MATHEMATICAL BELIEF RELATIONSHIP AND SPATIAL CAPABILITY WITH UNDERSTANDING OF GEOMETRY CONCEPTS

Fathinatul Hasanah[1], Wardhani Rahayu[2] & Fahrurrozi[3]
[1]Master of Elementary Education students at State University of Jakarta
[23]State University of Jakarta
corresponding email: f.hassanah@gmail.com

Abstract: This research is motivated by students' difficulties in understanding the concept of geometry. The thing that is thought to be related to the understanding of the concept of geometry is spatial ability and mathematical belief. The purpose of this study is to look at the correlation between mathematics and spatial ability with the understanding of geometrical concepts. This research uses survey method. The survey was conducted on 99 students. The results of the study show that mathematical belif correlates with the understanding of geometrical concepts. Likewise spatial ability correlates with understanding geometrical concepts. Even the correlation test together with mathematical belief and spatial ability with the understanding of geometrical concepts has a high correlation with the magnitude of 0.911.

Keywords: Mathematical Belief, Spatial Ability, Understanding of Geometry Concepts.

INTRODUCTION

Geometry is one of the materials in mathematics that has been taught to students from elementary school to college. As Leech argued that Geometry is a branch of mathematics that deals with measurement, nature, and the relationship of points, lines, spaces, and volumes. While according to Skinner: Geometry is a greek word that literally means the "means of procurement is concered with the means of the earth". In solving geometry problems students are required to be able to imagine an object in their minds (visual spatial). For example, if students are asked to find the volume of a space object, the student must be able to imagine the shape of the object and determine how to solve it. Almost all visual objects around students are geometric objects. Geometry is a space where children are, alive and moving. In that space children must learn to know, to explore, fight to win, plan and manage life (in order to live), breathe and do better (move better in it).

The purpose of geometry learning is to develop spatial abilities in the real world and support learning of other subjects. Learning geometry means learning critical thinking mathematically, which is putting a

hierarchical structure of concepts at a higher level that is formed on the basis of what has been formed before. As Traves et al. quoted by Iim and Indah states that: "Geometry is the study of relationships among points, lines, angels, surfaces and solids." For example when students are faced with a cube and given a concept of nets, students are required to think critically to find other cube nets. One part of geometry is building a flat side space which includes cubes, beams, prisms, and pyramid. The ability to visualize an event into an image for everyone is different. This depends on the spatial ability of each person, with good spatial ability can help in understanding mathematical concepts.

Basically geometry has a greater opportunity for students to understand compared to other branches of mathematics. This is because geometric forms have been known and known by students before they learn mathematics, so that geometry is expected to be the most easily understood branch of mathematics. But in reality, there are still many students who have difficulty understanding geometry. Both field evidence shows that geometry learning outcomes are still low and need to be improved. Even among various branches of mathematics, geometry occupies the most concerning position.

Students' difficulties in learning geometry occur from elementary to tertiary level. This learning difficulty is what causes imperfect understanding of geometric concepts that will ultimately hamper the process of further geometry learning. The results of the research conducted by Clement and Battista on seventh grade junior high school students revealed their findings that: (1) only 64% of a total of 52 students who knew that the rectangle was a parallelogram; (2) 50% of a number of students do not like the problem of proof; (3) students are better at solving geometric problems that are presented visually than verbally. This student difficulty is caused by a lack of understanding of the geometry of students previously lined up. Therefore, school geometry learning should be directed to the investigation and utilization of ideas and relationships between geometrical properties.

The research conducted by Siregih Sehatta on VII grade junior high school students revealed that in general students did not have a good ability regarding the characteristics possessed by each type of triangle so that they could not classify a triangular object, in this case the classification of types of equilateral triangles. and right angled. In general, students' knowledge of examples and not examples of the concept of triangles is limited to what is given by the teacher during learning. Students do not know that a concept of equilateral, equilateral, and right angles can be modeled in various forms. Based on this, there needs to be concern about understanding the concept of triangles and the visual, verbal and logical skills that must be possessed to support the understanding of geometrical concepts.

