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ERROR ANALYSIS IN SOLVING GEOMETRY PROBLEMS BASED ON NEWMAN'S ERROR ANALYSIS REVIEWED FROM LEARNING STYLES

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Abstract

The purpose of this study was to describe the types of student errors in solving problems based on Newman Error Analysis (NEA) in terms of learning styles, namely visual, auditory, and kinesthetic. This type of research uses qualitative-descriptive research. The technique used to collect data in this study was to fill out a learning style questionnaire, problem solving tests, interviews, and documentation and then triangulated to obtain valid data. The results showed: (1) subjects with visual learning styles made mistakes at the stage of process skills (process skills) and writing answers (encoding). (2) subjects with auditory learning styles make mistakes in the stages of understanding (comprehension), transformating (transformation), processing skills (process skills) and writing answers (encoding). (3) subjects with a kinesthetic learning style make mistakes in the transformation, process skills, and writing answers (encoding) stages.

Keywords: *Analysis, Errors (NEA), Geometry, and Learning Style*.

Abstrak

Dari observasi awal dalam memecahkan masalah geometri peserta didik lemah dalam memahami soal, dan kurang teliti dalam perhitungannya, sehingga menyebabkan hasil akhir yang salah. upaya untuk memahami dan mengkaji lebih dalam mengenai kesalahan peserta didik, pendidik hendaknya harus mengetahui faktor-faktor yang harus diperhatikan dalam mempelajari matematika adalah gaya belajar peserta didik. Terdapat tiga tipe gaya belajar yaitu visual, auditorial, dan kinestetik. Dan kesalahan-kesalahan yang dialami oleh peserta didik tersebut dapat dianalis menggunakan prosedur *Newman's Error Analysis (NEA)*. Jenis penelitian yang digunakan adalah penelitian kualitatif-deskriptif dengan tujuan mendeskripsikan Mendeskripsikan jenis kesalahan peserta didik dalam memecahkan masalah berdasarkan *Newman Error Analysis (NEA)* ditinjau dari gaya belajarnya. Teknik yang digunakan untuk mengumpulkan data dalam penelitian ini adalah mengisi angket gaya belajar, tes pemecahan masalah , wawancara, dan dokumentasi yang kemudian ditriangulasikan untuk mendapatkan data yang valid. Hasil penelitian ini menunjukan bahwa (1) subjek WR dengan gaya belajar visual melakukan kesalahan di tahap keterampilan proses (*process skills*) dan penulisan jawaban (*encoding*). (2) subjek RY dengan gaya belajar auditorial melakukan kesalahan di tahap memahami (*comprehension*), trasformasi (*transformation)*,keterampilan proses (*process skill*) dan penulisan jawaban (*encoding*).(3) subjek WR dengan gaya belajar kinestetik melakukan kesalahan di tahap trasnformasi (transformation), keterampilan proses (*process skills*), dan penulisan jawaban (*encoding*).

Kata kunci: *Analisis*, *Kesalahan (NEA), Geometri, dan Gaya Belajar.*

INTRODUCTION

Mathematics is very important for human life, because in daily activities humans cannot be separated from things that are mathematical, that is the reason why mathematics is a compulsory subject for students from elementary, junior high, high school up to college. One of the materials that plays an important role in learning mathematics is geometry. This geometry material is one of the important topics in mathematics.

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Initial observations about the geometry of students are weak in understanding the problem, and are less thorough in their calculations. It is the obligation of an educator to understand and examine more deeply about student errors, educators should not scold students if students experience errors in answering questions. Educators should guide students and find out about mistakes made by students so that these mistakes can be corrected and do not happen again. Educators should also know the factors that must be considered in studying mathematics, one of which is the characteristics of students. So that educators can implement a better learning system according to the characteristics possessed by students.

