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ERRORS 8th GRADE STUDENTS SOLVE STATISTICAL LITERACY: NEWMAN PERSPECTIVE

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Abstrak

Literasi statistik penting bagi siswa karena siswa akan dihadapkan pada peran mereka sebagai pembuat dan pengguna data. Penelitian ini mendeskripsikan kesalahan siswa kelas VIII dalam menyelesaikan soal literasi statistik berdasarkan perspektif Newman. Dua siswa kelas VIII SMPN 6 Bondowoso yang melakukan kesalahan paling banyak menjadi subjek dalam penelitian ini. Penelitian ini merupakan penelitian deskriptif kualitatif melalui soal literasi, dokumentasi, dan wawancara. Data dianalisis berdasarkan perspektif Newman dan pedoman untuk menjawab soal literasi statistik. Hasil penelitian menunjukkan bahwa terdapat empat kesalahan dalam mengerjakan soal literasi statistika yaitu (1) kesalahan memahami soal, tidak menuliskan informasi yang ada pada soal; (2) kesalahan transformasi, subjek salah dalam melakukan operasi hitung yang digunakan; (3) kesalahan keterampilan proses, subjek tidak melakukan perhitungan dengan benar. Selain itu, pada kesalahan ini subjek tidak melakukan prosedur penyelesaian dengan benar; dan (4) kesalahan dalam menuliskan jawaban akhir, subjek salah dalam menuliskan jawaban akhir. Penyebab subjek melakukan kesalahan adalah karena kurang teliti dan kurang memahami soal yang diberikan. Untuk itu, guru perlu membiasakan siswanya untuk menyelesaikan soal-soal literasi statistik. Selain itu, bagi siswa yang mengalami kesulitan dalam menyelesaikan soal literasi, guru dapat memberikan scaffolding.
Kata kunci: Kesalahan; Literasi Statistik; Newman

Abstract

Statistical literacy is important for students because students will be exposed to their roles as producers and consumers of data. This study describes the errors of 8th-grade students in solving statistical literacy problems based on Newman's perspective. Two students of 8th-grade students at SMPN 6 Bondowoso who made the most errors were subjects in this study. This is a qualitative descriptive study through literacy problems, documentation, and interviews. The data were analyzed based on Newman's perspective and the guidelines for answering statistical literacy questions. The results showed that there were four errors in working on statistical literacy problems were (1) misunderstanding the problem, did not write down the information in the problems; (2) transformation error, the subject incorrectly the arithmetic operation used; (3) process skill error, the subject didn't the calculation correctly. In addition, in this error the subject did not properly carry out the settlement procedure; and (4) errors in writing the final answer, the subject incorrectly write the final answer. The cause the subject makes errors is because they are not careful and do not understand the questions given. For this reason, teachers need to familiarize their students with solving statistical literacy problems. In addition, for students who have difficulty solving literacy problems, the teacher can provide scaffolding.
Keywords: Errors; Statistical Literacy; Newman.

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INTRODUCTION

The results of the 2018 PISA survey, Indonesia position in the bottom ten ranks in terms of education quality. The survey was conducted by the Organization for Economic Cooperation and Development (OECD) as a basis for knowing the development of education in various countries, both developed and developing countries. This survey is also used as a basis for measuring literacy and numeracy levels in the countries participating in the survey.

Literacy is still a chore and a challenge for developed and developing countries, including Indonesia. Currently, mathematical literacy is an interesting topic of conversation among many educational practitioners. Mathematical literacy focuses on students' ability to analyze, reasoning, convey ideas effectively, formularize, solve, and interpret mathematical problems in various forms and situations. This refers to students' ability to relate problems in informal situations with their mathematical knowledge and skills.

Literacy to be developed and applied to various fields, including statistical literacy. The statistical literacy is adjusted to the field that is the focus of the study, statistics. Control of statistical literacy has direct implications for the basic needs of young people as producers and consumers of a collection of data. As data producers, the younger generation mastered the presentation of data so that it can be easily read and understood by others. As data consumers, the younger generation is required to be able to read the data and understand the purpose of presenting the data. So teachers need to familiarize students with their statistical literacy skills.

