

Dominant Factor were Caused Eight Grade Students Errors in Solving on Cartesian Coordinate Multistep Routine and Non-Routine Modification Story Problems

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ABSTRACT

Article History:

Received : 19-01-2022

Revised : 22-03-2022

Accepted : 25-03-2022

Online : 12-04-2022

Keywords:

Causes;

Students Errors;

Cartesian Coordinate;

Multistep Routine Non;

Routine Modification;

Story Problems;



Giving a high level modification story problems with multistep routine and non-routine problems in cartesian coordinate learning is an effort to achieve optimal learning and also important because it has good effect for students. Less than optimal learning of cartesian coordinates for eight grade it was usually represented by the frequent of student errors occurrence on an ongoing basis in solving on mathematical problems in assignments and daily tests. This research purpose was to reveal the dominant factor were caused eighth grade student errors in solving on cartesian coordinate multistep routine and non-routine modification story problems. This research is a descriptive qualitative in type. Research data collection based on survey, interview, test and documentation. The research subjects in this research were eight grade students of junior high school. In this research 18 students of eight grade students of junior high school as the research sample. The sampling technique it was used in this research is purposive sampling. The results of this research indicate the dominant factor were caused eighth grade student errors in solving on cartesian coordinate multistep routine and non-routine modification story problems is students difficulties. Students difficulties such as compiling steps to solve problems in the form of multistep story problems, understanding the position conception of starting point with a certain point, understanding the conception of a perpendicular lines and a parallel lines to the X and Y axis, determining the distance of a point to certain point. The implication of this research is can obtain information about the dominant factor were caused student errors in solving on cartesian coordinate multistep routine and non-routine modification story problems as the relation to the current idealization of mathematics learning optimization and can be able for planing another appropriate and solution steps for the implementation of mathematics learning in an effort to minimize student errors.



<https://doi.org/10.31764/jtam.v6i2.7313>



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A. INTRODUCTION

Educational activities as said by John Dewey are important because these lead to the development of artistic skills in any form, specialized scientific abilities, effective citizen and professional occupation (Abramovich et al., 2019). So it should be, the development of education in every path, type and level of education became the main orientation and in this case is very much needed to optimize the educational quality. Education is a conscious effort that allows students to develop their potential optimally through the learning process. In

implementation of learning, the first consideration that needs to be considered is what the obstacles in learning. So in this case the construction of superior human resources like students as the next generation who can compete globally is an absolute demand that cannot be avoided in education. Meanwhile entering the era of the 21st century, quality of Indonesian human resources is still not competitive. Indonesia's human resources are ranked 111th out of 189 countries in the latest 2019 report (Pramana et al., 2021).

Mathematics is one of many educational programs that can build or reinforce critically and logically to repair problem-solving creativity and investigation skills (Cresswell & Speelman, 2020). Mathematics in Indonesia is used as a compulsory subject to be studied beginning to the basic education level to the higher education level. However in the real context, until now most of perspectives of Indonesian students still view mathematics is difficult and confusing subject because like the abstraction and so many formulas were confusing, so Indonesian students still not interested to learning more deeply. In line with that like what expressed by Cooney and Cotton, some students view mathematics is fascinating while others view it tedious (Vionita & Purboningsih, 2017). Most of the students are bored because they viewed its difficult. Then there was unfavorable perception of mathematics among the students who view it as a difficult lesson which resulted in anxiety during mathematics learning as well as at the test (Amalia & Surya, 2017). As a result of these perception, the majority of students then stop to learn mathematics (Li & Schoenfeld, 2019). According to Stafford-Brizard, students must have a positive mindset in order to be productive citizens (Darling-Hammond et al., 2020). In connection with that matter, in fact until now Indonesian students conditions are still reluctant to really study mathematics as indicated by this perspective and also because they are reluctant to practice solved on other math problems that have been developed by the teachers. Basicly even though by often practicing trying to solved on such other problems it will increase absorption and problem solving abilities related to the learning material it was being studied. This matter then causes the mathematical ability Indonesian students are not develop, so its caused the indication difficulties in learning mathematics and the low mathematical ability Indonesian students were it has evidenced by the facts below.

There are several survey which represents the problem of low mathematical ability Indonesian students like the results from PISA in 2015, Indonesia achieved in 63rd place out of 72 countries with 386 average score in mathematics while the international average score 490 (Elmiwati et al., 2020). Then the results from the last PISA in 2018 explained that Indonesia was ranked 73rd out of 79 countries in the mathematics category (Pramana et al., 2021). Change and relationship, space and shape, quantity, uncertainly and data are the contents of mathematics problems it was tested by PISA (Hasibuan et al., 2019). One of four mathematics materials or math problems it was tested by PISA namely space and shape, one of which is related to the cartesian coordinate problem. The weak ability Indonesian students to solve routine and non-routine problems on high level became a factor that contributed the low achievement Indonesian students in PISA (Elmiwati et al., 2020). Then the results of other recent survey such as from TIMSS in 2015 showed that Indonesia's average score and ranking in the mathematics category was still very far from the international average score and was still in the backward rank. The international average score was 500 while Indonesia only

reached on 397 (Firdausy et al., 2021). In the TIMSS version, Indonesia was ranked 44th out of 49 countries in the mathematics category (Firdausy et al., 2021).

One of the most significant disciplines is mathematics, like in daily life and even most human activities are dependent on it (Ankita & Richa, 2017). Mathematics it was purposed to provide students with mathematics literacy ability to use it and apply mathematical knowledge in real life contexts which has been related to the relevance of mathematics teaching in schools (Sumirattana et al., 2017). So therefore the efforts to improve quality of Indonesia's mathematics education in all lines, types and levels of education as well as at the elementary education level in junior high schools needs to be given more attention. Given the importance of mathematics for the next generation in dealing problems, the challenges of dynamics life, the development and the progress of science technology and global competition. Among the essential aims of learning mathematics is to develop and improve students mathematical abilities. But in reality, obstacles such as learning difficulties in learning mathematics are still became a context that needs to be considered along with need of independent efforts and deepening of learning from students so that the knowledge or mathematical concepts (basic and advanced) can be optimally constructed in students mindset. Learning difficulties as a situation in the learning process that is marked by certain constraints that impede attainment of learning goals (Anggadewi, 2017). There are two factors that might influence the success or failure of a students learning activities in learning process : internal factors which originate from within student it self and external factors which come from outside the student (Rohmaniyah et al., 2020). Students lowly mathematical abilities is caused by the students weaknesses then its caused errors in learning mathematics as well as in solving on math problems. These weaknesses include difficulty in mastering prerequisite knowledge by not understanding and recognizing the basic concepts, not being careful and not careful in listening to the problems, not being able to reflect back on answers that have been obtained and difficulty in logical reasoning.

