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Limited Dissemination of Van Hiele Bridge Theory in Efforts to Improve Understanding of Geometry Mathematics with The Academic Community of MI Futuhiyyah Palebon Semarang-Indonesia

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Abstract

Implementation of the Van Hiele Bridge theory is an intermediary step for teachers to convey mathematical geometry material in an effort to provide an overview of students getting mathematics subject matter on the subject of geometry. Mathematics is a subject that is generally not liked by students, because it is difficult and boring. From two things, it is a form of collaboration between researchers from universities and the MI Futuhiyyah Palebon Semarang-Indonesia Academic Community. In its implementation, first by observation through interviews, the following stages are presentation of material about the van Hiele Bridge theory in the learning process, after the explanation can be understood and understood then it is used as basic knowledge with the micro teaching program via video. Then the next stage is direct practice in class with the researcher positioned as a model teacher of how the van Hiele Bridge theory is implemented. Through limited dissemination of collaboration between researchers and the MI Futuhiyyah Palebon academic community, it is hoped that the academic community can improve teacher skills and can increase students' understanding of mathematics, especially geometry material. And making the van Hiele Bridge a meaningful method or approach to learning geometric mathematics for teachers and students.

Keywords: *Dissemination, van Hiele Bridge, Circle Geometry.*

INTRODUCTION

Mathematics is the "Queen and Servant of Science", meaning that apart from being a foundation for other sciences, mathematics is also a helper for other sciences, especially in the development of that science. This is because mathematics in the world of education is one of the basic sciences that can be used to support sciences such as physics and chemistry. As Queen, you must be beautiful and smart, but it turns out that behind this nickname it is generally stated that mathematics is the most difficult and scary subject, so that mathematics has the nickname "scourge" for most students from the past until now.

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Once the importance of mathematics is given at various formal levels, it is hoped that students can master the discipline of mathematics well. However, a phenomenon shows that there are still many students who do not like studying mathematics. This is in accordance with the opinion of Turmudi (Abdullah, N., dkk.2010). Who stated that: "For years, efforts have been made to ensure that students can master mathematics well by education experts and mathematics education experts. However, the results still show that not many students from each class like mathematics. "It is thought that many students don't like mathematics because they think that mathematics is a subject with complicated calculations.

According to Dienes (Ruseffendi 2006:156), there are children who enjoy mathematics only when they first become acquainted with simple mathematics. The higher one goes to school, the more difficult the mathematics one learns, the less interest one has. Besides that, there are many children who, after learning even simple parts of mathematics, do not understand many things, they understand many concepts incorrectly. Mathematics is considered a difficult, complicated and deceptive science. So, mathematics is still considered a very difficult subject compared to other subjects.

According to Jamal (2014:20), "There are 3 things that cause students to experience difficulties in learning mathematics, including perception (metamatics calculations), intervention and extrapolation of the implementation of the teaching and learning process which will greatly determine the extent of success that must be achieved by a mathematics subject". These difficulties can trigger various problems such as students' fear of mathematics and students' lack of interest in learning mathematics. In fact, not a few students are afraid to study mathematics. They feel anxious and stressed during the learning process, especially with teachers who they consider scary.

Based on the results of a questionnaire about difficult lessons for elementary school students, the answer is mathematics lessons, and based on observations of classroom learning, it shows that teachers tend to be dominant with smart students as question, and answer partners. As a result, many students reportedly face difficulties in mathematics, especially in solving mathematical problems (Tay Lay Heong 2005; Tarzimah 2005; Mohd Johan 2002; Zalina 2005; Lim See Kiat 1995).

Mathematical problem solving is not a topic but a process that underlies the entire mathematics program that contextually helps concepts and skills to be learned (Ibrahim 1997). Many mathematical skills are involved in problem solving. However, a large number of students have not acquired the basic skills they need in mathematics (Mohd Nizam & Rosaznisham 2004; Berch & Mazzocco 2007). If the teaching and learning process does not involve all students, it will be difficult for students to acquire mathematics skills and this will make students dissatisfied with learning mathematics.

