



ANALYSIS OF ERROR SOLUTION OF MATHEMATICS STORIES BASED ON WATSON CRITERIA

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Abstract

This research is motivated by the number of errors made by students in solving math problems. The purpose of this study was to determine the types of errors made by students in working on math problems based on Watson's criteria in class IX.8 and to determine the factors that caused students to make mistakes in doing math problems based on Watson's criteria in class IX.8. The research method used is descriptive method with a qualitative approach. The sampling technique used is purposive sampling technique. The sample in this study consisted of 32 students, for further research from the existing sample, namely 5 students according to the level of academic ability and certain considerations. The results of this study indicate that the types of errors made by students with high academic abilities are incorrect procedures and missing conclusions. The types of errors of moderate ability students are missing data, wrong procedures and missing conclusions. The types of errors made by students with low academic ability are inaccurate data, wrong procedures, missing data and missing conclusions. The cause of students making mistakes is that students do not understand the questions, students are confused in answering questions and forget to use the correct formula. So it can be said that the error in reading mathematical stories is in accordance with Watson's Criteria.

Keywords: Analysis Problems, Watson Criteria, Question

INTRODUCTION

Mathematics plays an important role in every activity carried out by humans and it is a science that is applied in almost all levels of education. Novtiar & Aripin (2017), stated that mathematics relies on

thinking processes. According to James & James (2016) mathematics is the science of logic, form, arrangement, quantity, and related concepts. Mathematics based on Wardani & Firmansyah (2019) are thinking patterns, organizing patterns,



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logical proofs. However, in reality, many students think that mathematics is complicated, so that many students experience errors in doing math problems, especially story questions.

According to Runtukahu & Kondou (2014), Mathematics is a structured science, with initial abilities a prerequisite for subsequent abilities. Mathematics learned through formal education has a very important role for students as a provision of knowledge in shaping their attitudes and mindset. (Septiani, 2013).

One way to find out the extent of students' understanding of the indicators of the mathematics material that has been taught is to use story questions (Wardani & Firmansyah, 2019). Story questions have several advantages other than usual which talked about everyday cases that are close to their daily lives, story questions also require a good understanding of language so that they can turn it into the form of mathematical operations, it can also see how students think in doing it, compared to students directly in the classroom. give with students directly given in the form of mathematical operations (Sapta, 2019).

According to Budiyo (2008), form of question that presents problems in everyday life are in the form of narrative or story. Davis & McKillip (1980), although the skill of solving story problems plays an important role in the long term, story problems are not easy for teachers to teach. While according to Sarwoedi (2019), story questions in mathematics are questions that are presented in the form of everyday sentences and are generally an application of the mathematical concepts learned.

Based on events in the field, many students lack understanding of story problems, using sentences in everyday life as examples of objects in making questions, this can be seen from the results of research conducted at the school. Students are also lacking in memorizing formulas and students are less thorough in completing the answers and students are less familiar with using conclusions in each final answer.

Based on interviews with mathematics teachers in class IX.8, information obtained that students felt they understand the material being taught, but there were some students who did not understand the material taught by the teacher, so that some students completed the questions incorrectly, while the results of interviews with some students in class IX.8 obtained information that some students considered mathematics to be a difficult subject to understand, one of which was story questions, students said math story problems were difficult to understand, where students had difficulty understanding questions and made students confused in choosing formulas to solve the problem.

Errors also cannot be seen from the results of students' answers but can also be seen from the student's learning process. Errors in solving the test questions given are of course not only found in students with low test scores, but students in medium and high groups (Sapta, 2019). The description of the errors of each group of students needs to be known so that it can then be known the tendency of errors made by students in the high group, medium group and low group, so that later it can be used as material for teacher consideration in determining which

errors need to be corrected immediately.

Errors based on Depdiknas (2001) is a mistake, a wrong action is an act that violates the law and so on. The error referred to according to Munawaroh et al. (2018) is a mistake made by students in solving a mathematical problem on the subject of curved side spaces. In a mathematics lesson, students often make mistakes, especially errors in solving and understanding a problem.

