduction

Learning in school is very important in the education system because it relates to developing a person's cognitive aspects of one's thought process, whether or not one's thinking process can be measured and seen from intelligence. After all, intelligence is the perfection of one's mind in thinking, understanding, and perfect growth; therefore, learning intelligence will affect knowing a person because everyone's intelligence is different. Thus the way of learning of each person can not be equalized. Reinforcing this statement, Diezman &Watters (2005) said in their theory that humans have several types of intelligence: linguistic Intelligence, mathematical logic intelligence, intrapersonal intelligence, interpersonal Intelligence, Musical Intelligence, visual/spatial intelligence, and kinesthetic Intelligence(Diezmann & Watters, 2005). Education is a very important human need because education has a duty to prepare Human Resources (HR) for the development of the nation and state (Pradana et al, 2020). According to Astuti et al (2019) Education is an obligation of every human being that must be pursued to hold responsibilities and try to produce progress in knowledge and experience for the lives of every individual. Education is one of the efforts to improve the ability of human intelligence, thus he is able to improve the quality of his life (Saleh and Mujahiddin, 2020). Education is expected to be able to answer all the challenges of the times and be able to foster national generations, so that people become reliable and of high quality, with strong

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characteristics, clear identities and able to deal with current and future problems (Azhar, 2018). Education and skills are the main keys in gaining social status in community life (Lubis et al, 2019).

Referring to Gardner's theory statement above and the current phenomenon, it is known that one of the intelligence that most people very rarely possess is spatial intelligence. Supporting the information, Critten et al. (2018) stated that students rarely include spatial-visual intelligence(Critten et al., 2018). Therefore, the improvement of spatial ability in learning is needed because, according to Gardner, spatial intelligence is intelligence to understand things related to space or place and understand colours, lines, shapes, and areas.

Strengthening the statement obtained observation and survey data and dividing the questionnaire through google form at the beginning of the researchers showed that students lacked spatial intelligence. It was characterized by less interest in images, shapes, and difficulty remembering the layout of objects. So there need to be solutions that can solve the problem. Especially when it comes to improving spatial capabilities. Teachers in mathematics studies have not optimized the application of enhanced learning media to measure mathematics lessons.

The media have not supported the weaknesses of Mathematics learning in the field for learning in elementary school children. At the same time, the era is increasingly advanced(Benavides-Varela et al., 2020). Technology is increasing, still fixated on conventional systems, teachers in the area only use books as a reference and School Worksheets in measurement learning. Media provided only images made by teachers on the board so that students are less interested in explaining materials provided by teachers. Also, teachers do not include learners in learning(Fjørtoft, 2020).

Most teachers use the easy way by using the lecture method and rely on memorizing the facts. So often, learners do not understand what he or she learns. Proven when the exam learners cannot understand the measurement material, so the test results are meagre. Using the media of this development, students are expected to construct science on measurement materials in mathematics subjects. To help students in understanding measurement materials and can apply them in daily life.

The problem that has been described above takes a solution that can be the way out. One of the right solutions is using the correct method, which is a method that can get students involved in the learning atmosphere. The teaching method is one of the ways used by teachers in teaching students. Therefore, learning methods are a tool to create the learning process(Suryasubroto, 2017). Efforts to improve the medium of mathematics learning in learning mathematics are to develop various aspects, especially learning media, supported by technological conditions that are overgrowing in the era of globalization that began to erode the culture of origin.

Today, the development of science and technology is overgrowing, including in the world of education. As already known with technology, many things in the world of education can be developed significantly. Existing technology can help the learning process optimally when used appropriately. Technology that can be used in education is often referred to as learning media(Martinez, 2019). Learning activities learning media is used to support the teaching and learning process more effectively than conventional methods. As previously presented, to improve spatial intelligence, students needed solutions to technology-based learning media solutions.

Learning media is a tool that teachers can use. Learning media is one of the components in the teaching and learning process that is very important and supports its success(Liu, 2018; Moser & Zumbach, 2018). Learning media, according to Gagne, are

various types of components and environments of students that can stimulate them to learn(Buscombe, 2013). Learning media can be in the form of conventional or technological sophistication. By using CD learning media, students are expected to have new learning experiences, have a vital context, or build a strong mind in learning mathematics. Thus the learners not only memorize but also understand the material. So when positioned like any, they can solve problems or test measurement competencies. Also, without realizing the learners have understood the region's distinct culture, namely East Java, preserving culture is also obtained.