Furthermore, (Ben-Zvi & Garfield, 2004) states statistical literacy as an important basic ability to understand statistical information or research results. This understanding includes the ability to organize data, read, and interpret it. In fact, students are faced with mathematical literacy problems, there are still many students who make various errors (Pala, 2018). The consequent that the resulting solution is not appropriate. This is reinforced by (Thirafi, 2017) which states that

the statistical literacy level of students is in the very low category (48.6%). As a result, most students have difficulty working on the given statistical literacy questions because students are not used to solving literacy problems.

The importance of an error analysis for students is to find out what errors are made by students in working on the questions. So, to minimize the types of similar errors that will be made by the next student. Study on error analysis in literacy statistical has been carried out by many researchers (Jatisunda et al., 2020; Maryati, 2021; Purnomo et al., 2022; Sari et al., 2022; Tak & Kim, 2020) and others. Previous study, the error analysis using Newman's perspective (Purnomo et al., 2022), Kastolan's perspective (Sari et al., 2022), and others study not used spesification persepective . This creates a gap for researchers to analyze student errors when solving statistical literacy questions, considering statistical literacy as a basic need of the younger generation using Newman's perspective. This is cause limitations of research on statistical literacy errors based on certain perspectives, one of which is Newman

In this study, researchers analyzed the types and causes of students making errors based on Newman's perspective. Newman's perspective was chosen because the stages are suitable for analyzing student errors in solving literacy problems. So, the purpose of this study is to describe the errors of 8th-grade students of SMPN 6 Bondowoso in solving statistical literacy problems by referring to Newman's perspective.

METHOD

This is a qualitative study with a descriptive method involving 13 students of class VIII SMPN 6 Bondowoso. The students involved in this study were 6 male students and 7 female students. Data were collected through semi-structured tests and interviews. The test questions used are in the form of a description of statistical literacy, while the interview guide was developed by the researcher as a reference in conducting interviews with the subject. Statistical literacy questions used in this study are:

SMPN 6 Bondowoso will send a participant in the championship sprint 100 meters. For this situation, the coaching team conducted 7 training sessions with three candidates. The following is data on the time taken by each candidate (in seconds) for 7 times which has been recorded by the coaching.

	1	**2**	**3**	**4**	**5**	**6**	**7**
Sarah	15,2	15,0	14,8	14,7	14,6	14,5	14,2
Rita	15,3	15,4	15,5	15,6	14,5	14,3	14,2
Maria	14,3	14,6	14,8	14,7	15,0	15,1	15,5

Who will be selected for the upcoming championship? Show your steps!

Test and interview instruments, the researchers take validation to lecturers and mathematics teachers' at SMPN 6 Bondowoso to determine the feasibility of the instruments used. This validation was made in November 2021, then revised according to validation input. The results in solving statistical literacy questions were then identified by errors made by students based on Newman's perspective, so that it was known which students made the most errors.

Students who make the most errors were made as research subjects. After determining the subject, the researcher conducted interviews to obtain the information. Students errors were analyzed using Newman's perspective based on the indicators presented in Table 1 below.

Table 1. Errors Indicator Based on Newman's Perspective

Stages	Indicator	Code
Reading errors	Misread keywords, symbols, tables or important information in the problem situations	RE_1
Comprehension errors	Don't write down what is asked in the problem	CE_1
	Don't write down information in the problem	CE_2
Transformation errors	Incorrect using arithmetic operations	TE_1
Process skill errors	Miscalculated	PS_1
	Incompletion procedure	PS_2
Encoding errors	Conclude the solution incorrectly	EE_1

RESULT AND DISCUSSION

The researcher gave test questions to 13 students of 8th-grade SMPN 6 Bondowoso then checked to identify the errors made. The recapitulation of student errors in solving statistical literacy questions is presented in Table 2 below.