Learning is an activity carried out to create a state (process) of learning, therefore it must be properly understood how students get knowledge from their learning activities. In the mathematics education context, this requires its not just application of mathematical knowledge but also the integration of mathematics into a meaningful context for students (Polman et al., 2021). The relevance of the implementation meaningful mathematics learning activities is like doing application of emphasis on solving mathematical problems or development a high level mathematical problems. Examples such as application development of multistep routine and non-routine modification story problems. However in reality this practice is not always successful due to learning errors of students, especially with the condition Indonesian students who are reluctant to actually learn mathematics and are also reluctant to practice solved on other math problems that have been developed by the teacher. Associated with that context will certainly greatly affect and hinder the achievement of optimization mathematics learning as demanded by competency standards in the curriculum. But of course for the sake of achieving the optimization learning it is not enough just reach the curriculum competency standards. If the direction and the purpose to achieve learning optimization are of course more or not just achieving curriculum competency standards. As with the application of developing a high level mathematical problems such as multistep

routine and non-routine modification story problems in learning it is an effort to achieve optimal learning. So mastery of each content material as well as in the sub-chapters mathematics learning materials including the competence in solving on problems or questions by students is an absolute demand that cannot be avoided and it is also very important.

Based on researcher surveys and interviews that researcher conducted with the mathematics teacher of eighth grade on junior high school namely SMPN 4 Wonosobo was founded the information that it was still very common to find the same errors were continuously by eighth grade students on an ongoing basis in terms solving on math problems like on modification development high level mathematical problems as well as in one of the sub-chapters of mathematics learning materials on geometry content namely cartesian coordinates. These errors were found by the teacher after correcting students work on assignments and daily tests. The teacher also said the effort with develop high level mathematical problems had actually been done by developing high level modification mathematical problems as an accommodation step for students to understanding in order to achieve the best optimization and the other as an effort to improve quality of learning so to achieve optimal learning. The high level modification mathematical problems were developed by the teacher are usually constructed in the form of multistep routine and non-routine modification story problems and were applied to several occasions such as on assignments and daily tests. However during implementation, the teacher said that there were still got a problem, namely that the same student errors were still very often encountered on an ongoing basis. Teacher also said indication the causes because there are most of student still had a perception that think mathematics is difficult so most of students being lazy to practice solved on other math problems that have been developed or it was given then students errors occur. Referring to the statements it was conveyed by the teacher such as the case still very common to find the same errors were continuously on an ongoing basis and conveyed the possible causes such as most of student still had a perception that think mathematics is difficult so most of students being lazy to practice solved on other math problems that have been developed or it was given, this is indicates that the teacher not yet doing a research related to the problem it was hapens or try to known why its all hapens in-depth. So that, a urgency for doing a research were very important because for the context of solving on high level multistep math story problems there are usually a lot of factors was inhibitting so we need to observe them in order to achieve optimization mathematics learning. With doing a research to known why its all hapens, we can know and can obtain information about the dominant factor were caused student errors as the relation to the current idealization of mathematics learning optimization and can be able for planing another appropriate and solution steps for the implementation of mathematics learning in an effort to minimize student errors. Based on this, then the researcher are interested to conducting more in-depth research related to that context. So in this research, based on the descriptions it was presented what are the dominant factor were caused eighth grade students errors in solving on cartesian coordinate multistep routine and non-routine modification story problems. To answer this context in this research will be carried out regarding the dominant factor were caused eighth grade students errors in solving on cartesian coordinate multistep routine and

non-routine modification story problems. Then the hoped by doing this research it can contribute to providing information related to context the dominant factor were caused eighth grade students errors in solving on cartesian coordinate multistep routine and non-routine modification story problems because basically the causative factors can come from student internal factors or student external factors. The distinction to the other previous research, in this research are focus on the context high level multistep routine and non-routine modification story problems which were in other previous researchs most its just discuss on simple math problems context related it at cartesian coordinates.

B. METHODS

This research type is descriptive qualitative. Descriptive it means to describes in depth. Inductive in nature and in general researchers explore the meaning and insights from given conditions, it is qualitative research (Mohajan, 2018). Qualitative researchers study at things in their natural conditions, attempting to understand or interpret the meaning of phenomena terms (Aspers & Corte, 2019). In this research the purpose is to reveal the dominant factor were caused eighth grade students errors in solving on cartesian coordinate multistep routine and non-routine modification story problems. This research was conducted at SMPN 4 Wonosobo (eighth grade of junior high school). In this research, the research participants were mathematics teachers of eighth grade SMPN 4 Wonosobo and eighth grade students SMPN 4 Wonosobo. Research data collection based on survey, interview, test and documentation. The research subjects in this research were eighth grade students of SMPN 4 Wonosobo. In this research 18 students of eighth grade students SMPN 4 Wonosobo as the research sample. The sampling technique it was used in this research is purposive sampling with the indicators: (1) The students has finish studied a mathematics material of cartesian coordinate, (2) The students it was choosen and determined its also from recommendation mathematics teachers of eighth grade SMPN 4 Wonosobo that was the students still make the same errors and continuesly when solve multistep routine and non-routine modification story problem on a high level related the cartesian coordinate which is known through the teacher corrections on an result of student work in a assignments as well as a daily tests of cartesian coordinates its made by the teacher in the form of multistep routine and non-routine modification story problem on a high level then the students are still more confused that is from the teacher observations during the implementation of learning and still often make errors when given a aplication problems its were modification, (3) The students its who have still not achieved at the school KKM score of 75 on the daily test cartesian coordinate, (4) The students it was choosen and determined its are the students who have or provide the necessary that needed and appropriate information for the research purposes and are considered as the best to be sampled by looking at the results of the students work on the written test (diagnostic test) it was tested by the researcher. The researcher given the test to eighth grade students SMPN 4 Wonosobo. The cartesian coordinate test problems (diagnostic written test problems) of the researcher are consisting 5 problems (multistep routine and non-routine modification story problems), its all can be seen in Figure 1 for english language version, as shown in Figure 1.