Hutama (2014:75), states that education in elementary schools plays a very important role in the overall success of education, so that all parties involved in the learning process in elementary schools must be really serious in carrying out their respective roles. If the teaching and learning process does not involve all students, it will be difficult for students to acquire mathematics skills and this will make students dissatisfied with learning mathematics. Understanding students' difficulties in mathematics skills is very necessary, namely by changing the teaching paradigm in problem solving by involving all students, where teachers act as learning partners and involve clever students as teacher assistants to help groups of students who experience difficulties or are less intelligent.

Efforts that can be made to increase student learning activities are by implementing appropriate learning models so that they can achieve learning objectives (Aldila et al., 2023; Rini & Aldila, 2023). Mathematics learning is the efficient learning and performance of mathematics, it needs to be endowed with a good sensory processing system and an efficient system for storing, maintaining and accessing information in memory, and can improve students' thinking abilities, and can improve their ability new knowledge as an effort to improve good mastery of mathematics (Susanto, 2013:186). Learning activities consist of learning and teaching activities. These two activities will collaborate into an activity that creates interaction between students and teachers, students and students, and students and their environment.

Considering that many students don't like mathematics because it is difficult, it is a challenge for researchers to find mathematics learning methods that are fun, exciting or meaningful for students and teachers. It is ironic that mathematics, as the queen of science, means that it has so many benefits that it is disliked and even feared starting at the elementary level, namely elementary school or Madrasah Ibtidaiyah. As a fundamental step, it is to create a pleasant, exciting learning atmosphere so that students feel at home learning and miss the mathematics lessons coming up. To create a conducive atmosphere, a growth mindset is needed for teachers and students, namely creating meaningful learning for students and teachers. In research on the implementation of the van Hiele Bridge as part of van Hiele's theory, it is related to the level of geometric thinking. There are five levels of development, namely level 0 (visualization), level 1 (analysis), level 2 (informal deduction), level 3 (deduction), and level 4 (rigor).

The Van Hiele Levels of Geometric Understanding

The first main idea of this article is that there is a learning hierarchy.

1. Visualization is basic level. Students at this level are able to recognize shapes just from their appearance.
2. Analysis follows visualization. At this level students see shapes as collections of properties.

3. Abstraction is the level at which students see relationships between properties. They can create meaningful shape definitions. They are able to justify their reasons with logical implications.
4. Deduction level, students are able to construct proof. They know the meaning of necessary and sufficient conditions for these numbers.
5. Rigor is the final level. Students at this level are building and comparing mathematical systems.

Other systems start from zero, or level per introduction. Students at this level only have some of the visual characteristics of figures. Although the NCTM Curriculum and Evaluation Standards for School Mathematics does not identify the van Hiele theory, it does recognize a hierarchy of understanding. This hierarchy also states that learners must recognize whole shapes, learn to analyze properties and make relationships.

The second main idea of this article is that assessments must be conducted to determine the phase at which the students need to begin. The research showed that most high school geometry teachers were starting at level 4 or 5, but the students were only at level 1 or 2. Assessments need to be created that allow the teacher to see the processes that the students are working through to determine their understanding.

The third main idea is that students must master one level before progressing. It may appear that a student has mastered a level but the instructor must ensure that the understanding is actually there.

The fourth main idea is that lecture and memorization is not understanding. Students may appear to have mastered the phase, when in actuality the memorization is not indicative of understanding.

Students that receive lecture and learn to memorize are unable to keep this information for a long period of time. The information is easily and quickly lost. Also, students that have memorized will be unable to apply this knowledge to a similar situation. Students must develop these processes through experiences which allow for discussions.

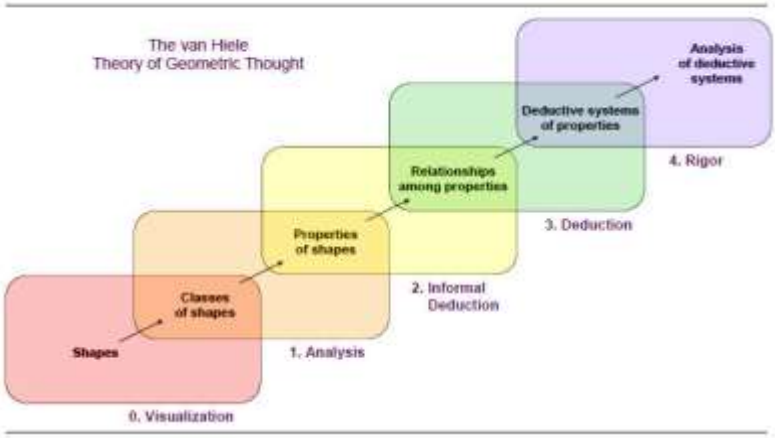

Figure 1. The van Hiele: Theory of Geometric Thought

Information:

1. Shapes are stairs or bridges to climb level 0 Visualization.
2. Classes of shapes are stairs or bridges to climb level 1 of Analysis.
3. Properties of shapes are stairs or bridges to climb level 2 of Internal Deduction.
4. Relationships among properties are stairs or bridges to climb level 3 Deduction.
5. Deductive systems of properties are stairs or bridges to climb level 4 of Rigor

Rigor level produces Analysis of deductive systems at this level students understand the way how mathematical systems are established. Form rigor level results, students are able to analyze based on evidence. And able to understand Euclidean and non-Euclidean geometric systems.

METHODS

This research is research using non-test techniques consisting of questionnaires, observation, interviews and documentation.The selection of these three instruments is based on Data Triangulation which aims to ensure the validity of the data (Creswell, 2010). Non-test techniques are used to collect data related to creative thinking dispositions student. Questionnaires are used to collect data related to students' attitudes towards mathematics. To collect data in the form of teacher activities during learning, an observation sheet is used. Then to find out information about opinions, aspirations, hopes, desires and beliefs of students towards mathematics, the author using interview techniques. Data collection in this research was carried out randomly descriptive where the data collected is not data in the form of numbers. the data comes from observation notes, interview results, documents, photos, audio and video recordings obtained through questionnaires, observations and in-depth interviews.

Qualitative descriptive research, data collection based on the results of observations, interviews, questionnaires and documentation.

1. Observation
   Observation is a technique for collecting data by observing ongoing activities, Sugiyono (2016:220). Creswell (2010:267) believes that observation is where researchers go directly to the field to observe the behavior and activities of individuals at the research location. Observations were carried out at MI "Futuhiyyah Palebon" Semarang-Indonesia with class VI objects Observations are carried out by observing teachers and students during the learning process.
2. Interview
   Interviews are a form of data collection technique that is widely used in qualitative descriptive research. Interviews were conducted orally in individual face-to-face meetings (Sukmadinata, 2016:216). In this research, the objects to be

interviewed are teachers, students and parents as sources or sources of data to be analyzed.

3. Questionnaire
   A questionnaire is a technique or method of collecting data indirectly (researchers do not directly ask questions and answers to respondents). The instrument or data collection tool is also called a questionnaire which contains a number of questions or statements that must be answered or responded to by the respondent (Sukmadinata, 2016:218).
4. Documentation
   Documentary study is a data collection technique by collecting and analyzing documents, both written, image and electronic documents, (Sukmadinata, 2016:221).

RESULTS AND DISCUSSION

The initial stages, namely the speech from the head of Madrasah Ibtidaiyah, contain the need to improve performance, starting with the need for us to teach with a new paradigm, namely teachers must have a growth mindset, the same goes for students so that there is dynamic harmony in learning and teaching, namely students enjoy going to school with the aim of wanting to smart. With students and teachers having a positive mindset, laziness and fear of certain lessons or teachers can become meaningful learning.

Figure 2. Socialization of van Hiele Bridge (VHB) Dissemination MI "Futuhiyyah Palebon" Semarang-Indonesia

After the head of the madrasah provided teacher motivation to change the growth mindset so that students enjoyed going to school and studied diligently, and really paid attention to the researchers' directions to gain new knowledge in implementing van Hiele's theory, namely the van Hiele bridge as applied van Hiele's theory in solving problems in geometric material. In its implementation, first by observation through interviews, the following stages are presentation of material about the van Hiele Bridge theory in the learning process, after the explanation can be understood and understood then it is used as basic knowledge with the micro teaching program via video. Then the next stage is direct practice in class with the researcher positioned as a

teacher modeling how the van Hiele Bridge (VHB) theory is implemented.