In line with the research results of Aisyah et al. (2019) it was found that the form of student errors were (1) incorrect student errors, (2) incorrect procedural errors, namely not being able to work on the questions to the final stage, (3) students' skill hierarchical problems, namely not writing down the procedures used to find the results at each work step, (4) response level conflict errors, (5) missing conclusions errors that were made, namely not writing conclusions even though they had found the final result.

In line with the research results of Purwati & Haryanto (2016) it was found that the types of errors made were errors in reading the questions, errors in understanding the questions, errors in transferring questions, errors in process skills and errors in the answers to the final results. The causal factor is the lack of students' reading ability and students do not understand the concept of fractions.

In the results of the study, it was found that the Watson criterion is one of the criteria that is considered quite complete in analyzing student errors in solving problems, one of which is in the form of story questions. So in this study, Watson's criteria were

used to identify student errors at each step of completion. Watson's error criteria can measure the location of students' cognitive abilities in working on test questions.

Based on Watson there are 8 errors categories in solving problem: (a) *Inappropriate Data/ID* is student didn't input the right data, (b) *Inappropriate Procedure/IP* is student's lack of understanding the meaning of question; (c) *Ommited Data/OD* is the loss of one or more data from student responses; (d) *Ommited Conclusion/OC* is the student is wrong in concluding problem; (e) *Response Level Conflict/RLC* is response level conflict; (f) *Undirected Manipulation/UM* is a correct answer with very simple reasons and illogical or random casting; (g) *Skills Hierarchy Problem/SHP* students are less careful in doing calculations and in the results of calculations; (h) *Above Other/AO* is writing wrong data and not responding (Winarsih et al., 2015).

Based on these statements, the researcher feels the need to identify student errors in working on math story problems that the researcher will examine using the Watson criteria. The research objective to be achieved is to find out the types of errors made by students in solving math story problems based on Watson's criteria in class IX.8.

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METHODS

There are two methods used in this study, namely the test and interview methods. According to

Arikunto (2014) The test is an instrument used to measure the presence or absence and the magnitude of the ability of the object under study. One of the tests carried out is a written test which is given in the form of questions in the form of a description (essay) based on the subject matter. While interviews were conducted to obtain information about the causes of students making mistakes in solving math story problems. The preparation of interview instruments begins with studying and reviewing theories in analyzing thinking patterns that will be used as guidelines in preparing interview questions.

Based on Fitri & Haryanti (2020) is a small part of the population that is taken according to a certain procedure so that it can represent the population representatively. The type and approach used in this research is descriptive research with a qualitative approach. According to Gunawan (2014) qualitative descriptive approach is a research procedure that produces descriptive data in the form of written or spoken words from people and observable behavior and is directed at the individual background as a whole. The research subject uses purposive sampling, where the subject is selected with certain considerations and goals (Sugiyono 2019). Based on the considerations made in this

research subject, the students of class IX.8 SMPN 7 Padang, taking the research subject based on the results of the essay test on math story questions given to class IX.8 students.

The research instrument used in this study was a test of students' ability to answer math story questions consisting of 5 questions in the form of essays, interviews and documentation. The test is an instrument used to measure the presence or absence and the magnitude of the ability of the object under study (Arikunto 2014).

The test was carried out twice, where a trial test was carried out at SMPN 25 Padang and a research test was carried out at SMPN 7 Padang. The trial was carried out to see whether the questions used were worthy of being research test questions. The data collection technique was taken from the results of tests, interviews and completed with evidence in the form of documentation. The data analysis technique has 2 steps, namely the analysis of story questions using a 4-scale rubric, and interview analysis.

RESULTS AND DISCUSSION

The results of student test answers are grouped based on academic ability, namely high academic ability, medium academic ability and low academic ability which can be seen in Table 1.

Table 1. Student academic test results according to the level of academic ability.

Academic Ability	Student Absent No	Total
High	S-05, S-27	2
Medium	S-01, S-02, S-04, S-07, S-09, S-12, S-14, S-15, S-17, S-19, S-20, S-21, S-24, S-28, S-29, S-30	16
Low	S-03, S-06, S-08, S-10, S-11, S-13, S-16, S-18, S-22, S-23, S-25, S-26, S-31, S-32	14
Total		32

Based on Table 1, it is known that from 32 students who completed the test questions with curved side space, 2 students had high academic ability, 16 students had moderate academic ability, and 14 students had low academic ability. While the students who will be interviewed for further research by taking samples using purposive sampling, 1 student is

obtained at a high ability level, 2 students at a medium ability level and 2 students at a low ability level.