Difficulties experienced by students in understanding the concept of geometry due to low spatial abilities of students and students' inability to connect between what is learned with how that knowledge will be used or utilized. This causes students difficulty in interpreting images in visual form. To solve problems in constructing a flat-side space, one must have spatial ability because in the matter of building a flat-side space there are many matter questions that cannot be realized in actual form or form.

Spatial ability greatly contributes to the ability to understand the geometrical concepts of students. Without spatial ability students will have difficulty recognizing shapes, communicating positions and relationships between objects, giving and receiving directions, and imagining changes in the position or size of an object. This can happen because teacher teaching is inappropriate. Students usually work on questions that are the same as those exemplified, but when they find a problem that requires a deeper understanding, they have difficulty resolving it. Students are used to memorizing a concept without knowing how the concept formation takes place. Many students are able to present the level of memorization they have with the material they receive, but in reality they often do not understand deeply the contents of the material.

METHOD

The study was conducted using survey methods using three tests. The first is the test of mathematical beliefs, the second is the spatial ability test, and the third is the understanding of the concept of geometry. This study was conducted on fourth grade elementary school students. The data obtained in this study were obtained from quantitative data. Quantitative data obtained will be in the prerequisites for testing normality and linearity. Then the correlation and regression tests were tested.

RESULTS AND DISCUSSION

Mathematical Belief

Mathematical data belief has a score range of 52. Based on the results of descriptive statistics obtained that students' mathematical belief data on the environment has an average value (mean) of 61.82 with a standard deviation of 9.55 where the variance value is 91.11 and the median value 62.

Spatial Ability

Data on spatial ability has a score range between 33 to 88 so that the score range is 55. The results of the calculation of the data obtained an average of 62.2; standard deviation of 1.32; variance of 175; and the median is 63. The grouping of data can be seen in the frequency distribution table as follows.

Understanding of the Concept of Geometry

Data understanding of geometric concepts students have a score range between 32 to 92 so that the score range is 60. The results of the calculation of the data obtained an average of 65.61; standard deviation of 1.23; variance of 151.83 and median of 66.

Relationship between Student Mathematical Belief and Understanding of Geometry Concepts

The results of testing the first hypothesis can be concluded that there is a positive relationship between mathematical beliefs and the understanding of geometrical concepts. Correlation test results show the correlation coefficient (R) = 0.896 with the coefficient of determination (R Square) = 0.803 = 80.3%. In addition, the Anova test produced a significance value of 0,000. Because of the significance value (0.000) $<\alpha$ (0.05), the correlation coefficient is significant with an influence of 80.3%.

The test results above provide clues that mathematical beliefs are one of the main factors contributing to the funeral of the concept of geometry. From these results it can also be interpreted that increasing mathematical beliefs will contribute

significantly to understanding mathematical concepts. This is consistent with the opinion of Pehkonen that belief is, "an individual subjective knowledge and emotions concerning objects and their relationships, and they are based on their personal experience". This explains that belief is a result of a combination of subjective knowledge possessed by individuals with emotions (one's acceptance attitude), and is usually based on personal experience. If the initial knowledge of students is formed with good learning experience, it will influence the way students "welcome" something new. This opinion is corroborated by the opinion of Mc Leod who explained that "beliefs are a major cognitive nature and are developed over a long period of time." This means that trust is largely cognitive and developed over a long period of time. The purpose of the words beliefs here contains the meaning of an opinion or picture of someone about something, which is the subject of knowledge and does not require truth or formal proof.

Beliefs are closely related to cognitive, so understanding which is part of cognitive will be influenced. Understanding is the deep absorption of a material being studied. Which is understanding is one of the students' achievement of the cognitive types / domains that are six, namely observation, memory, understanding, application / application, analysis (careful examination and selection), and synthesis (making a whole new alloy). So understanding here has two key words that lead to "how students can explain the material and how students can define by their own verbal in detail". From the description above explains that someone can be said to understand if he has passed the process of forming an understanding that is to know more in a material, apply in a real application, analyze and draw a conclusion from the concept. The above results are consistent with several studies of Princess Yuanita (2011). Diki Rijal Mufasir (2012), and Schoenfeld that practice beliefs have an influence on some cognitive abilities including understanding.