Characteristics of students who need to get attention from educators is their learning style. According to Rofiqoh (2016: 25) learning style is one of the important factors and concerns the way students understand certain lessons. In this case, it is important for educators to analyze the learning styles of their students so that they can carry out appropriate learning for students. DePorter & Hernacki (1992:117) classifies learning styles based on how to receive information easily (modalities) into three types, namely the visual type, the auditory type, and the kinesthetic type.

After knowing the learning styles of each student, it is expected that educators can help the difficulties experienced by students while solving math problems at certain stages. Further, the errors experienced by students can be analyzed using the Newman's Error Analysis (NEA) procedure. According to Newman's (in White, 2010: 133), there are several stages of student error in solving math problems, namely (1) reading, this stage is related to how someone reads the given problem so that it is related to how they understand facts and terms. given in the problem, (2) comprehension, this stage is related to how one can interpret what will be sought or asked from the question, (3) transformation, this stage is related to the strategy that will be used to answer the question, (4) process skills, this stage is the stage of problem solving or implementing strategies at the transformation stage, and (5) encoding, this stage is related to when students cannot write the correct answer in the form of numbers, symbols or words even though they have gone through the right stages of completion. .

Indicators that cause students to make mistakes in solving problems in the form of descriptions are based on the Newman procedure. The table of indicators that cause students to make these mistakes are as follows.

Table 1 Indicators of the Causes of Student Errors

Stages in NEA	Indicator
Reading (Reading)	a. Students are not able to read or recognize symbols in questions. b. Students are not able to interpret the meaning of each word, term or symbol in the problem.
Understanding (Comprehension)	a. Students do not understand what information is known in the problem completely. b. Students do not fully understand what is being asked in the question.
Transformation (Transformation)	a. Students are not able to make mathematical models from the information obtained. b. Students do not know the formula that will be used to solve the problem. c. Students do not know the arithmetic operations that will be used to solve problems.
Process skills(Process skills)	a. Students do not know the procedures or steps that will be used to solve the problem correctly.
Writing answers (Encoding)	a. Students are not able to find the final result of the problem based on the procedures or steps that have been used. b. Students cannot show the final answer of solving the problem correctly. c. Students cannot write the final answer according to the conclusion.

Jha, Singh and White (in Sughesti et al, 2016:569)

Based on the description above, the problem regarding the types of student errors can be studied through the NEA and in terms of their learning style in solving math problems in geometry, the researchers are interested in conducting research with the title "Error Analysis in Solving Geometry Material Problems Based on Newman's Error Analysis (NEA) Judging from the Learning Style".

The benefit of this research is to provide an overview of the mistakes made by students in determining the solution to a mathematical problem which in this case is very necessary to continue to be investigated what are the causes. From the results of the study, it is expected that it will be taken into consideration in investigating the errors experienced by students, so that when carrying out the teaching process educators can provide methods that are in accordance with the learning styles of students.

RESEARCH METHODS

The type used in this research is qualitative-descriptive research. The type of research used is qualitative-descriptive research with the aim of describing the types of errors students make in solving problems based on Newman's Error Analysis in terms of learning styles. This research was conducted in one of the SMPN Pamekasan. The research subjects are even semester students for the 2021/2022 academic year. The number of subjects is 3 students.

The instrument used in this study consisted of the main instrument, which is the researcher herself, because the researcher herself was directly related to the research subject and was not represented by other people. Second, the auxiliary instrument consists of a learning style questionnaire, test questions I, test II, interviews and documentation. In order to make the questionnaires and tests to be feasible and valid for use in this study, validation was carried out by two experts, they are a mathematics lecturer and a colleague from the Madura University. In addition, because in this study, interviews will be conducted to obtain in-depth information, students who have good communication skills will be selected based on consultation between researchers and educators in the field of mathematics studies.

Subject selection begins with the provision of a learning style questionnaire, prospective subjects are grouped according to the results of the questionnaire, namely visual, auditory and kinesthetic learning styles.