The discussion of the 5 people who were studied further is according to their level of academic ability. At a high level of ability the part where students often make mistakes is question number 1, the error is seen in the figure 1.

2. Diket: $D = 28$, $r = 14$
 $t = 48$

Dit: Luas ?

Jwb: $\pi \cdot r^2 (50 + 14)$ X
 $= \frac{22}{7} \cdot 14^2 (50 + 14)$ X
 $= 44 \cdot 64$ X
 $= 2816$ X

2x3=6
 1x0=0

PPT
 DH
 KH

Figure 1. Question number 1

The error analysis seen in the results of the answers above is that students do not complete the answers when students understand what is meant by the question. According to the Watson criteria, these errors include improper procedures, missing data and missing conclusions. The procedure is not appropriate because students do not use the correct formula, do not complete the answer and do not provide a conclusion at the end of the answer. Using procedures to solve problems is very important.

Based on Utami et al. (2018) students must be able to work on story form questions so that students practice and think deductively, can see the relationship and use of mathematics in everyday life, and can master mathematical skills and strengthen mastery of mathematical concepts.

According to Hastuti et al. (2012) students do not read the instructions for working on the questions, students do not understand what is stated in the questions and students do not practice various questions.

1. Diketahui: $r = 10\%$, naik
 $t = 5\%$, naik

dit: 1. Luas selimut tabung?
 2. Volume tabung ?

Jawab: a. $2\pi r t$
 $2 \times 1 = 2$

b. $V = \pi r^2 t$

PPT
 KH

2x3=6
 KH+1x0=0

Figure 2. Question number 2

At the moderate level of ability, 2 student answers are taken to be studied, but do not include question

number 1 because errors at all levels of ability on the results of student answer sheets are the same, the researcher

wants to examine other questions, so the questions that are considered mostly done at the moderate academic level are questions number 2 and 5, in question number 2 the error seen on the student's answer sheet is according to the figure 2.

The analysis of errors in the student's answers above is not writing down what is known in the answer sheet. So according to the error based

on Watson's criteria, data is lost and conclusions are lost. The final conclusion is used so that the results of solving the questions are said to be clearer by using the correct sentences, so that the questions asked are explained properly and precisely (Gunawan 2016).

In question number 5 the error seen on the student answer sheet is as shown in the figure 3.

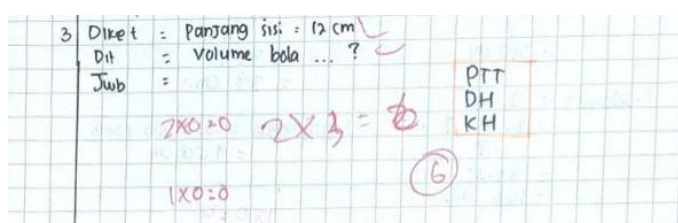


Figure 3. Question number 5

The analysis of errors in the answers above is that the students did not write down the answers in solving the test questions, and the conclusions were not written on the student answer sheets. So according to Watson's criteria, the categories of errors made by students are incorrect procedures and missing conclusions. This is in line with Puspita (2016) "that students make mistakes by not writing conclusions or writing conclusions but

wrong. In line with Khasanah & Sutarna (2015) which stated "that students do not master the mathematical concepts being studied"

At low level of academic ability, different questions are taken in order to be able to examine errors in all questions, then questions number 3 and 4 are taken. In question number 3 the errors seen on the student answer sheets are in accordance with the figure 4.

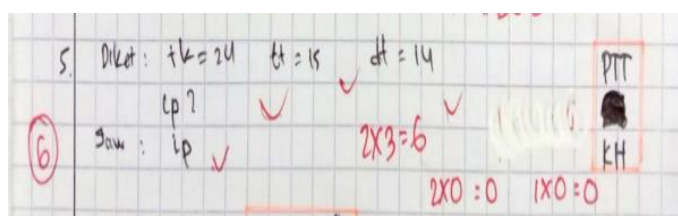


Figure 4. Question number 3

The analysis of errors in the student's answers above is that students do not write answers on the student answer sheets and students do not write conclusions on the student answer sheets. The error is in accordance with

Watson's criteria, namely the procedure is not right and the conclusion is lost. In accordance with the results of student answers, students feel a lack of time in completing answers. These results are in

accordance with the research conducted by Suwanto (2013) that students feel less time in working on questions”.

