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Analysis Of Geometry Thinking Ability Based on Intellegence Quotient Category in Schoology Assisted Collaborrative Problem Learning

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Abstract

The purpose of this study was to find patterns of students' geometric thinking abilities in terms of intelligence quotient (IQ) on collaborative problem-solving learning (CPS) assisted schoology. The research subjects were 31 students of class VII SMP Negeri 3 Temanggung for the academic year 2020/2021. IQ Score collected by the questionnaire method. Observation, documentation, and interview methods were used to find patterns of geometric thinking ability. Results The study showed that the IQ of the subjects in the focus of the study was found to have four categories, namely high average IQ, average IQ, low average IQ, and borderline defect *IQ.* The pattern of students ' geometric thinking ability varies for each IQ category. It was found that the pattern of geometric thinking ability was found, especially for the average and low IQ. The wedge pattern occurs because of the impact of CPS learning.

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INTRODUCTION

Geometry is a branch of mathematics that has an important role in life. The mathematics curriculum at every level of education, from primary, secondary, to tertiary education, always contains geometry content. Clement & Batista (in Tieng & Eu, 2014) revealed that learning geometry means learning visual patterns, this is like what was stated in that learning geometry can improve students' thinking skills using visual images.

Yazdani (2007) there is a strong positive correlation between the level of geometric thinking and learning achievement in geometry. That is, the higher the student's geometric thinking level, the higher learning achievement student geometry. Learning achievement can be influenced by many things. Likewise with the ability to think geometry. Mason (2009) states that geometric thinking skills are more related to experience than age or maturation. Some experiences can facilitate (or hinder) progress in a level or to a higher level. Therefore, one aspect that needs to be focused on methods and lesson plans in the classroom.

Van Hiele geometric thinking level consists of five levels, namely (1) level 0 or *visualization,* (2) level 1 or *analysis*, (3) level 2 or *ordering (informal deductive)*, (4) level 3 or *deduction (formal deductive*), and (5) grade 4 or *rigor*. Van Hiele suggested (in *Usiskin*, 1982) the properties of the five levels of geometric thinking, namely: (1) *fixed sequence*: students cannot reach a level n without passing through level n-1, (2) *adjacency* : at every level of thinking what was intrinsic in the previous level becomes extrinsic in the current level, (3) *distinction:* each level has its own linguistic symbols and its own network of relationships connecting their symbols, (4) *separation:* two students reasoning at different levels unable to understand each other, and (5) *attainment*: the learning process that leads to complete understanding at a higher level has five stages: *inquiry, directed orientation, explanation*, *free orientation*, and *integration* . The results of the research by Kurniawati and Junaedi (2015) show that the characteristics of geometric thinking in the Van Hiele phase of learning are: (1) level 1 subjects can define, group transformation types based on pictures, but not yet recognize traits, (2) level 2 subjects can define, classify the types of transformations, and mention the properties its nature. (3) subject level 3 could define, classify types of transformations from images, call properties and relate to other types.

One of the factors that influence students' mathematics learning is *Intelligence Quotient*, also known as *IQ.* According to Rusefendi (2006). *Intelligence* is the most important psychological factor in the student learning process because it determines the quality of student learning. There are ten factors that influence students in learning mathematics, namely: student intelligence, student learning readiness, students' talents, students' willingness to learn, student interests, ways of presenting material, teacher's personality and attitude, teaching atmosphere, teacher competence and the condition of the wider community. Anastasi (1997) states that intellectual ability can be measured by a test tool commonly called *IQ (Intellegence Quotient)*. *IQ* is an expression of the level of individual ability at a given time, in relation to existing age norms. Eysenck (1981) states that there are various kinds of intelligence measurements and each *IQ test* used will be tailored to the goals and needs of using the *IQ test.* Experts divide *IQ levels* vary, one of which is the *IQ* category based on Stanford-Binary which has been revised by Terman and Merill (Suparlan, 2013), the *IQ* categories can be seen in the following table:

Table 1. The distribution of *IQ* according to the Stanford revision.