After the subject was obtained, the subject was given a problem-solving ability test and an interview. To check the valid data, this study used time triangulation. Time triangulation in this study is to compare the data of the first test and interview with the second test and interview. If the first and second tests and interviews are inconsistent, it is necessary to do a third test and interview, then the results of the third test and interview are compared with the first and second tests and interviews. However, if the first, second and third tests and interviews have not been consistent, the errors will be continued with subsequent tests and interviews until the errors experienced by students are consistent.

RESULTS AND DISCUSSION

A. Research Subjects Type of Visual Learning Style (WR)

Table 2 Types of Visual Subject Error

Error Indicator	Test I	Test II
Process skills	WR was wrong in determining the hypotenuse of the base, WR used Pythagorean triples, namely 3,5 and 7 according to WR 7 was the hypotenuse and WR was also wrong in calculating the circumference of the base because he incorrectly determined the base, according to WR the base is a right triangle so that the circumference of the base is also wrong.	WR is wrong in determining the hypotenuse of the base, WR uses Pythagorean triples, namely 5,12 and 19 according to WR 19 is the hypotenuse and WR is wrong in calculating the circumference of the base because he wrongly determined the base, according to WR the base is a right triangle so that the circumference of the base is also wrong .
Encoding	WR was wrong in the encoding stage because the process skill was wrong, causing the final result to be wrong and WR wrongly writing down the unit of area, the unit of area should be cm2 but according to WR the unit is cm	WR was wrong in the encoding stage because the process skill was wrong, causing the final result to be wrong and WR wrongly writing down the unit of area, the unit of area should be cm2 but according to WR the unit is cm

B. Students with Auditorial Learning Style (RY) Type

Table 3 Types of Auditorial Subject Errors

Error Indicator	Test I	Test II
Comprehension	RY only wrote and mentioned the length of the side of the cake on the first plate, which was 18 cm, while the length of the side of the second cake, which was 9 cm, was not mentioned and was not written.	RY only wrote and mentioned the length of the side of the cake on the first plate, which was 24 cm, while the length of the side of the second cake, which was 12 cm, was not mentioned and was not written.
Transformation	a. RY made an error in the transformation stage because RY was wrong in writing the arithmetic operation on the formula for the surface area of the prism, according to RY, the surface area of the prism=2·la+ka+tp should be the surface area of the prism=2·la+ka·tp. b. RY made an error in the transformation stage because RY was wrong in writing the formula for the volume of the pyramid, according to RY the volume of the pyramid=1/3 area of the base×height of the base should be the volume of the pyramid=1/3 the area of the base x the height of the prism.	a. RY made an error in the transformation stage because RY was wrong in writing the arithmetic operation on the formula for the surface area of the prism, according to RY, the surface area of the prism=2·la+ka+tp should be the surface area of the prism=2·la+ka·tp. b. RY made an error in the transformation stage because RY was wrong in writing the formula for the volume of the pyramid, according to RY the volume of the pyramid=1/3 area of the base×height of the base should be the volume of the pyramid=1/3 the area of the base x the height of the prism.

Process skills	a. RY made a mistake in the process skills stage because RY wrongly determined the area of the base, RY assumed that 64 was obtained from the area of ABFE and according to RY the base of the prism was ABFE not ABCD while the problem was the base was ABCD.	a. RY made an error in the process skills stage because RY incorrectly determined the area of the base, RY assumed 36 was obtained from the area of PQTU and according to RY the base of the prism was PQTU not PQRS, while the problem was that the base was PQRS.
	b. RY made an error in the process skills stage because in the previous stage the transformation had an error so that the process skills were wrong and RY was also wrong in calculating one side of the base, according to RY the hypotenuse of the base is 7, so the result of the circumference of the base is wrong.	b. RY made a mistake in the process skills stage because in the previous stage the transformation had an error so that the process skills were wrong and RY was also wrong in calculating one side of the base, according to RY the hypotenuse of the base is 19, so the result of the circumference of the base is wrong.
	c. RY made an error in the process skills stage because in the previous stage RY had an error in writing down the height of the base not the height of the pyramid so that it was wrong to write down the height, according to RY the height was 18, while the correct one was 9 and RY was wrong in calculating the area of the base, according to RY the area of the base 18×18, obtained from the length of the side of the cube × the length of the side of the cube so that the result of the area of the base is wrong.	c. RY made a mistake in the process skills stage because in the previous stage, RY had an error in writing down the height of the base not the height of the pyramid so that it was wrong to write down the height, according to RY the height was 24, while the correct one was 12 and RY was wrong in calculating the area of the base, according to RY, the area of the base 24×24, obtained from the length of the side of the cube × the length of the side of the cube so that the result of the area of the base is wrong.
Encoding	RY made an error in the encoding stage because RY was wrong in drawing conclusions, according to RY the unit of volume is cm.	RY made an error in the encoding stage because RY was wrong in drawing conclusions, according to RY the unit of volume is cm.