In question number 4 the error seen on the student answer sheet is in accordance with the figure 5.

4. Diket: tinggi tabung 16
 Diameter bola 42
 Ditany: volume air

Jwb: $V_B = \frac{4}{3} \pi r^3$
 $= \frac{4}{3} \pi r^3$
 $= \frac{4}{3} \pi 42^3 \times 16$
 $= \pi 4 \times 42 \times 42 \times 16$
 $= 98.784$

$V_T = \pi r^2 \cdot t$
 $= \frac{32}{7} \times 42 \times 42 \times 16$
 $= 232.848$

$V_B - V_T$
 $98.784 - 232.848$
 $= 134.064$

PTT
 DH
 KH

2x2=6
 3x2=6
 (12)

Figure 5. Question number 4

The analysis of errors in student answers above is that students do not use the correct formula in answering questions and students do not write conclusions on the answer sheet. The errors that appear to be in accordance with Watson's criteria are incorrect procedures and missing conclusions.

Based on Silitonga & Febrian (2017) This error occurs because students are unable to understand the purpose of the problems they face because they are not prepared to take the essay test seen in the student's answers contained in question number 1.

Missing data errors indicate data inaccuracies and lack of accuracy in solving questions with the Watson criteria (Sari, 2018).

CONCLUSION AND RECOMMENDATION

Based on the results of student test analysis and discussion of research results, it can be concluded that the types of errors that are often made by class IX.8 students in solving math

story problems based on Watson's criteria are incorrect procedures, missing data and missing conclusions.

So from the results seen, the author suggests that mathematics learning be carried out by paying close attention to the results of what students do, giving the form of writing answers such as known, asked and answered and conclusions. Teachers are also expected to be able to correct directly so that students are easier to understand and solve the story problems given.

REFERENCES

- Aisyah, Fitria N. K., Hariyani, S., & Riski N. I. (2019). Analisis Kesalahan Penyelesaian Soal Cerita Berdasarkan Kriteria Watson. *Jurnal Review Pembelajaran Matematika* 4(1):11–22. doi: <https://doi.org/10.15642/jrpm.2019.4.1.11-22>.
- Arikunto, S. (2014). *Prosedur Penelitian Suatu Pendekatan Praktik*. Jakarta: Rineka Cipta.