IQ Score	Category
140-169	Very superior
120-139	Superior
110-119	Average height
90-109	Average
80-89	Low average
70-79	*Borderline defect*
20-69	Mentally weak

By category *IQ* according to Stanford-Binary, then the *IQ category* in this study uses that category.

Learning by teachers needs to be adapted to the chosen learning model, one of which is *collaborative problem solving* (CPS), The application of *CPS* makes it possible for each group member to play a role and communicate actively in expressing their perspective to solve existing problems. *The Program for International*

Student Assessment (PISA 2015) explains that *Collaborative Problem Solving (CPS)* is an important and necessary skill in all educational settings and in the world of work. In CPS, each member shares their understanding and knowledge which is then combined with opinions that can reach a solution to the problem solving to the maximum and benefit each member. The activity encourages students to be able to develop their geometric thinking skills.

CPS learning can be combined with *schoology*. *Schoology* is a free web-based educational application such as social media that allows teachers and students to create, manage, and interact with each other and share academic content without time limits (Latifah & Utami, 2019). *Schoology* offers cross-school networking, which allows schools to collaborate by sharing data, groups, and class discussions (Choirudin, 2017).

Indrawati, Wardono, and Junaedi (2022) stated that the teacher's activity in learning mathematics assisted by *schoology* had an average result for each meeting and a final average in the very good category and could seek to explore students' mathematical abilities.

In March 2020 Learning at SMP Negeri 3 Temanggung was carried out online due to the Covid-19 pandemic (SE Sesmendikbud). Learning is carried out virtually using *e-learning.*

Efforts to facilitate students' geometric thinking skills can be done by learning CPS with the help *of* schoology. This geometric thinking ability needs to be described according to the student's *IQ,* whether the value of geometric thinking ability obtained is truly a representation of their *IQ* or not.

The purpose of this study was to find patterns of students' geometric thinking ability in terms of *IQ in* CPS learning with the help of schoology.

METHOD

The research was carried out with qualitative methods. The research subjects were 31 students of class VII SMP Negeri 3 Temanggung for the academic year 2020/2021. Research data were collected by questionnaires, tests, documentation, interviews, and observations. The students' intelligence quotient data was obtained through an IQ test, while the students' geometric thinking ability data was obtained through a written test. Data analysis was carried out by data reduction, data display, triangulation, data interpretation, and data conclusions. Meanwhile, the data validity test includes the credibility test, the transferability test, the dependency test, and the test can be confirmed (Sugiyono, 2017). Credibility test is done by triangulation method and source triangulation, the transferability test was carried out by describing students' geometric thinking skills in CPS learning with the help of schoology in detail and systematically. Dependency test is carried out by taking student data according to the IQ category and level of geometric thinking they have, the test can be confirmed by linking research data with existing theories, confirming research results with experts or supervisors.

RESULTS AND DISCUSSIONS

To obtain a description of the pattern of students' geometric thinking ability in terms of *IQ,* the researchers determined 3 instruments consisting of an *IQ test questionnaire*, a geometric thinking ability test, and interviews. The *IQ* test questionnaire was compiled using *Google Forms* whose links were shared with students via the class *WhatsApp groups* to identify the students' *IQ categories.* The geometric thinking ability test in the form of a written description test is given to identify students' geometric thinking skills according to the geometric thinking skill indicators. Interviews were conducted in private between the researcher and the research subjects via the *WhatsApp message service* to ensure the identification of the student's *IQ category* with the student's geometric thinking ability.