1. In the map, the Wonosobo City is mapped in Cartesian Coordinates. Wonosobo Square is located at $(0,0)$, Great Mosque of Jami' is located at $(-2,-1)$, KRT Hospital Setjonegoro is located at $(-7,-4)$, Resort Police is located at $(-5,-9)$, Sapen Gas Station is located at $(-4,-15)$ and SMPN 4 Wonosobo is located at $(9,-17)$. Draw the points in Cartesian Coordinates and determine: a.) The distance of Sapen Gas Station to the X axis b.) The distance of KRT Hospital Setjonegoro to the Y axis c.) The position of Great Mosque of Jami' towards Resort Police d.) The position of Sapen Gas Station to KRT Hospital Setjonegoro e.) The position of Wonosobo Square to Resort Police f.) The position of Wonosobo Square to Sapen Gas Station g.) The distance between SMPN 4 Wonosobo and Wonosobo Square
2. The village is mapped in Cartesian Coordinates, the School is located at $(0,0)$. The Kamling Post is located 8 units to the left and 1 unit down. Hendri's House is located 5 units to the left and 5 units down. Aldi's House is located 2 units to the left and 7 units down. Shely's House is located 6 units to the left and 3 units down. Based on this: a.) Draw the Cartesian Coordinates and determine coordinates of the Kamling Post, Hendri's House, Aldi's House and Shely's House ! b.) Determine position of the Kamling Post to Aldi's House ! c.) Determine the position of Shely's House against Hendri's House ! d.) What is the distance between Hendri's House and the School ?
3. The Regional Head plans to use the vacant land in his area to build two sports fields, namely a volleyball field and a futsal field. Then the Regional Head summoned the fields designer to describe the layout of the two fields. Designers describe it in the Cartesian Coordinate plane. If the designer draws at $(0,0)$ then the corner points of the volleyball field $(-1,3)$, $(1,3)$, $(1,6)$ and $(-1,6)$ while the corner points of the futsal field $(-1,1)$, $(-1,-2)$, $(-5,-2)$ and $(-5,1)$. Draw the points in Cartesian Coordinates and determine: a.) Sides of the field are parallel to the X axis b.) Sides of the field are parallel to the Y axis c.) Sides of the field are perpendicular to the X axis d.) Sides of the field are perpendicular to the Y axis e.) The closest distance between a volleyball field and a futsal field
4. The position of the sub-districts within the district with a cardinal directions is mapped in Cartesian Coordinates. District A is located in the east with a distance of 3 km from the district center, District B is located in the north with a distance of 3 km from the district center, District C is located in the west with a distance of 3 km from the district center and District D is located in the south with a distance of 6 km from the district center. If point O $(0,0)$ is the center of district, what shape is formed when the four points of District A, B, C and D it was connected ? Find the area then determine the distance between a points of District D and District C !
5. Mr. Irkham the owns of three plots of land which shape are Trapezoid, Square and Rectangle. He brought someone from the National Land Agency to draw a map of the land location. The location plan is depicted in Cartesian Coordinates. Suppose the point $(0,0)$ is the original position of drawing a National Land Agency, that drawer can clearly see the corner points of the land which shape is a Trapezoid at the points $(-1,3)$, $(3,3)$, $(2,5)$ and $(-1,5)$. However, the land with a Square shape can only be seen with three corner points at the points $(1,-1)$, $(3,-1)$ and $(3,1)$ because 1 other corner point is missing. Then the land that is Rectangular shape can only be seen clearly at the three corner points $(5,1)$, $(9,1)$ and $(5,3)$ because the other corner stake was covered by shrubs. Based on this, draw the points in Cartesian Coordinates and determine: a.) Coordinate of the missing corner points on Square soil b.) Coordinates of the other corner points it was covered by shrubs on Rectangular soil c.) The distance other missing corner points of Square soil and other corner points it was covered by shrubs on Rectangular soil d.) Sides of the soil are parallel to the X axis e.) Sides of the soil are perpendicular to the Y axis

Figure 1. Cartesian Coordinate Diagnostic Written Test Problems of the Researcher in English Language

Then the Indonesian language version of Cartesian coordinate test problems (diagnostic written test problems) of the researcher which it was consisting 5 problems (multistep routine and non-routine modification story problems) can be seen in Figure 2.