Relationship of Spatial Ability with Understanding of Geometry Concepts

The results of testing the second hypothesis can be concluded that there is a positive relationship between spatial ability and understanding of geometrical concepts. Based on the test results obtained the correlation coefficient (R) = 0.892 with the coefficient of determination (R Square) = 0.796 = 79.6%. The significance of the value of the correlation coefficient is shown by Anova test which produces a significance value of 0,000. Because of the significance value (0.000) $<\alpha$ (0.05), the correlation coefficient is significant with an influence of 79.6%. This conclusion shows that the higher the spatial ability, the higher the understanding of geometrical concepts will be. The correlation between spatial ability and understanding of geometrical concepts shows its meaning, both through product moment correlations and partial correlations.

The results of this analysis provide clues that spatial ability is one of the main factors contributing to the understanding of geometrical concepts. From these results it can also be interpreted that increasing spatial ability will contribute meaningfully to the understanding of geometrical concepts.

Spatial ability contains a person's ability to understand more deeply the relationship between object and space. Students with this ability will easily create

imagination or make forms (in memory) into three-dimensional forms or objects that appear by the senses. Good spatial ability will help students understand the concepts of geometry and other mathematical concepts.

Gardner explained that spatial ability is the ability to form and use mental models. Followed by an explanation of Dijkstra, Krammer and Merrienboer, spatial ability is defined as cognitive skills or manipulating mental images of real objects or imagined in order to determine the best choice or solve problems. Children with this ability are also able to easily and quickly understand the spatial concept and look enthusiastic when carrying out activities related to this ability. Visual-spatial ability is an abstract concept that includes spatial perception involving spatial relationships including orientation to complex abilities involving manipulation and mental rotation.

Spatial ability is a person's ability to capture space with all its implications. Meanwhile, according to Carter, spatial ability is a perception and cognitive ability that makes a person able to see the relationship of space. Another opinion says that spatial ability involves the ability to present, transform, and recall symbolic information. This explains that spatial ability will help students in forming information into a symbol that has the same meaning as the informant. However, if the spatial ability is not owned by the student, the learning material will be difficult and takes longer so that students can understand abstract subject matter. This is consistent with research from La Timbu (2009) and Anita (2016) that spatial ability is able to improve visual ability and understanding of geometrical concepts. Based on the above, that true spatial ability will be closely related to understanding the concept of geometry. If the spatial ability is good, then the understanding of the geometrical concept is also good.

The Relationship between Mathematical Belief and Spatial Ability Together with the Understanding of the Concept of Geometry

The results of testing the third hypothesis can be concluded that mathematical beliefs and spatial abilities together have a positive relationship with the understanding of geometrical concepts. Based on the results of the study obtained the value of multiple correlation coefficient (R) = 0.911 with a coefficient of determination (R Square) = 0.829 = 82.9%. The significance of the multiple correlation coefficient is shown by Anova test which produces a significance value of 0,000. The test criteria are if the significance value $<\alpha$ (0.05) is that the multiple correlation coefficients are significant. Because of the significance value (0,000) $<\alpha$ (0,05), the multiple correlation coefficient is significant with an influence of 82,9%.

Spatial ability contains a person's ability to understand more deeply the relationship between object and space. Students with this ability will easily create imagination or make forms (in memory) into three-dimensional forms or objects that appear by the senses. Good spatial ability will help students understand the concepts of geometry and other mathematical concepts. In addition to spatial abilities, there are other factors that can affect the ability to understand students' geometrical concepts, namely belief.

Student's belief in mathematics influences how he "welcomes" his mathematical lessons. Belief (belief) contains an emotional or affective

assessment, cognitive component or knowledge about the object and the conative aspect or tendency to act. Low mathematical beliefs can result in a lack of understanding of the subject matter concerned.

Some things that become elements in the framework of thinking are as follows the importance of instilling mathematical beliefs in students before learning begins. In addition the teacher should pay attention to other aspects that are thought to affect the ability to understand students 'mathematical concepts, especially those that affect the ability of students' geometrical concepts during learning.