IQ test questionnaire is in accordance with the conceptual IST test (*Intelligenz Structure Test*), which consists of 9 sub-tests totaling 176 items, each sub-test has a different time limit and is administered manually (Polhaupessy, in Amthauer, 1955). There are nine subtests in the IST, namely: (1) SE *(Satzerganzng)* measures decision formation, meaning of reality, and independent thinking, (2) WA (*Wortausuahl*) measures language skills, feelings of empathy, inductive thinking, and understanding language understanding, (3) AN (*Analogien*) measures the ability of flexibility in thinking, combines, detects and transfers relationships as well as clarity and consequences in thinking, (4) GE

(*Gmeinsamkeiten*) measures verbal abstraction, the ability to state, form understanding, find the core of the problem and think logically in form of language, (5) RA (*Rechen Aufgaben*) measures practical ability in counting and draws conclusions, (6) ZR *(Zahlen Reihen)* measures theoretical thinking by counting, inductive thinking with numbers, and agility in thinking, (7) FA (*Form Ausuahl)* measures the ability to imagine, construct, and think comprehensively in concrete, (8) WU *(Wurfal Aufgaben*) measures the visual power of space., three-dimensional ability, analysis, and technical constructive ability, (9) ME (*Brand Aufgaben*) measures memory and concentration.

IQ test link for each subtest is shared through the class *WhatsApp group* with a time limit for filling out, each subtest running the link can only be clicked open 1 time and time runs backwards. Of the total 31 students, 28 filled out the questionnaire before the deadline, 2 filled out the questionnaire at the deadline, and 1 filled in after the deadline.

After obtaining the students' *IQ scores*, they are presented in the following table.

Table 2. Category IQ scores of subjects

No	Category IQ	Number of Subjects
1	High average IQ	1
2	Average IQ	9
3	Low average IQ	16
4	IQ *borderline defect*	5

From Table 2, it was found that subjects with a low average *IQ* category of 16 students dominated the research locus. Meanwhile, there are still 5 students who have *a borderline defect IQ category.*

Furthermore, all subjects are given CPS assisted learning model *schoology.* After learning the subject given a geometric thinking ability test (TKBG). At the time of learning the subject is also observed to get patterns of answers that show the ability to think geometry.

Here are presented categories of stages/ levels of geometric thinking.

Tab el 3. Geometric Thinking Stages

No	Stages/Levels	Number of Subjects
1	Haven't reached *visualization yet*	5
2	V*isualization*	5
3	*Analysis*	18
4	*Informal deductive*	3

Based on Table 3, it is known that there are 5 students with geometric thinking skills have not yet reached the visualization level*, an analysis,* and *informal deductive.* Based on the data, it shows that the level of geometric thinking ability of grade VII students at the research locus still reaches the *informal deductive* level. This is indicated by the properties of Van Hiele's level of thinking (in Usiskin, 1982), namely *distinction*, the subject at the *analysis level* does not conceptualize that a flat shape may have more than one name, a square can also be called a rectangle, but not vice versa, the subject level of *analysis* does not understand that this kind of thing can happen. Ideas and accompanying language are only understood by subjects who are at level 2 or *informal deductive.*

The pattern of students' geometric thinking ability is described based on the achievement of geometry skill indicators. The geometric thinking indicators used are (1) visual skills; (2) verbal skills; (3) drawing skills; (4) logic skills; (5) applied skills (Fuys *et al*, 1988). Description of geometric thinking level students in terms of student *IQ* as follows.

Students with a high average *IQ category*

high average *IQ* category have geometric abilities, namely at level 2 (*informal deductive*). The geometric thinking ability pattern of students with a high average *IQ* at the *deductive informal* geometric thinking level are able to master visual, verbal, drawing, applied skills, and quite master logic. In responding to questions students can answer clearly and creatively. Students with a high average *IQ* tend to have good performance characteristics in completing academic tasks.

The thinking patterns of students with a high average *IQ* in thinking are as follows, according to the nature of the fixed sequence geometric thinking level students can pass the *visualization level*, namely students identify flat shapes, name shapes, compare, and

operate geometric shapes. Then students can pass level 1 (*analysis)*, where students analyze flat shapes based on their components and the relationship between components and discover the nature or rules of a set of shapes empirically. The subject stops at level 2 *(informal deduction)*, that is, students are logically quite able to relate the properties of plane figures found previously by providing informal arguments, but students experience a deadlock not seeing the need for basic definitions and assumptions for the relationship between flat shapes, in terms of this is not yet deductively perfect.