1. Dalam suatu peta, kota Wonosobo dipetakan kedalam Koordinat Kartesius. Alun-alun Wonosobo terletak pada Koordinat $(0,0)$, Masjid Agung Jami' terletak pada korrdinat $(-2,-1)$, RSUD KRT. Setjonegoro terletak pada koordinat $(-7,-4)$, Polres terletak pada koordinat $(-5,-9)$, SPBU Sapen terletak pada koordinat $(-4,-15)$ dan SMPN 4 Wonosobo terletak pada koordinat $(9,-17)$. Berdasarkan informasi tersebut, gambarlah titik-titiknya ke dalam Koordinat Kartesius kemudian tentukan: a.) Jarak SPBU Sapen terhadap sumbu-X b.) Jarak RSUD KRT. Setjonegoro terhadap sumbu-Y c.) Posisi Masjid Agung Jami' terhadap Polres d.) Posisi SPBU Sapen terhadap RSUD KRT. Setjonegoro e.) Posisi Alun-alun Wonosobo terhadap Polres f.) Posisi Alun-alun Wonosobo terhadap SPBU Sapen g.) Jarak titik SMPN Wonosobo dan Alun-alun Wonosobo
2. Dalam suatu Perkampungan yang dipetakan ke dalam Koordinat Kartesius, Sekolah terletak pada koordinat $(0,0)$. Pos Kamling terletak di 8 satuan ke kiri dan 1 satuan ke bawah. Rumah Hendri terletak di 5 satuan ke kiri dan 5 satuan ke bawah. Rumah Aldi terletak di 2 satuan ke kiri dan 7 satuan ke bawah. Rumah Shely terletak di 6 satuan ke kiri dan 3 satuan ke bawah. Berdasarkan informasi diatas: a.) Gambarlah Koordinat Kartesius dan tentukan koordinat Pos Kamling, Rumah Hendri, Rumah Aldi dan Rumah Shely ! b.) Tentukan posisi Pos Kamling terhadap Rumah Aldi ! c.) Tentukan posisi Rumah Shely terhadap Rumah Hendri ! d.) Jarak titik Rumah Hendri dan Sekolah ?
3. Seorang Ketua RW berencana memanfaatkan tanah kosong yang ada di wilayahnya untuk dibuat dua buah lapangan olahraga, yakni lapangan voli dan lapangan futsal. Kemudian Ketua RW tersebut memanggil ahli perancang lapangan untuk menggambarkan denah lokasi kedua lapangan. Ahli perancang menggambarannya ke dalam bidang Koordinat Kartesius. Apabila ahli perancang menggambar pada titik asal $(0,0)$ maka titik-titik sudut lapangan voli adalah $(-1,3)$, $(1,3)$, $(1,6)$ dan $(-1,6)$ sedangkan titik-titik sudut lapangan futsal adalah $(-1,1)$, $(-1,-2)$, $(-5,-2)$ dan $(-5,1)$. Gambarlah titik-titik tersebut ke dalam Koordinat Kartesius, kemudian tentukan: a.) Sisi-sisi lapangan yang sejajar sumbu-X b.) Sisi-sisi lapangan yang sejajar sumbu-Y c.) Sisi-sisi lapangan yang tegak lurus sumbu-X d.) Sisi-sisi lapangan yang tegak lurus sumbu-Y e.) Jarak terdekat antara lapangan voli dan lapangan futsal
4. Posisi kecamatan-kecamatan di suatu kabupaten berdasarkan arah mata angin dipetakan ke dalam Koordinat Kartesius. Kecamatan A terlatak pada arah timur dengan jarak 3 km dari pusat kabupaten, Kecamatan B terletak di arah utara dengan jarak 3 km dari pusat kabupaten, Kecamatan C terletak pada arah barat dengan jarak 3 km dari pusat kabupaten dan Kecamatan D terletak pada arah selatan dengan jarak 6 km dari pusat kabupaten. Jika titik $O(0,0)$ adalah pusat kabupaten, bangunn apakah yang terbentuk apabila keempat titik Kecamatan A, B, C dan D dihubungkan ? Carilah luasannya kemudian tentukan jarak titik Kecamatan D dan Kecamatan C !
5. Pak Irkham memiliki tiga bidang tanah berbentuk Trapesium, Persegi dan Persegi Panjang. Ia membawa seorang dari Badan Pertanahan Nasional untuk menggambar denah lokasi tanahnya. Denah lokasi tersebut digambarkan dalam Koordinat Kartesius. Misalkan titik asal $(0,0)$ adalah posisi menggambar seorang dari Badan Pertanahan Nasional, orang tersebut dapat melihat dengan jelas patok titik-titik sudut tanah yang berbentuk Trapesium yakni di titik $(-1,3)$, $(3,3)$, $(2,5)$ dan $(-1,5)$. Namun tanah yang berbentuk Persegi hanya dapat dilihat tiga patok titik-titik sudut saja yakni di titik $(1,-1)$, $(3,-1)$ dan $(3,1)$ karena 1 patok titik sudut lainnya hilang. Kemudian tanah yang berbentuk Persegi Panjang juga hanya dapat dilihat dengan jelas pada tiga patok titik-titik sudut saja yakni di titik $(5,1)$, $(9,1)$ dan $(5,3)$ karena 1 patok titik sudut lainnya tertutup semak belukar. Berdasarkan informasi tersebut, gambarlah titik-titik tersebut dalam Koordinat Kartesius dan tentukan: a.) Koordinat patok titik sudut lain yang hilang pada tanah yang berbentuk Persegi b.) Koordinat patok titik sudut lain yang tertutup semak belukar pada tanah yang berbentuk Persegi Panjang c.) Jarak patok titik sudut lain yang hilang pada tanah berbentuk Persegi dan patok titik sudut lain yang tertutup semak belukar pada tanah yang berbentuk Persegi Panjang d.) Sisi-sisi tanah yang sejajar sumbu-X e.) Sisi-sisi tanah yang tegak lurus sumbu-Y

Figure 2. Cartesian Coordinate Diagnostic Written Test Problems of the Researcher in Indonesian Language

So the problems from the researcher are various problems that were developed and modification as a written diagnostic test and the form is a high level multistep routine and non-routine story problems related the context of cartesian coordinates. The problems were developed and modification are contextual. Diagnostic testing is a method (that adopted) to locating and identifying student's learning difficulties or shortcomings in a subject as well as the causes (Esomonu & Eleje, 2020). About diagnostic tests, Skinner state that it designed to provide a pattern or specified examination of an individual's performance in a skills and abilities variety (Arora, 2015). Gagne state from executing mathematics problems there are three primary phases: converting verbal problem statements into mathematical expressions, conducting operations on expressions and verifying solutions (Umbara & Suryadi, 2019). Basically multistep story problems are a form of high level problems because multistep story problems have a relevance of characteristics as the characteristics of high level problems namely measuring the ability to transfered one concept to anothers, processing of information, applied of information, find links from different kinds of information, used information to

solved problems, examine ideas and information critically. The level of researchers problems (5 problems above) are at high level from C4-C6. It should be noted routine problems is the problems that can be solved by following procedures that have been studied. Meanwhile non-routine problems is the problems that have a character which requires more than just translating the problem or using a known procedures so in the sense non-routine problems requires problem solving by making an own solving methods. This test problems instrument (cartesian coordinate diagnostic written test problems) foregoing validated by the experts validator namely 3 Lecturers with 2 Mathematics Education Lecturers and 1 Mathematics Lecturer. Indicators for experts validator are: (1) Mastering the context of mathematics material and (2) Qualified in the context of construction and development research test instrument for mathematics education scope. This test problems instrument (cartesian coordinate diagnostic written test problems) can be used if it has been validated by an experts validator with proper to used and at least gets a "Good" score or equal to "4" for a minimum with a criteria (1 = "Not Good", 2 = "Not Enough Good", 3 = "Enough Good", 4 = "Good", 5 = "Very Good"). The results of validation from the experts validator concluded that the test problems instrument in general is was "Very Good" or equal to "5", declared fit for used and could be used to collect data. There is the result of validation by experts thats can be seen in Table 1.

Table 1. The Result of Validation Test Problems Instrument by Experts Validator

| Experts Validator Code | Validation Final Value | Total Final Validation Value divided by 3 | Criteria |
|------------------------|------------------------|---|-------------|
| V01 | 4 | $\frac{4+5+5}{3} = 4,67$ ≈ 5 (Value Approach) | "Very Good" |
| V02 | 5 | | |
| V03 | 5 | | |

The test problems instrument its said to be valid if $r_{xy} > r_{table}$. The test problems instrument of this research its all valid. There are the result an calculation validity the test problems instrument (cartesian coordinate diagnostic written test problems) of the researcher thats can be seen in Table 2.