C. Research Subjects Type of Kinesthetic Learning Style (HT)

Table 4 Types of Kinesthetic Subject Errors

Error Indicator	Test I	Test II
Transformation	HT made an error in the transformation stage because HT wrote the formula for the volume of the cube wrong, according to HT the volume of the cube =p×l×t, while the correct volume of the cube = s^3	R HT made an error in the transformation stage because HT wrote the formula for the volume of the cube wrongly, according to HT the volume of the cube =p×l×t, while the correct volume of the cube =s^3
Process skills	a. HT is wrong in determining the hypotenuse of one of the bases of the prism, according to HT the hypotenuse is 7, HT is wrong in calculating the circumference of the base according to HT K=7+7+5+6, the heights of the triangles are also added up, the heights should not be added up enough only the side of the triangle, HT is wrong in writing the height, according to HT the height here is the height of the base not the prism height, while what is meant is the prism height and HT is also wrong in calculating, according to HT 2·25+25·5 = add up first 25+25 then the result of the sum is multiplied, it should be multiplied first before adding it. b. b. HT made an error in the process skills stage because: HT was not careful in calculating the volume of the cube.	a. HT is wrong in determining the hypotenuse of one of the bases of the prism, according to HT the hypotenuse is 19, HT is wrong in calculating the circumference of the base according to HT K=19+19+12+10, the heights of the triangles are also added up, the heights should not be added up enough only side of the triangle, HT is wrong in writing the height, according to HT the height here is the height of the base not the prism height, while what is meant is the prism height, and HT is also wrong in calculating, according to HT 2·60+60·12 = add up first 60+ 60 then the sum is multiplied, it should be multiplied first and then added up. b. b. HT made an error in the process skills stage because: HT was not careful in calculating the volume of the cube
Encoding	a. HT made an error in the encoding stage because the process skill was wrong so that the final result was also wrong and HT was also	a. HT made an error in the encoding stage because the process skill was wrong so that the final result was also wrong and HT was also

	wrong in drawing conclusions, according to HT the unit of volume is cm.	wrong in drawing conclusions, according to HT the unit of volume is cm.
	b. HT made an error in the encoding stage because the process skill was wrong, namely the volume of the cube was wrong so that it caused the remaining volume of the cake to be wrong, the remaining volume of the cake was obtained from the volume of the cube - the volume of the pyramid and HT was wrong in drawing conclusions, according to HT the unit of volume is cm.	b. HT made an error in the encoding stage because the process skill was wrong, where the volume of the cube was wrong so that it caused the remaining volume of the cake to be wrong, the remaining volume of the cake was obtained from the volume of the cube - the volume of the pyramid and HT was also wrong in drawing conclusions, according to HT the unit of volume is cm.

CONCLUSIONS AND SUGGESTIONS

1. Type of Subject Error : Type Visual Learning Style (WR)

WR made mistakes in the process skills and writing answers (encoding). Process skills errors are errors in the process of calculating the Pythagorean Theorem, in test I the Pythagorean results are 3, 5 and 7, in test II the Pythagorean results are 5, 12, and 19, and wrong in calculating the circumference of the base of the prism. The encoding error is wrong because the process skill has an error, and it is also wrong in determining the unit of the prism surface area because according to the student the unit is cm.