average *IQ* category

Students who have an average *IQ* category of 9 subjects have different levels of thinking ability. From the data found two students with geometric thinking level at level 2 (*informal deductive*) and seven students at level 1 *(analysis).* 2 Students with an average *IQ at the level of informal deductive* geometric thinking can master visual, verbal, and drawing and quite master logic and applied. Meanwhile, seven students with an average IQ are at level 1 *(analysis).* According to the nature of Van Hiele's geometric thinking, namely *distinction*, this is indicated by the subject at the *analysis stage* being able to analyze flat shapes based on components and relationships between components and discovering the nature of the set of flat shapes empirically but experiencing a deadlock when solving problems with using known properties, has not led to an understanding of the subject's answers.

low average *IQ* category

low average *IQ* category have 16 subjects with 2 levels of geometric thinking ability, namely level 1 (*analysis*) and level 0 *(visualization).* This is shown according to the nature of Van Hiele's geometric thinking, namely *Adjacency*, namely at the level of *visualization,* for example, students are only able to determine the properties of shapes but have not been able to analyze them.

The geometric thinking ability in the category of low *IQ* average is at level 1 (*analysis*), which is 11 subjects. The following is a description of the ability to think geometry, students master visual and verbal skills, quite mastered drawing and applied, but lack of mastery of logic. Subjects experience a deadlock when using strategies to solve problems on the questions.

5 subjects with a low average *IQ* who have geometric abilities at level 0 (*visualization*) this is shown by a picture of one of the answers of the subject S-1.

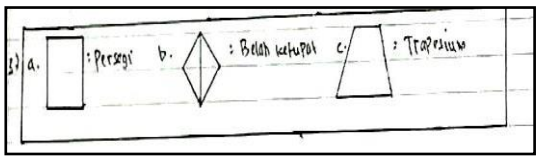

Figure 1. Subject's answer S-1

The subject is only able to name one shape for each character point, even though in the properties each question point can be used for the nature of more than one shape, so that S-1 is less able to express the relationship of flat shapes. S-1 is not able to recognize the differences and similarities of flat shapes, it is proven that they only describe one shape at each point of nature and have not been able to classify shapes that have several characteristics mentioned in the problem. So that five students with *visualization level* stopped at the analyzing stage, in accordance with Van Hiele's nature of thinking, namely *fixed sequence*, that students cannot reach a level n without passing through level n-1.

Students with IQ category borderline defect

There are 5 subjects who have *a borderline defect IQ* category with the level of geometric thinking ability, has not yet reached the stage of *visualization.* This is indicated by a picture of one of the answers to the subject S-24.

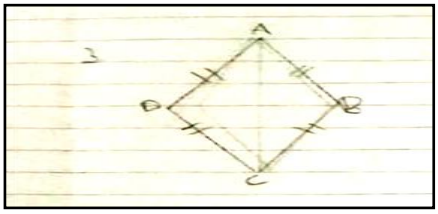

Figure 2. Subject's answer S-24

In the same problem with subject S-1, subject S-24 only mentions 1 flat shape without naming the shape. S-24 is not perfect in classifying flat shapes according to their nature, there are three question points on the question, and students only mention one shape. In verbal skills, the subject is also less able to show shapes, because it is not clear which rhombus shape is a matter of which points, so students are less able to express the properties of flat shapes. So that 5

subjects with *IQ borderline defects* have not yet reached the level of *visualization*, in accordance with Van Hiele's nature of thinking, namely *fixed sequence*, that students cannot reach a level n without passing through level n-1.

Based on data analysis, it was found that geometric thinking skills in the same *IQ category* have varying levels of geometric thinking abilities. It was found that subjects with an average *IQ and* geometric thinking ability with the same level but having geometric thinking ability patterns were not necessarily the same.

CONCLUSION

The results showed that the pattern of geometric thinking ability of seventh grade students of SMP Negeri 3 Temanggung in terms *of IQ in CPS* learning assisted by *schoology* had varied patterns. We found a slice of geometric thinking ability pattern, especially for the average and low average IQ, with level pattern *informal deduction* and rate *analysis*, some are the same, some are different.