Table 2. Recapitulation of Student Errors Based on Newman's Perspective

Initial	RE_1	CE_1	CE_2	TE_1	PS_1	PS_2	EE_1	Total
NKS	0	1	1	1	0	1	1	5
DA	0	0	1	1	0	1	0	3
SDWS	0	1	1	0	0	0	0	2
K	0	0	1	1	0	0	1	3
MSH	0	0	0	1	0	1	0	2
LHQ	0	1	1	0	0	1	0	3
DAA	0	1	1	0	0	0	1	3
AR	0	1	0	1	0	0	1	3
AW	0	1	1	0	1	1	1	5
RFY	0	0	0	1	0	0	1	2
MIS	0	1	1	0	0	0	0	2
SRM	0	1	0	0	0	0	1	2
FAM	0	1	1	0	0	1	0	3

Based on Table 2, the students who made the most errors were the two subjects coded NKS and AW. Each subject made five errors, CE1, CE2, TE1, PS2, and EE1. Furthermore, NKS is coded as S1 and AW is coded as S2. The following describes the errors made by S1 and S2 based on their work based on Newman's perspective.

1. Reading Errors

Students are said to have made an error in reading if they did not mark the keywords, symbols, and tables or write them on their answer sheet. This can be seen from the keywords that were not given to each subject on the answer sheet and interviews on the following.

R : There are keywords from the problems above? *(S1.R.11)*
S1 : Championship, student delegation *(S1.R.12)*
R : Why you dont write them? *(S1.R.13)*
S1 : No sis, no instruction for this *(S1.R.14)*

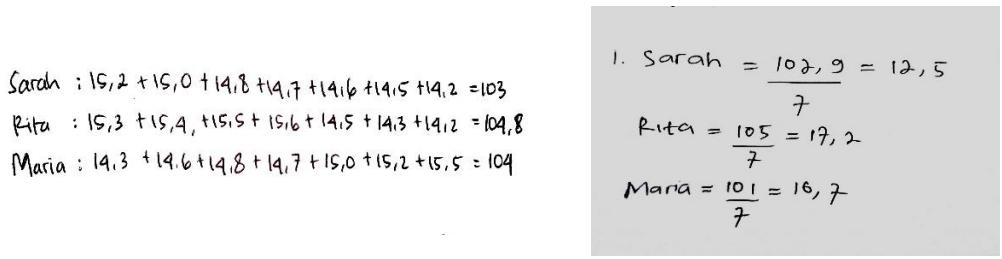
R : From situation above, any keywords? *(S2.R.9)*
S2 : student delegation be elected by the coach *(S2.R.10)*
R : Why you dont write them? *(S2.R.11)*
S2 : Hehehe...no sis *(S2.R.12)*

In subject's interview show that the subject was able to mention keywords from the problem situation. Keywords in problem situations are an important thing to solving

the problem including statistical literacy. Analog previous studies (Juniarso et al., 2020; Prayitno et al., 2018; Prayitno et al., 2020; Prayitno et al., 2020; Rachmawati et al., 2019) keywords are the key to success in the problem-solving process. Based on Newman's perspective showed that the subject made errors. This leads to an incorrect understanding problem situation and difficulty writing down the information as known in the answer sheets (Prayitno, Purwanto, Subanji, Susiswo, & As'ari, 2020; Prayitno, Purwanto, Subanji, Susiswo, Mutianingsih, et al., 2020).

2. Comprehension Errors

Errors in comprehension the problem situation occur when students do not write down variables are known and asked in the questions. The errors in comprehension the problem situation made by S1 and S2 in solving statistical literacy problems are presented in Figure 1.



S1 comprehension errors S2 comprehension errors

Figure 1. Subject Errors in Comprehension Solving Statistical Literacy Problem

In Figure 1, S1 and S2 made an errors not writing down information was asked in the problems (CE1) and not writing down what was known in the question (CE2). S1 and S2 immediately wrote down the solution to the problem because they did not know what they wanted from the question. This is reinforced by the quote interview as follow.