2. Type of Subject Error Type : Auditorial Learning Style (RY)

RY made mistakes in the stages of understanding (comprehension), transformation (transformation), process skills (process skills) and writing answers (encoding). Comprehension error is that students do not understand the information that is drawn. The transformation error is incorrect in determining the operation in the formula used, the operation used should be multiplication but the student uses addition. Process skill errors, namely: wrong in calculating the Pythagorean Theorem, wrong in determining the height of the pyramid. Encoding error is incorrect in determining the correct unit. The student assumes that the unit of volume is cm.

3. Type of Subject Error : Type of Kinesthetic Learning Style (HT)

HT made mistakes at the transformation stage, process skills, and writing answers (encoding). Transformation error. That is wrong in using the formula for the volume of a cube, according to the student, the formula for the volume of a cube is =p×l×t. Process skill errors, namely wrong in calculating the Pythagorean theorem, wrong in calculating the circumference of the base to calculate the circumference. The student also adds up the height of the base and is wrong in calculating the volume of the cube. The encoding error is wrong in determining the right unit, the student assumes that the unit of volume is cm.

Based on the explanation above, it can be concluded that the types of errors made by visual (WR), auditorial (RY) and kinesthetic (HT) subjects have several similarities, namely: RY and HT both make mistakes in the transformation stage, and WR, RY, and HT both made mistakes in the process skills and encoding stages.

Suggestion

1. From the results of the study, it was revealed that the subject did not understand the prerequisite material, namely the Pythagorean Theorem, where it made the subject being less ready to accept new material, and therefore educators should ensure in advance that the student has completed the prerequisite material at the beginning of learning.
2. From the results of the study, it was revealed that the subject was not used to working on questions that were different from the sample questions given by the educator, this resulted in the subject experiencing errors when doing the test, therefore educators should also provide examples of different questions so that students get used to it. working on questions that are relatively new, besides that the subject is also less careful when working on questions and is unable to determine the right unit, therefore educators should also familiarize students with solving problems in their entirety from writing what is known to the final conclusion.

DAFTAR PUSTAKA

Arikunto, S. 2010. *Prosedur Penelitian Suatu Pendekatan Praktik.* Yogyakarta: PT Rineka Cipta.

Deporter, B. & Hernacki, M. 1992. *Quantum learning: Membiasakan Belajar Nyaman dan Menyenangkan*. Dari Google Books,(Online), (https://books.google.co.id). Diakses 10 November 2017.

Moleong, L. 2010. *Metodologi Penelitian Kualitatif. Bandung*: PT Remaja Rosdakarya.

Rofiqoh, Z. dkk. (2016). "Analisis Kemampuan Pemecahan Masalah Siswa Kelas X Dalam Pembelajaran *Discovery Lerning* Berdasarkan Gaya Belajar Siswa". *Unnes Journal Of Mathematics Education*, (online). 5 (1): 25-32 (http://lib.unnes.ac.id/22322/), diakses 6 November 2017.

Sughesti, M.M. Dkk. Jenis Kesalahan Siswa Dalam Menyelesaikan Soal Cerita Berdasarkan Prosedur Newman. *Pendidikan Matematika Pascasarjana Universitas Negeri Malang.*

Sugiyono, 2008. *Metode Penelitian pendidikan Pendekatan Kuantitatif, Kualitatif dan R & D*. Bandung:Alfabeta.

White, A. L. 2010. "Numeracy, Literacy and Newman's Error Analysis". *Journal of Science and Mathematics Education in Southeast Asia 2010,* (online).. 33 (2):129-148. (http://www.recsam.edu.my/R&D_Journals/YEAR2010/dec2010vol2/allan(129148).pdf), diakses 6 November 2017.