Presentation of material about the van Hiele Bridge theory in the learning process

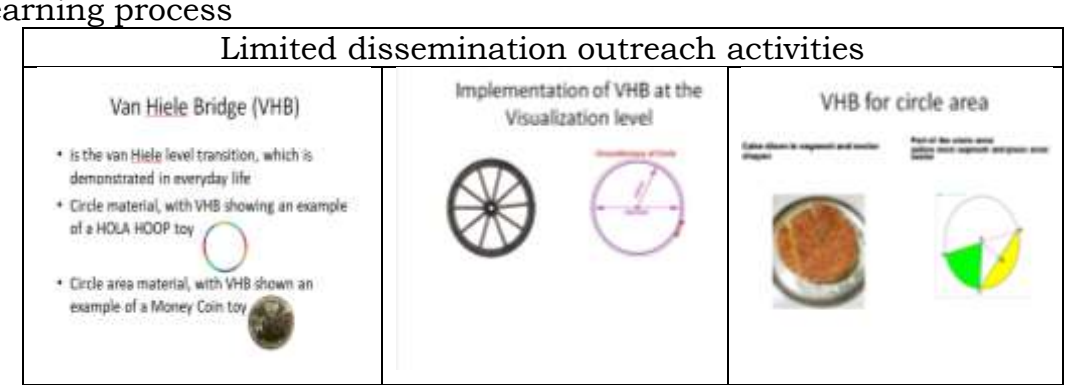

Figure 3. VHB Theory and Circle Material

The aim of studying geometry is for students to gain confidence in their mathematical abilities, become good problem solvers, be able to communicate mathematically, and be able to reason mathematically (Bobango, 1993:148).

The model teacher gave an example of how with the implementation of VHB circle material students were enthusiastic in learning by asking and answering, which shows the meaningfulness felt by the students, namely that there is no fear and no feeling that they cannot because the model teacher acts as a learning partner.

Photos of model teacher activities and student activities for 3 Madrasah Ibtidaiyah out of 11 Madrasah Ibtidaiyah (MI) as dissemination samples.

Figure 4. Model Teacher Activities and Student Activities

Interview and Questionnaire Results

Based on the results of the implementation of VHB in learning, it shows that students enjoy mathematics lessons on circle geometry material with a model teacher as a learning partner, making material circle problems and circle areas with demonstrations and everyday reality into problem solving as if they are not problematic, that is, they can be solved by themselves or with the guidance of the model teacher and class teacher. as a learning partner. With the meaningfulness of learning, namely the researcher as a model teacher and the class teacher collaborating in learning, making the learning of circle material geometry run smoothly, it is meaningful for the class teacher and also meaningful for the students.

Questionnaire Results

In the VHB implementation assessment questionnaire, the teacher shows:

Respondent	Category		
	NG	QG	G
Teacher	-	-	ν

Information:
NG : Not Good
QG : Quite Good
G : Good

Student assessment questionnaire, implementation of VHB in learning with model teachers as learning partners, shows:

Respondent	Category		
	NH	QH	H
Student	-	-	ν

Information:
NH : Not Happy
QH : Quite Happy
H : Happy

Based on the results of teacher and student questionnaires, it shows that van Hiele's theory regarding levels of geometric thinking and with the help of the van Hiele bridge makes circle geometry material easy for class VI students at MI “Futuhiyyah Palebon” Semarang-Indonesia to understand, which the students show is happy, and the teacher says it is good.

CONCLUSIONS

Dissemination of the implementation of the Van Hiele Bridge (VHB) in geometry material is very in accordance with the Van Hiele (VH) learning theory regarding geometric levels of thinking and with the help of VHB shows the meaningfulness of learning for students and teachers.

Implementation of the Van Hiele Bridge, based on the results of a questionnaire to teachers, it was concluded that learning became more dynamic, students were happy, not burdened with fear because they couldn't and teachers were fierce, but by changing the teacher's growth mindset by becoming a learning partner, the students' mindset changed, making mathematics lessons fun according to The results of the student questionnaire stated that learning mathematics geometry material with the help of VHB was fun.

With the dissemination of the implementation of the Van Hiele Bridge (VHB) mathematics learning material on circle geometry, class VI students of Madrasah Ibtidaiyah "Futuhiyyah Palebon" Semarang-Indonesia in the 2023/2024 academic year experienced an increase in geometric thinking.

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