References

Anita, *Hubungan Bermain Balok Unit dengan Perkembangan Kemampuan Spasial Anak Usia 5-6 Tahun*, Skripsi (Bandar Lampung: Universitas Lampung, 2016), h. 59

Bonnie Coulter Leech, *Geometry Great Thinkers*: The History of Geometry (New York: The Rosen Publishing Group Inc., 2007), h. 4

Diki Rijal Mufasir, *Pengaruh Prestasi Belajar Siswa Terhadap Beliefs Tentang Matematika di Kelas VIII SMP Negeri 9* (Cirebon : Institut Agama Islam Negeri Syech Nurjati), h. 2

Djamilah Bondan Widjajanti "Mengembangkan Keyakinan *(Belief)* Siswa Terhadap Matematika Melalui Pembelajaran Berbasis Masalah". *Makalah KNPM3 MAT UNY 2009*, h. 6

Evi Febriana, "*Profil Kemampuan Spacial Siswa Menengah Pertama (SMP) dalam Menyelesaikan Masalah Geometri Dimensi Tiga Ditinjau dari Kemampuan Matematika"*, "Jurnal Elemen", 2015, h. 14

Howard Gardner, *Multiple Intellegences*: The Theory in Practice : A Reader (New York: Basic Books, 1993), h.9

Iim Rohimah dan Indah Nursuprianah, "Pengaruh Pemahaman Konsep Geometri Terhadap Kemampuan Siswa dalam Menyelesaikan Soal-soal Bidang Datar", *Jurnal EduMa Vol. 5 No. 1 Th. 2016*, h. 21

Kapetanas Eleftherios and Zachariades Theodosios, "*Students' Beliefs and Attitudes About Studying and Learning Mathematics* (Seoul: Proceeding of the 31st Conference of the International Group for the Psychology of Mathematics Education, Vol.3, 2007), h. 97

La Timbu, *Pengaruh Bentuk Penilaian (Assessment) Terhadap Hasil Belajar Fisika dengan Memperhatikan Kecerdasan Spasial Siswa SMA, Tesis* (Jakarta: Universitas Negeri Jakarta, 2009), h. 153

M. Hariwijaya, *Tes Itelegensi* (Yogyakarta : Andi Offset, 2005), h. 14

Muhibbin Syah, *Psikologi Belajar* (Jakarta: PT. Raja Grafindo Persada, 2003), h. 214

Nur'aini Muhassanah, *Analisis Keterampilan Geometri Siswa dalam Memecahkan Masalah Geometri Berdasarkan Tingkat Berpikir Van Hiele* (Jurnal Elektronik Pembelajaran Matematika Vol. 2 No. 1 Maret 2014), h. 56

Philip Carter, *Tes IQ dan Bakat* : Menilai Kemampuan, Penalaran Verbal, Numerik, dan Spacial Anda (Jakarta: PT. Indeks, 2010), h. 28

Putri Yuanita, *"Kepercayaan (beliefs) Matematika dan Kemampuan Pemecahan Masalah Siswa SMP Negeri 13 Pekanbaru dalam Pelaksanaan Pembelajaran Pendekatan Realistic*

Mathematics Education (RME) (Riau : Universitas Riau, 2011), h. 19

Sanne Dijkstra, Hein P. M. Krammer, dan Jeroen J.G. Van Merrienboer, *Instructional Models in Computer-Basid Learning Environments* (University of Twence The Nederland:1991), h. 199

Schoenfeld, A. H., *Exploration of Students' Mathematical Belief and Behavior*, (dalam Journal for Research in Mathematics Education, 1989), h. 338-335

Stephen Skinner, *Sacred Geometry* : Disiphering the Code (New York: Sterling Publishing Co. Inc., 2009), h.6

Sumantri, M. S., Prayuningtyas, A. W., Rachmadtullah, R., & Magdalena, I. (2018). The Roles of Teacher-Training Programs and Student Teachers' Self-Regulation in Developing Competence in Teaching Science. *Advanced Science Letters*, *24*(10), 7077-7081.