The use of media in learning will increase the effectiveness of learning. According to Ethel &Jamet, learning media in the learning process can improve students' learning process, who are expected to enhance their learning outcomes (Erhel & Jamet, 2013). The utilization of learning media enables the achievement of learning effectiveness in students and improves student learning outcomes (Sumantri & Rachmadtullah, 2016). Learning media provides fun and exciting, challenging learning opportunities for various students (Deater-Deckard et al., 2014). Video tutorial learning, the learning process is not only a transfer of knowledge, but a learning process that is building knowledge and skills through various learning activities such as observing, classifying, collecting data, and concluding (Parida et al., 2019).

Video tutorial-based learning media strongly supports learning motivation, efficiently understanding knowledge to learn outcomes (Wade et al., 2019). Media video tutorials can guide software design training that directs designers to optimize quality and moderate or reduce yield weaknesses(Van Der Meij & Van Der Meij, 2014). Video tutorial media can be used as an exciting learning resource, in self-learning or as a complement to face-to-face learning, with what is now called traditional knowledge (Bétrancourt & Benetos, 2018). That media is a self-learning guide material.

This study aims to obtain an overview of interactive video tutorial learning media and interactive ppt learning media (external factors) and high and low spatial intelligence (internal factors) on mathematics teaching results at SD Negeri Malang. The research question is, Is there a difference in the works of mathematics learning between students who are studied using interactive video tutorial learning media and those taught using interactive ppt learning media? And is there a difference in math learning outcomes between students with high spatial intelligence and low spatial intelligence? The mapping of previous research novelty uses video media and spatial intelligence to mathematics learning grade 1 elementary school students.

II. Review of Literature

Learning outcomes are learning processes that are generally activities that result in behaviour changes, learning to understand conducted by teachers to change students' behaviour better. Student learning outcomes may increase if students' learning interest in the course also increases (Putriani & Rahayu, 2018). Differences in learning outcomes are caused by different learning and other thinking skills(Abadi et al., 2018). Learning outcomes are influenced by students' learning styles, learning interests, and intelligence. The results of learning mathematics students in Indonesia are still far from expectations, although their learning achievements can reach optimal levels for individuals. Such a large gap needs to be fixed to improve his or her learning achievements. Many factors that affect students' math achievement are still low.

External factors, including inadequate physical facilities, high cost of education, uneven quality of competent teachers, and uneven access to education, the most significant

influence still comes from the student's self, are physiological factors related to the physical condition and psychological factors that are things related to the student's mental illness. Internal factors that play a role in determining students' achievements in education are academic potential. The educational potential has a lot in common with intelligence when viewed from its constituent components (Achdiyat & Utomo, 2017). Improving mathematics learning results requires an intelligent learning environment to innovate and creativity in enhancing their learning outcomes.

Guney (2019) said that learning outcomes are the end goal of schools' learning activities(Güney, 2019). Learning outcomes can be improved through conscious efforts made systematically, leading to positive changes, referred to as the learning process. The end of the learning process is the acquisition of a student's learning outcomes. Student learning outcomes in the classroom are collected in a set of class learning outcomes. All the learning outcomes are the result of an interaction of learning and teaching. From the teaching side, the teaching action ends with the evaluation process of learning outcomes, while from the student side, the learning outcome is the end of the parting and peak of the learning process (Wulandari et al., 2019).

That student learning outcomes are results achieved through the process of interaction between educators and students. The products of learning in Bloom's taxonomy are grouped into three domains, namely cognitive domains, namely thinking ability, affective or attitude domains, and psychomotor domains or skills. Schunk stated to obtain results that show that mastering learning will improve students' achievements/learning outcomes in long-term memory and attitude towards subjects and subjects(Schunk, 2012) (Schunk, Dale H, 2012). Learning outcomes can be amputated through the cognitive, affective, and psychomotor spheres. Based on the description, it is concluded that the results of mathematics learning are the culmination of learning activities in the form of changes in cognitive, affective, and psychomotor structures in terms of ability about numbers, wake up, relationships of concepts, and logic that are continuous and can be measured or observed. Internal factors influence students' math learning outcomes, are factors that come from within the student themselves such as motivation, intelligence, confidence, independence, attitude, and others, and external factors are factors that come from outside the student, such as facilities and infrastructure, environment, teachers, and teaching methods.