The wedge pattern occurs because of the impact of CPS learning. Subjects with *IQ* high average and average have slices of drawing, applied, and quite mastery of logic. Meanwhile, *IQ* subjects with borderline defects in geometric thinking ability patterns do not have slices in visual and verbal, drawing and applied and lack of mastery of logic.

REFERENCES

Amthauer, R. (1955), "Intelligenz structur test: Handanweisung fiir die durchfiihrung ung auswertung. 4., unveranderte auflge". *Gottigen : verlag fur psychologie*.

Anastasi, A, dan Urbina, S. (1997). *Tes Psikologi (Psychological Testing).* PT. Prehanllindo, Jakarta. cc. p. 14.

Choirudin. (2017). "Efektivitas Pembelajaran Berbasis Schoology". *NUMERICAL: Jurnal Matematika dan Pendidikan Matematika*, 1(2), 52-62.

Eysenck, H.J dan Kamin L. (1981). *Intelligence: The Batle For The Mind. Pan Book*. London dan Sydney.

Fuys, D., D. Geddes. & R. Tischler. (1988). "The Van Hiele Model Of Thinking in Geometry Among Adolescents". *Monograph* Number 3. Reston: NCTM.

Idrawati, F.A, Wardono & Junaedi, I. (2022). "Mathematics Literacy Ability in Terms Of Self Efficacy in Cooperative Learning Type of Group Investigation Model With Humanism Approach Assisted by Schoology". *Unnes Journal of Mathematics Education Research*. 1 (1), 83-9

Kurniawati,M., Junaedi, I., & Mariani, S. (2015). "Analisis Karakteristik Berpikir Geometri Dan Kemandirian Belajar Dalam Pembelajaran Fase Van Hiele Berbantuan Geometers Sketchpad". Unnes Journal of Mathematics Education Research. 4(2).

Latifah, S., & Utami, A. (2019). "Pengembangan Bahan Ajar Interaktif Berbasis Media Social Schoology". *Indonesian Journal of Science and Mathematics Education*, 2(1), 36-45.

Mason, M. (2009). "The Van Hiele Levels of Geometric Understanding". *Virginia: University of Virginia*.

PISA. (2015). "*Draft Collaborative Problem Solving Framework*", hlm. 3

Ruseffendi, E.T. (2006). *Pengantar kepada Membantu Guru Mengembangkan Kompetensiya dalam Pengajaran Matematika untuk Meningkatkan CBSA*. Bandung: TARSITO.

Sugiyono. (2017). *Metode Penelitian Pendidikan: Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.

Suparlan, A. (2013). "*Eksperimentasi Pembelajaran Kooperatif Tipe Numbered Heads Together(NHT) dan Tipe Two Stay Two Stray(TSTS) pada Pembelajaran Matematika Ditinjau dari Intelligence Quotient Siswa Kelas VII SMP di Kabuaten Purworejo Tahun Pelajaran 2011/2012".* Tesis. Solo: Universitas Sebelas Maret.

Surat Edaran Menteri Pendidikan dan Kebudayaan Nomor 15 Tahun 2020 tentang Pedoman Penyelenggaraan Belajar dari Rumah dalam Masa Darurat Penyebaran Corona Virus Disease (Covid-19).

Tieng, P. G., & Eu, L. K. (2014). "Improving Students' Van Hiele Level of geometric Thinking Using Geometer's Sketchpad". *The Malaysian Online Journal of Educational Technology* Vol. 2 Issue 3, 20-31.

Usiskin, Z. (1982). *Van Hiele Levels And Achievement In Secondary School Geometry*. Chicago: The University of Chicago.z

Yazdani, M. (2007). "Correlation between Students' level of Understanding Geometry According to the Van Hieles' Model and Students' Achievement in Plane Geometry". *Journal of Mathematical Sciences & Mathematics Education*, 1(5): 40-45.