- Budiyono. (2008). “Kesalahan Mengerjakan Soal Cerita Dalam Pembelejaran Matematika. *Paedagogia* 11.
- Davis, J. & W. McKillip. (1980). *Improving Story Problem Solving in Elementary School Mathematics. Virginia: NCTM.*
- Depdiknas. (2001). *Penyusunan Butir Soal Dan Instrumen Penilaian.* Jakarta : Depdiknas.
- Fitri, Zaenul, A., & Haryanti, Nik. (2020). *Metode Penelitian Pendidikan Kuantitatif, Kualitatif, Mixed Method, Dan Research and Development.* Cita Intrans Selaras (Citila).
- Gunawan, Ansyori. (2016). Analisis Kesalahan dalam Menyelesaikan Soal Cerita Pada MataPelajaran Matematika Siswa Kelas V SDN 59 Kota Bengkulu. *Ilmiah Pendidikan Guru Sekolah Dasar* 9:216–25.
- Gunawan, I. (2014). *Metode Penelitian Kualitatif: Teori dan Praktik.* Jakarta : Bumi Aksara. Hlm. 167.
- Hastuti, I., Surantoro, & T. D. Rahardjo. (2012). Analisis Kesalahan Dalam Menyelesaikan Soal Materi Pokok Kalor pada Siswa Kelas X SMA. *Jurnal Materi Dan Pembelajaran Fisika* 2:1–11.
- Khasanah, U., & Utama. (2015). Kesulitan Menyelesaikan Soal Matematika pada Siswa SMP. Pp. 79–89 in *Seminar Nasional Pendidikan Matematika.*
- Munawaroh, Nurul, Rohaeti, E. E., & Usman Aripin. (2018). Analisis Kesalahan Siswa Berdasarkan Kategori Kesalahan Menurut Watson dalam Menyelesaikan Soal Komunikasi Matematis Siswa SMP. *Jurnal Pembelajaran Matematika Inovatif* 1:5.
- Novtiar, C., & U. Aripin. (2017). Meningkatkan Kemampuan Berfikir Kritis Matematis dan Kepercayaan dan Kepercayaan Diri Siswa SMP Melalui Pendekatan Open Ended. *Jurnal PRISMA Universitas Suryakanca* VI(2):119–31.
- Purwati & Haryanto, Dadang S. (2016). Analisis Kesalahan Siswa Dalam Menyelesaikan Soal Cerita Bilangan Pecahan Kelas VIII SMP 19 Manokwari. *3(1):130–470.*
- Puspita, R. A. (2016). Deskripsi Kesalahan Siswa Kelas IX SMP Pada Materi Sistem Persamaan Linier Dua Variabel Berdasarkan Klarifikasi Watson. Universitas Kristen Satya Wacana Salatiga.
- Runtutahu, J. & S. Kondou. (2014). *Pembelajaran Matematika Dasar Bagi Anak Berkesulitan Belajar.* Yogyakarta: Ar-Ruzz Media.
- Sapta, Andy. (2019). Peningkatan Kemampuan Pemahaman Konsep Matematik Mahasiswa Melalui Pembelajaran Problem Posing. *Mathematics Paedagogic* IV:12–22.
- Sari, I. W. (2018). Analisis Kesalahan Mahasiswa dalam Menyelesaikan Soal Trigonometri Berdasarkan Kriteria Watson. *Jurnal Widyaloka IKIP Widya Darma*

- 5(2):139–46.
- Sarwoedi. (2019). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Matematika berdasarkan Kriteria Watson. *Jurnal Matematics Paedagogic* 4(1):12–22.
- Septiani, M. D. (2013). Pembentukan Karakter dan Komunikasi Matematika Melalui Model Problem Posing Berbantuan Scaffolding Materi Segitiga.
- Silitonga, N., & F. Febrian. (2017). Penelesaian Masalah Bangun Datar Siswa Kelas VII: Kesalahan dan Kategorisasinya. *Jurnal Gantang* 1(2):57–68.
- Sugiyono. (2019). *Metode Penelitian Kuantitatif Kualitatif Dan R&D*. Kedua. Bandung: Alfabeta.
- Susilawati & Febrian. (2016). Analisis Kesalahan Siswa Kelas X MIA 3 SMA Negeri 1 Tanjungpinang Tahun Pelajaran 2015/2016 Dalam Menyelesaikan Permasalahan Peluang Dengan Menggunakan Kategori Kesalahan Watson. *Jurnal Ilmiah Mahasiswa* 10(2):1–15.
doi: <http://dx.doi.org/10.22342/jpm.10.2.3630.39-52>.
- Suwarto. (2013). Pengembangan Tes Diagnostik Dalam Pembelajaran. *Pustaka Belajar*. Yogyakarta: Pustaka Belajar.
- Utami, R. W., Endaryono, Bakti T., & Djuhartono, T. (2018). Matematika Kemampuan Kemampuan Peserta Didik Dalam Menyelesaikan Soal Cerita. *Ilmiah Kependidikan* 5:187–92.
- Wardani, Nadia, & Firmansyah, Dani. (2019). Kesalahan Siswa Dalam Menyelesaikan Soal Cerita Dengan Menggunakan Kriteria Watson. 17–29.
- Winarsih, K., T Sugiarti, & Khutobah. (2015). “Analisis Kesalahan Siswa Berdasarkan Kategori Kesalahan Menurut Watson dalam Menyelesaikan Permasalahan Pengolahan Data Siswa Kelas VI SDN Baletbaru 02 Sukowono Jember Tahun Pelajaran 2014/2015. *Artikel Ilmiah Mahasiswa* 1:1–5.