Children from an early age need to learn math, struggle, and feel math as part of their lives. His interactions and activities using mathematics must be challenging, engaging, and needs, not because he is forced or forced. Thus, it is necessary to correct ways and strategies according to the child's characteristics and mathematics. Do not let the learning of children who are still at an early age only photocopies how to learn adults or children who have a high level of maturity of thinking. Teaching the introduction of mathematics through the child psychology approach and the character of child thinking is a practical and sensible way for early childhood teachers. This relates to patterns, sequences, classifications, sizes, concepts of numbers, one-on-one correspondence, concepts of geometric shapes, estimating and processing simple data by manipulating and using concrete media before operating.

The concept of mathematics for early childhood, according to Hawes et al. (2019), mentions the concept of early childhood mathematics, i.e.,(Hawes et al., 2019) a) matching is the concept of one-to-one correspondence, b) classification, c) comparing, and d) ordering or seriation. The opinion also explains that mathematics for early childhood starts from the child learning to match, classify or place objects according to a particular shape or category, compare, and equations. Kennedy (2012) stated that the mathematical concept of

a) matching and discriminating, comparing and contrasting, b) classifying, sorting and grouping, c) ordering, sequence, and seriation. The child responds differently to anything he encounters. Matching starts with the relationship between two objects. Children develop matching and specific skills and compare and contrast the thinking skills of various experiences and activities(Kennedy et al., 2012). Classification of saving, grouping, or categorization sees two objects similar to matching things with the same properties. Classification is an essential skill in all subject areas.

Mathematics is essential in our lives because, in everyday life, we can not be separated from the use of concepts in mathematics, such as when we shop, count objects, measure objects, and others. Given the importance of mathematics in life, concepts in mathematics must be introduced early on. Mathematical ideas that must be presented to early childhood include numerals, geometry, measurements, seriation, number operations, patterns, classifications, and graphs. Introducing mathematics to children will be easier to understand if allowed to experience alone or use concrete objects. At this stage, the child learns to use symbols and still can not think systematically.

Based on the above opinion, it can be concluded that mathematics in early childhood can be developed by classifying, matching, sorting, comparing numerals, geometry, patterns, and measurements. This ability is an essential ability that needs to be created first before the child learns more complicated math skills. This ability is also one of the capabilities that the author focuses on and requires more optimal development.

The objectives of mathematics learning can essentially be explained as follows: 1. Train the way of thinking and reasoning in concluding, for example, through investigation, exploration, and experimentation, showing similarities, differences, consistency, and inconsistencies. 2. Develop creative activities that involve imagination, intuition, and discovery by developing originality, originality, curiosity, making predictions and guesses, and dabble. 3. Develop problem-solving skills. 4. Develop the ability to convey information or communicate ideas through oral speech, notes, graphs, maps, diagrams, and explaining ideas. From the above objectives, it is clear that learning mathematics can solve a problem through various counting operations. Furthermore, as mentioned, mathematics can increase children's creativity and reasoning according to their development level.

Media as a means or learning aids have many kinds and types. The learning media used in this study is an interactive video tutorial media that relies on suasa elements, visual press that focuses on image elements, and audiovisual media that can be used according to learning needs, as well as interactive PPT media that focuses on the display and can be used according to the needs of the learning process. Sandman suggests that audiovisual media in learning produces or delivers materials using mechanical and electronic machines to present audio and visual messages (Sadiman, 2007). Similarly, Sanjaya explained that audio optical media is a type of learning media that contains sound elements and has details of images that can be seen, such as video recordings, various sizes of movies, sound slides, and so forth. Furthermore, Sanjaya explained that audiovisual media's ability is considered better and more interesting than other media types because it combines sound and image elements that are very important in optimizing students' understanding and avoiding verbalism.

Interactive multimedia tutorials can be a solution to learning media's limitations as a learning resource for students. The interactive Multimedia tutorial is a multimedia learning presentation format that, in its delivery, the material is done in a tutorial, as is the teacher or instructor does the tutorial. The information presented contains text, images, either still or moving, and graphics (Daryanto, 2010). Stacey et al. (2008) reveal the meaning of the video is a unique form of visual communication that has been influenced by historical

factors, technical development, and criticism given to another form of media(Stacey et al., 2008). Defining video is difficult because we have been introduced to the medium through many related technologies–most of which grew from developing another form of media. The term "video" relates to a process and can denote either the actual visual image.