Table 2. The Result Calculation Validity the Test Problems Instrument (Cartesian Coordinate Diagnostic Written Test Problems) of the Researcher

| Items/Problems | Validity (r_{xy}) | r_{table} | Criteria |
|----------------|-----------------------|-------------|----------|
| 1 | 0,850 | 0,468 | Valid |
| 2 | 0,720 | | Valid |
| 3 | 0,837 | | Valid |
| 4 | 0,884 | | Valid |
| 5 | 0,913 | | Valid |

Then the test problems instrument its said to be reliable if $r_{11} > r_{table}$. The result an calculation reliability the test problems instrument (cartesian coordinate diagnostic written test problems) of the researcher its obtained $r_{11} = 0,878$ with $\alpha = 5\%$, $N = 18$ and $r_{table} = 0,468$. Therefore $0,878 > 0,468$ or its means $r_{11} > r_{table}$, so the test problems instrument is reliable. Interviews were also conducted with the teachers and the students of eighth grade (eighth

grade of junior high school) SMPN 4 Wonosobo who became research participants. Interviews were conducted to gather informations. In this research also using (help) *Whatsapp*, this was done because the condition of school during Covid-19 pandemic doing learning from home. In this research researchers used Miles and Huberman's interactive data analysis model namely described the results of research data obtained by going through the stages data reduction, data presentation and verification or drawn conclusions. Data reduction entails summarizing, selecting the primary things, focusing on the primary important things, searching themes and patterns so the data obtained provides a clearer view and it makes so much easier for researchers to gather or find additional data if it necessary. Data presentation is a collection of structured information that provides the possibility for drawing conclusions and taking action, with the data presentation it will make it easier to understand what is happening and can plan for further action based on what has been understood. Then verification or drawn conclusions is a part of complete configuration activity so that it is able to answered the research question and the research purpose.

C. RESULT AND DISCUSSION

In this research researchers conducted a survey first to SMPN 4 Wonosobo as well as in eighth grade (eighth grade of junior high school). Then also conducted interviews with the mathematics teacher of eighth grade (eighth grade of junior high school) SMPN 4 Wonosobo. As description a problem which described in introduction there are the results of survey and interview with the teacher. There was served Figure 3 related to the cartesian coordinates assignment problem of the teacher, as shown in Figure 3.

- | The Problem in English Language | The Problem in Indonesian Language |
|---|---|
| <p>1. Mr. Farhan plans to use the vacant land in his area to build two sports fields, namely a futsal field and a volleyball field. Then Mr. Farhan summoned the drawer to describe the layout of the two fields. The drawer describe it in the Cartesian Coordinate plane. If the drawer draws at (0,0) then the corner points of the futsal field (-5,-1), (-1,-1), (-1,2) and (-5,2) while the corner points of the volleyball field (-1,4), (1,4), (1,7) and (-1,7). Draw the points in Cartesian Coordinates and determine: a.) Sides of the field are parallel to the X axis b.) Sides of the field are parallel to the Y axis c.) Sides of the field are perpendicular to the X axis d.) Sides of the field are perpendicular to the Y axis e.) The closest distance between a futsal field and a volleyball field</p> | <p>1. Pak Farhan berencana menggunakan lahan kosong di wilayahnya untuk membangun dua lapangan olahraga yaitu lapangan futsal dan lapangan voli. Kemudian Pak Farhan memanggil ahli gambar untuk menggambarkan tata letak kedua lapangan tersebut. Ahli gambar menggambarannya dalam bidang Koordinat Kartesius. Jika penggambar menggambar di (0,0) maka titik sudut lapangan futsal (-5,-1), (-1,-1), (-1,2) dan (-5,2) sedangkan titik sudut lapangan bola voli (-1,4), (1,4), (1,7) dan (-1,7). Gambarlah titik-titik dalam Koordinat Kartesius dan tentukan: a.) Sisi-sisi lapangan sejajar sumbu-X b.) Sisi-sisi lapangan sejajar sumbu-Y c.) Sisi-sisi lapangan tegak lurus sumbu-X d.) Sisi-sisi lapangan tegak lurus sumbu-Y e.) Jarak terdekat antara lapangan futsal dan lapangan voli</p> |

Figure 3. Cartesian Coordinates Assignment Problem of the Teacher

And there was served Figure 4 related to the errors occurrence in the results of student work on cartesian coordinates assignment of the teacher, as shown in Figure 4.

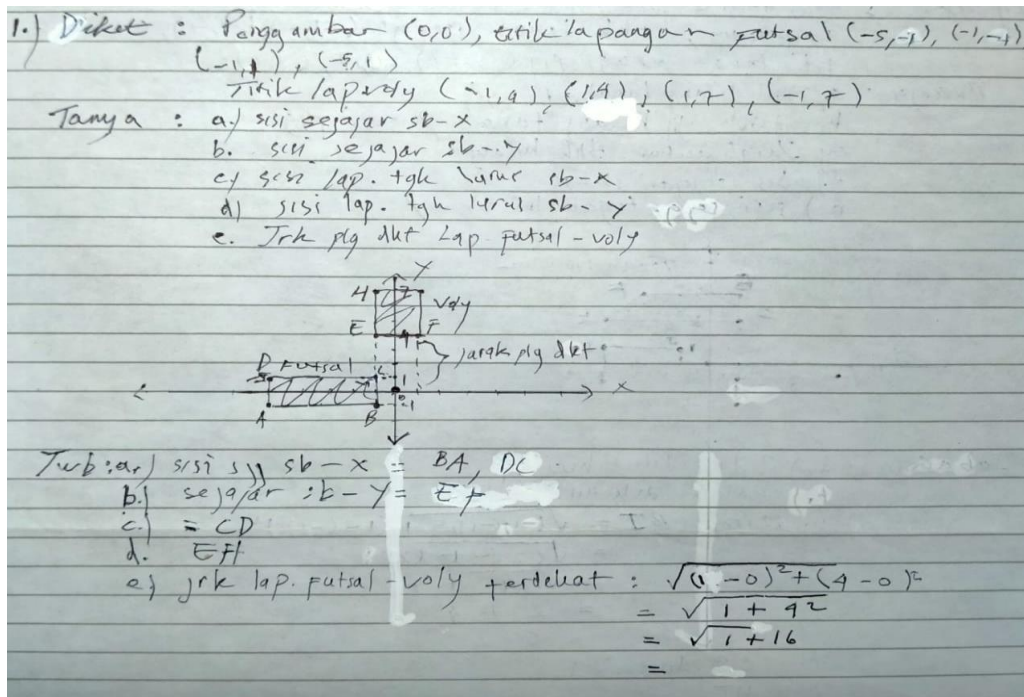


Figure 4. Errors Occurrence in the Results of Student Work on Cartesian Coordinates Assignment of the Teacher

Then, there was served Figure 5 related to the cartesian coordinates daily test problem of the teacher, as shown in Figure 5.

The Problem in English Language

- Mrs. Anggun the owns of three plots of land which shape are Trapezoid, Square and Rectangle. He brought someone to draw a map of the land location. The location plan is depicted in Cartesian Coordinates. Suppose the point (0,0) is the original position of drawing, that drawer can clearly see the corner points of the land which shape is a Trapezoid at the points (-1,3), (3,3), (2,5) and (-1,5). However, the land with a Square shape can only be seen with three corner points at the points (-1,-3), (-1,-1) and (-3,-1) because 1 other corner point is missing. Then the land that is Rectangular shape can only be seen clearly at the three corner points (4,-1), (4,1) and (1,1) because 1 other corner point is missing. Based on this, draw the points in Cartesian Coordinates and determine: a.) Coordinate of the missing corner points on Square soil b.) Coordinate of the missing corner points on Rectangular soil c.) The distance of missing corner points on Square soil and missing corner points on Rectangular soil d.) Sides of the soil are parallel to the X axis e.) Sides of the soil are perpendicular to the Y axis

The Problem in Indonesian Language

- Bu Anggun pemilik tiga bidang tanah berbentuk Trapesium, Persegi dan Persegi Panjang. Dia membawa seseorang untuk menggambar peta lokasi tanah. Lokasi digambarkan dalam Koordinat Kartesius. Misalkan titik (0,0) posisi awal penggambar, sehingga penggambar dapat melihat dengan jelas titik-titik sudut tanah yang berbentuk Trapesium di titik (-1,3), (3,3), (2, 5) dan (-1,5). Namun, tanah dengan bentuk Persegi hanya dapat dilihat tiga titik sudut saja yaitu (-1,-3), (-1,-1) dan (-3,-1) karena 1 titik sudut lainnya hilang. Kemudian tanah yang berbentuk Persegi Panjang hanya dapat terlihat jelas pada tiga titik sudut (4,-1), (4,1) dan (1,1) karena 1 titik sudut lainnya juga hilang. Gambarkan titik-titik dalam Koordinat Kartesius dan tentukan: a.) Koordinat titik sudut yang hilang pada tanah berbentuk Persegi b.) Koordinat titik sudut yang hilang pada tanah berbentuk Persegi Panjang c.) Jarak titik sudut yang hilang pada tanah berbentuk Persegi dan titik sudut yang hilang pada tanah berbentuk Persegi Panjang d.) Sisi-sisi tanah sejajar sumbu-X e.) Sisi-sisi tanah tegak lurus sumbu-Y

Figure 5. Cartesian Coordinates Daily Test Problem of the Teacher

And there was served Figure 6 related to the errors occurrence in the results of student work on cartesian coordinates daily test of the teacher, as shown in Figure 6.

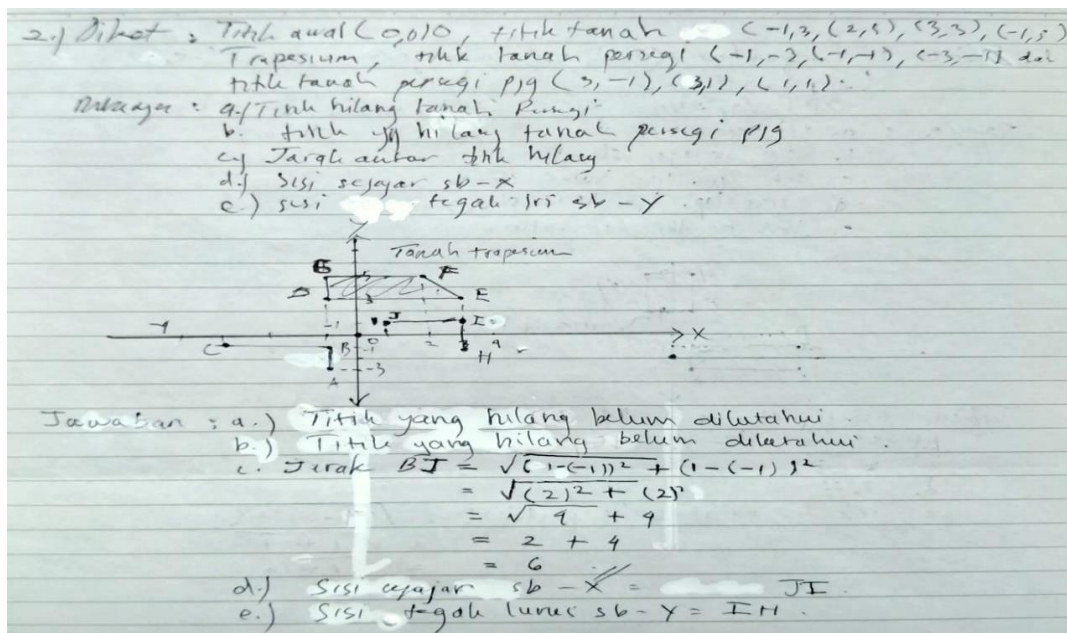


Figure 6. Errors Occurrence in the Results of Student Work on Cartesian Coordinates Daily Test of the Teacher

That figures is one of the documents it was documenting by the results of student work on assignment and daily test were researchers documented from teacher documents. From that figures it can be seen the student make errors in solving on cartesian coordinate multistep routine and non-routine modification story problems that were applied by the teacher. Based on the document documentation (Figure 4 and Figure 6) of student work it can be seen how the student make errors such as errors in determining the steps for solving problems, understanding the position conception of starting point with a certain point, understanding the conception of perpendicular lines and parallel lines to the X axis and Y axis and determine the distance from a point to certain point. From survey of this document documentation (Figure 4 and Figure 6) was also supported by interviews that researcher conducted with the mathematics teacher of eighth grade (eighth grade of junior high school) SMPN 4 Wonosobo. There are the results of interview with the teacher:

Researcher: "From the learning that has been going on so far such as on cartesian coordinate learning especially in the context of solving high level cartesian coordinate multistep routine and non-routine modification story problems that you usually applied, what do you think about the same and continuous student errors were frequently still found?"