Furthermore, Smaldino et al. (2018) explain that video is available for almost all types of topics and this type of learner in cognitive teaching, affective, motor skills, interpersonal(Smaldino et al., 2018). They can take learners almost anywhere, expanding students' interest beyond classroom walls. Objects are significant to bring into the classroom, dangerous events to observe such as solar eclipses. The time and cost of a field trip can be avoided.

Based on some of the expert opinions above, the researchers concluded that the video tutorial is a medium that presents information visually and audio designed by an educator that contains learning messages to help to understand a learning material as guidance or learning materials that can be selected according to the needs of students.

Microsoft PowerPoint is software created and developed by a Microsoft company and is program-based multimedia. In a computer, usually, these programs are already grouped in Microsoft office programs. This program is specially designed to deliver presentations, whether organized by companies, governments, education, or individuals, with various menu features that can make it an exciting medium of communication. Some of the things that make this media enjoyable to use as a presentation tool are the various capabilities of text, colour, image processing, and animations that can be processed by themselves according to the user's creativity(Asset et al., 2015). Media is a practical communication tool in conveying tech information into images and is understood by the recipient.

In principle, the program consists of several elements and operational control. The part in question consists of text slides, images, and colour fields combined with the available backgrounds. These elements can be made motionless or made with specific movements as desired. The program's entire look can be adjusted as needed, whether to run itself according to the preferred timings or run manually, i.e., by clicking the mouse button. Usually, if used to deliver teaching materials that attach importance to the interaction between students and educators, then the control of operations using manual means(Ploetzner & Schlag, 2013). Media can facilitate learning between educators and students.

Information and communication technology is developing rapidly, triggered by findings in the field of micro-electronic material engineering. This development significantly influences various aspects of life; even human behaviour and activities are now much dependent on information and communication technology. A real example of the utilization of this technological development is by creating learning media that utilizes Microsoft PowerPoint application programs. This program has excellent ability in presenting a presentation material and is already widely used in the world of education.

III. Research Method

This study was conducted on students studying at MI Mambaul Ulum, divided into two groups: the group of students given treatment and the group that served as control. The results of spatial intelligence instruments that students have filled are used to determine groups with high spatial intelligence and low spatial intelligence groups. This research study aims to see the influence of interactive video tutorial learning media and interactive ppt learning media and high spacial Intelligence and low spacial Intelligence on the results

of mathematics learning students of MI Mambaul Ulum. The selected research method is an experimental method with a factorial design of 2 x 2.

This study's target population was all MI Mambaul Ulum students, which amounted to 600 students. Grade 6 consists of 3 classes with 90 students, grade 5 consists of 3 courses with 90 students, and grade 4 consists of 3 courses with 90 students. The grade 3 to grade 1 consists of 4 classes, each with a total of 120 students. The affordable population is the entire regular first graders of the 2021/2022 school year consisting of 5 parallel classes with 120 students.

Sampling techniques in this study were conducted with random sampling techniques. This technique is used because sampling from the population is done randomly regardless of the population's strata. The experimental class and control class's determination is done by randomly selecting two categories used in the study from the existing style drawn by lottery number 1 to number 10, then taking two numbers. The first number that comes out is an experiment class (a class treated by interactive video tutorial media). The second number that comes out is used as a control class (a class that uses interactive ppt media).

IV. Result and Discussion

This section will explain the study results, namely the description of data, hypothesis testing, discussion of research results, and research limitations. Next will be presented data calculation such as table 1.

Table 1. Descriptive analysis of research data

		Instruction Media	
Spatial Intelligence (B)	Statistic data	Learning outcomes with video tutorials (A_1)	Learning outcomes with interactive PPT (A_2)
High spatial intelligence (B_1)	N	20	18
	Mean $\bar{Y}$	82,85	81,50
	Minimum	75	77
	Maximum	93	90
	Std. deviation	5,011	3,485
Low spatial intelligence (B_2)	N	10	12
	Mean $\bar{Y}$	72,70	74,50
	Minimum	70	70
	Maximum	77	80
	Std. deviation	2,541	3,261
N		30	30
Mean $\bar{Y}$		79,23	78.70
Minimum		70	70
Maximum		93	90
Std. deviation		6,366	4,829

As a result of the hypothesis test, the researchers used a two-way ANOVA analysis. Two-Way ANOVA analysis calculation results using SPSS 24.0 as shown in Table 2.