Teacher : "Based on the corrections for assignments and daily tests of the cartesian coordinates which usually applied in the form of high level multistep routine and non-routine modification story problems the same and continuous student errors are determining the steps for solving problems, mis conceptions on understanding the position of starting point with a certain point, mis conceptions on understanding the lines were perpendicular and parallel to the X and Y axis and errors on determining the

distance of a point to certain point. In my opinion these errors occur its caused students are still having difficulties in thinking about the algorithm for solving problems, this matter are indication is caused they are reluctant to practice solved on other additional math problems it was given and like they are still think that mathematics is difficult so they are being lazy to try or practice intensely then that errors occur when they are got solve any problems”

Students difficulties are represented and can be known from the students errors that was occur or in the sense that student errors describe student difficulties. Reviewing the results of interview with the teachers that there are had correlation between the document documentation (Figure 4 and Figure 6) that researchers described previously and the results of teacher interview it was conducted. Looking at the document documentation (Figure 4 and Figure 6) and the results of interviews with the teachers a common thread it can be drawn that students are still having difficulties in determining the steps for solving problems, understanding the position conception of starting point with a certain point, understanding the conception of a perpendicular lines and parallel lines to the X axis and Y axis and determine the distance from a point to certain point. To review for further the researcher then conducted the test and also interviewed the eighth grade student (eighth grade of junior high school) SMPN 4 Wonosobo. There are the results cartesian coordinate diagnostic written test of the researcher that it was served through Figure 7 related the result of student work with errors occurrence in number 3, as shown in Figure 7.

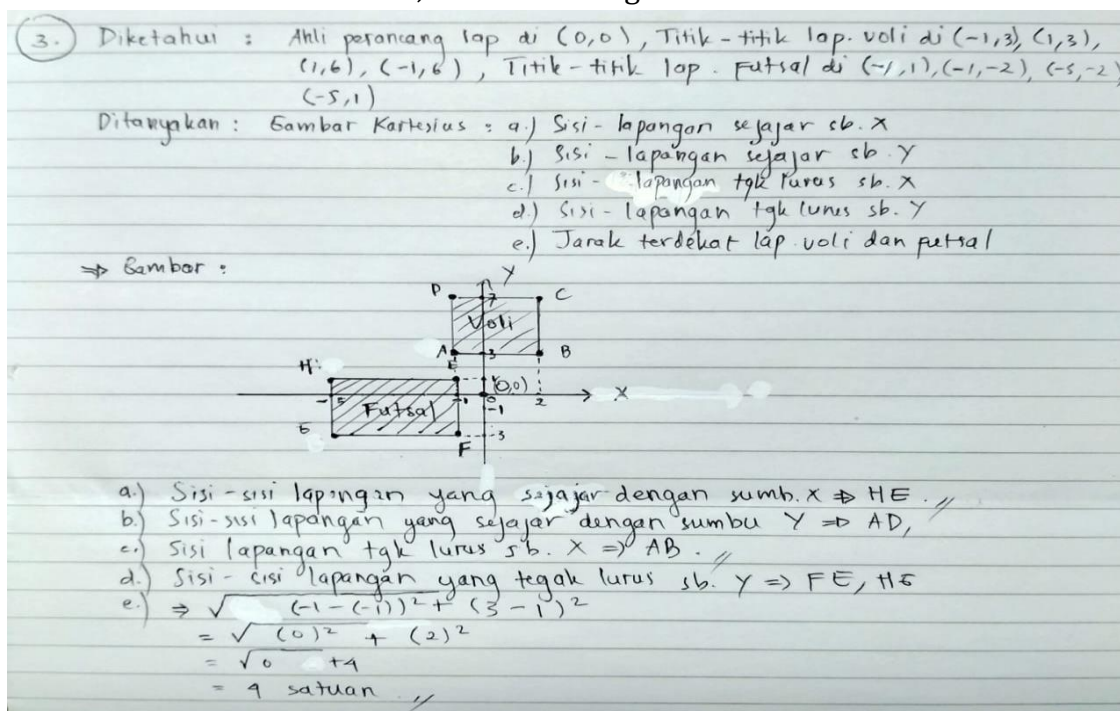


Figure 7. Errors Occurrence Number 3 in the Results of Student Work on Cartesian Coordinate Diagnostic Written Test of the Researcher

And there are the results cartesian coordinate diagnostic written test of the researcher that it was served through Figure 8 related the result of student work with errors occurrence in number 5, as shown in Figure 8.