Table 2. Hypothesis Test Results

Source Variant	df	Quadrant Mean	F_0	Ft	p-Value
Outcome learning (A)	1	2.215	0.144	4.17	0.705
Spatial intelligence (B)	1	976.985	63.721	4.17	0.000
Interaction (AxB)	1	27.138	1.770	4.17	0.189

4.1 First Hypothesis

Based on the two-way ANOVA test calculation results, it was found that the value F0 = 0.144. p-value>α = 0.05, statistical hypothesis rejects H1 or receives H0, so it can be concluded that there is no difference in mathematical learning outcomes between students who are studied using interactive video tutorial learning media with interactive PPT teaching media.

4.2 Second Hypothesis

Based on the results of the two-way ANOVA test calculation, it was found that the value F0 = 63,721> Ft = 4.17 or with a value of p = 0.000 < α = 0.05 then the statistical hypothesis rejects H0 or receives H1, so it can be concluded that there are differences in mathematical learning outcomes between students who have high spatial with low spatial.

The theory is a valuable tool for teachers to improve their input materials' effectiveness further and, thus, promote student success because students who are taught in the way they like are more successful. Therefore, it was decided to examine the impact of teaching activities serving spatial-visual intelligence on student learning achievement (Šafranj & Zivlak, 2018). Many teachers do not know and understand what basic needs students need and "what intelligence students have. Sometimes teachers assume that intelligent students are proficient in math subjects and teachers reject students' various intelligence(Ridwan, 2015). Teachers are trained on the implementation of several intelligence-based instructions and intelligence profiles before treatment.

Students in experimental groups are instructed with some intelligence theories. The lesson plan on science education is planned considering this strategy. Within eight weeks, the experimental group was given various intelligence methods in the teaching session Students performed all the activities prepared given the eight types of double intelligence in their learning environment. In control groups, teacher-directed strategies representing traditional approaches are used. Teachers who teach while standing in front of the class, writing on the board, asking students questions about assigned readings or papers, waiting while students finish their written work, and giving students daily homework. Most of the time, teachers present topics, and students listen and answer questions asked by teachers. The students did some of the activities given in their science textbooks(Abdi et al., 2013).

This strategy integrates interests and talents informal learning to achieve mastery of science concepts and develop students' dominant intelligence. So far, interests and skills have not been developed in the classroom but rather in nonformal activities(Winarti et al., 2019). This finding is in line with Salam et al. (2019)'s study results that the integrative learning model will provide internal stimulus to students with high spatial intelligence to process the learning provided to build their knowledge to improve the understanding of the subject matter. On the other hand, students who have high spatial intelligence who tend to be active and like creative and explorative activities will quickly become bored, lazy, and lack motivation in learning when taught by direct learning models (Salam et al., 2018). This is because hands-on learning is a teacher-centred learning model that is efficient and

effective in teaching targeted knowledge but inhibits students' curiosity and creativity (Becker & Park, 2011).

These findings agree with a previous study of Ge at al (2020) that emphasized that direct learning models are more effectively given to students with learning disabilities (Ge et al., 2020). Students with low spatial intelligence will be more effective when taught using teacher-centred guided learning models (Lambert, 2019). Students with low spatial intelligence are taught by integrative learning models that require students to be active will discourage students from creative and explorative, lazy, and demotivated activities in learning. Geometry learning is closely related to students' spatial intelligence; students with high spatial intelligence with an effective learning model will be easier to build mathematical knowledge than students with low spatial Intelligence (Boaler et al., 2016).

V. Conclusion

Based on the study results, there is no difference in learning outcomes between students treated with interactive PPT video tutorial media. This means that media that is well developed and by students' needs can improve learning outcomes. While students have low and high spatial intelligence, there are differences in learning outcomes. A solution is needed to address students with low spatial intelligence. This research media's weakness has not improved the learning results in students who have low spatial intelligence. Hence, it needs further research to develop a learning medium that can improve students with low spatial intelligence.

This study's results impact the overall learning process and can contribute to the selection of learning media used by teachers and become an innovation for students who follow the learning process by students' characteristics so that the learning process becomes exciting and not monotonous.

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