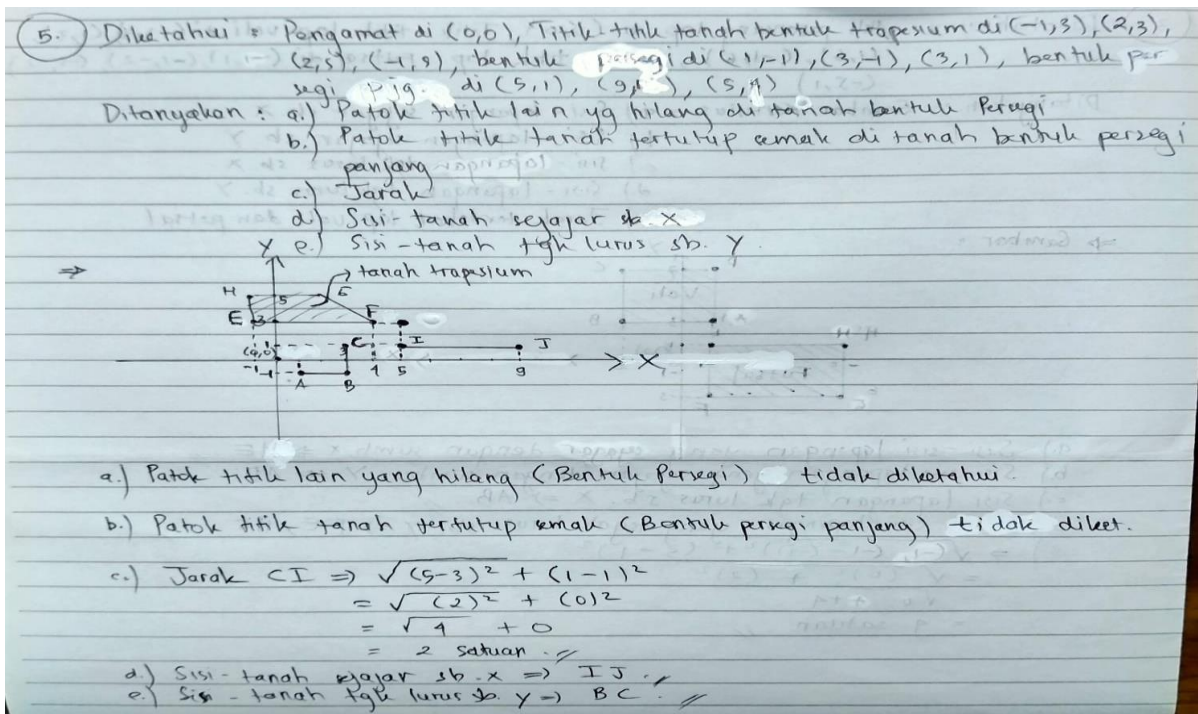


Figure 8. Errors Occurrence Number 5 in the Results of Student Work on Cartesian Coordinate Diagnostic Written Test of the Researcher

That figures is one of the documents it was documenting by the results of student work on the test it was conducted by researcher. That figures is an representation of students errors as is the case on other problems. In this case the researcher presents only these representation of errors because in other problems students errors are broadly the same so researcher takes that representation. Based on the document documentation (Figure 7 and Figure 8) of student work it can be seen how the student make errors such as errors in determining the steps for solving problems, understanding the position conception of starting point with a certain point, understanding the conception of perpendicular lines and parallel lines to the X axis and Y axis and determine the distance from a point to certain point. Then to find out for more informations researcher also conducted interview with the eighth grade student (eighth grade student of junior high school) SMPN 4 Wonosobo. There are the results of interview with the student:

Researcher: "Do you still find out difficulties when solved the problems it as given? Where's the difficulty?"

Student : "Yes Sir, I still find out difficulties when solved the story problems. Because it's to long and dizzy so I just needs to make the steps to solve it though but I don't know for sure whether its true or not and so just done. Then sometimes I even get confused when determined the position of starting point with a certain point especially if it all that points in quadrant III, I also confused

- whether for writing with a negative sign or not"*
- "For the perpendicular lines and parallel lines to the X axis and Y axis do you understand ?"*
- Researcher: *axis do you understand ?"*
- Student : *"Little bit Sir but if the problems changed I got confused again"*
- "If you determine the distance from a point to certain point is there any difficulty ?"*
- Researcher: *there any difficulty ?"*
- Student : *"I was confused Sir especially when describing the results of the roots"*
- "How the condition when you studying at home do your parents or family always monitor, support and help you when you studying ? Is the environment around the house also conditioned if you got studying ? If you got a problems when studying do you discuss it with your classmates so that you get help from your classmate or also the teacher ?"*
- Researcher: *or family always monitor, support and help you when you studying ? Is the environment around the house also conditioned if you got studying ? If you got a problems when studying do you discuss it with your classmates so that you get help from your classmate or also the teacher ?"*
- Student : *"Yes Sir but I don't have a discussion, I worked for that as the best I can do so it can be finished quickly"*
- Researcher: *"How do you view mathematics ?"*
- Student : *"I think mathematics is difficult and so bored Sir. Especially if the questions are so long, I'm even more lazy"*
- "Do you like to practice to solved on other problems such as additional problems it was usually given by the teacher to be done ?"*
- Researcher: *additional problems it was usually given by the teacher to be done ?"*
- Student : *"Rarely Sir and sometimes was never"*

Students difficulties are represented and can be known from the students errors that was occur or in the sense that student errors describe student difficulties. Reviewing the results of interview with the student that there are had correlation between the document documentation (Figure 7 and Figure 8) of the test results that researcher described previously and the results of interview with the student. Looking at the document documentation (Figure 7 and Figure 8) of the test results that researcher described previously and the results of interview with the student a common thread it can be drawn that students are still having difficulties in determining the steps for solving problems, understanding the position conception of starting point with a certain point, understanding the conception of a perpendicular lines and parallel lines to the X axis and Y axis and determine the distance from a point to certain point.

Then by reviewing for exposure the results of interview previously the student said conditions when studying at home parents or family are always monitored, supported and helped student when studying, environment around the house was also conditioned when got studying and if had difficulties the classmates or the teachers were also conditioned to helped. From all of this it can be drawn a common thread that there are no problems from external student factors (the factors that come from outside of students) such as family environment, community environment and school environment. So based on analysis data's obtained it can be known that the dominant factor were caused eighth grade students errors in solving on

cartesian coordinate multistep routine and non-routine modification story problems it is from internal student factors (the factors that come from inside of students) such as student difficulties. Internal student factors is the factors that come from inside of students such as student difficulties which are the fundamental basic but are very crucial in the context solving on math problems especially likes in solving on cartesian coordinate multistep routine and non-routine modification story problems.

D. CONCLUSION AND SUGGESTIONS

This research concludes that the dominant factor were caused eighth grade students errors in solving on cartesian coordinate multistep routine and non-routine modification story problems is students difficulties. Students difficulties such as compiling steps to solve problems in the form of multistep story problems, understanding the position conception of starting point with a certain point, understanding the conception of a perpendicular lines and a parallel lines to the X and Y axis, determining the distance of a point to certain point. The implication of this research is can obtain information about the dominant factor were caused student errors in solving on cartesian coordinate multistep routine and non-routine modification story problems as the relation to the current idealization of mathematics learning optimization and can be able for planing another appropriate and solution steps for the implementation of mathematics learning in an effort to minimize student errors. Suggestions that can be submitted which is considering importance researchs the dominant factors that caused student errors in solving on math problems as well as high level multistep routine and non-routine modification story problems in the implementation (optimization) mathematics learning so in the future it is hoped there will be developing for similar researchs and this research can be an material reference for the future development reasearchs. Why is this very important because for the context of solving on high level multistep math story problems there are usually a lot of factors was inhibitting so we need to observe them in order to achieve optimization mathematics learning.

ACKNOWLEDGEMENT

The researcher or the authors realizes this research cannot be dethaced from support, guidance, direction and assistance from a various part. For this reason the researcher or the authors wanted to convey the profoundness gratitudes to SMPN 4 Wonosobo (junior high school) both to the principal, mathematics teacher of eighth grade and eighth grade students of SMPN 4 Wonosobo (junior high school). The researcher or the authors also would like expresses the deepest gratefulness to expert validators namely Mathematics Education Lecturers and Mathematics Lecturers who have validated this research instruments.

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