R : Hi, why you don't write down information in your answer? (S1.Up.38)
S1 : I'm not habitual to write information known and asked (S1.Up.39)
R : Can you explain to me what is the problem wants? (S1.Up.40)
S1 : I don't know sis, what the problem wants to solve (S1.Up.41)

R : AW, why you don't write down the problem information? (S1.Up.28)
S2 : Sorry sis, I'm just focused on solving the problem (S2.Up.29)

From the interview quote above, S1 is not used to writing down information are known and asked from a problem situation. This is reinforced by the statement that

S1 does not know what is desired from the question, while S2 only focuses on solving the problem so that it does not write down information are known and asked. Based on Newman's perspective, the two subjects who did not write down were in the category of making errors. Analog (Hidayat & Pujiastuti, 2019) states that misunderstandings about problem situation can be seen from the students work when writing down information are known and asked. Understanding is shown through important words that are often not written by students on the answer sheet. In line with (Septiahani et al., 2020) that the error in understanding the problem (comprehension error) is not understanding the information in the question completely. In addition, students do not understand the questions in the problem, so students cannot arrange questions and answer them at the same time. Misunderstanding occurs because students do not know the meaning of the question implicitly in the question (Amalia et al., 2018).

3. Transformation Errors

S1 made a transformation error by using the sign of a arithmetic operation to solve literacy problems and S2 did the transformation process correctly. The transformation errors made by S1 in solving statistical literacy problems are presented in Figure 2 below.

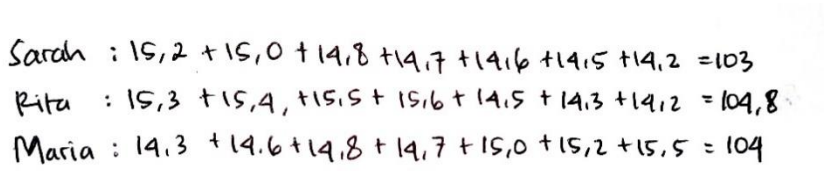


Figure 2. Subject Errors in Transformation Solving Statistical Literacy Problem

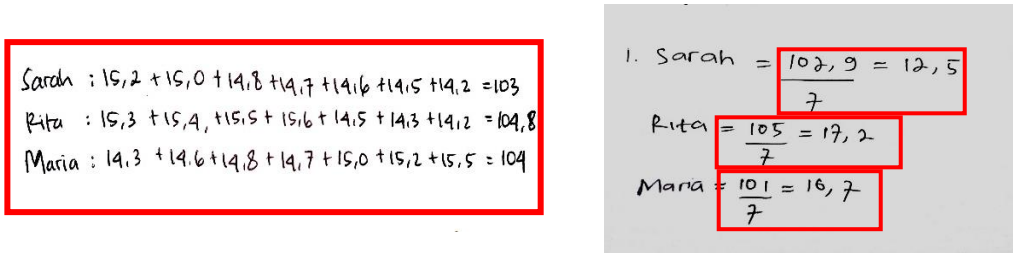
In figure 2 above, S1 determines the sign of the arithmetic operation incorrectly to solve the problem. S1 only uses the addition arithmetic operation, the operation used is the addition calculation operation and then the division is carried out according to the amount of data. This is reinforced by the results of the interview as follows

R	: Are you sure about your answer?	(S1.T.66)
S1	: *I'm confused, what should I do with it (scratching)*	(S1.T.67)
	So I just add it all to find the answer	(S1.T.68)

From the interview above, it was shown that S1 had confusion in choosing the arithmetic operation that should be used. Based on Newman's perspective, the subject is in the category of incorrectly determining arithmetic operations. In line with the previous study that transformation error is an error that often occurs when students cannot determine arithmetic operations correctly (Fauzi & Diansyah, 2021). Many factors are the cause, one of which is that students do not know the arithmetic operations that will be used to solve problems (Amalia et al., 2018; Septiahani et al., 2020). It is different from the S2 subject can determine the arithmetic operation in solving literacy problems correctly. S2 can translate the keywords from the given literacy questions well so that they can transform well. The transformation of keywords is an important step for students in solving problems (Prayitno et al., 2018), especially literacy problems.

4. Process Skill Errors

Process skill errors are errors in the calculation process and perform the procedure incorrectly. Process skill errors made by S1 and S2 in solving statistical literacy problems are presented in Figure 3 below.



S1 process skill error S2 process skill error

Figure 3. Subject Errors in Process Skill Solving Statistical Literacy Problem

In Figure 3 above, S1 made a transformation error and did not make a process skill correctly. However, the transformation error made is certainly one of the factors that the subject makes a process skill error that is the final results of the answers given. Meanwhile, S2 made a calculation error and perform the procedure incorrectly. This is reinforced by the interviews as follows.

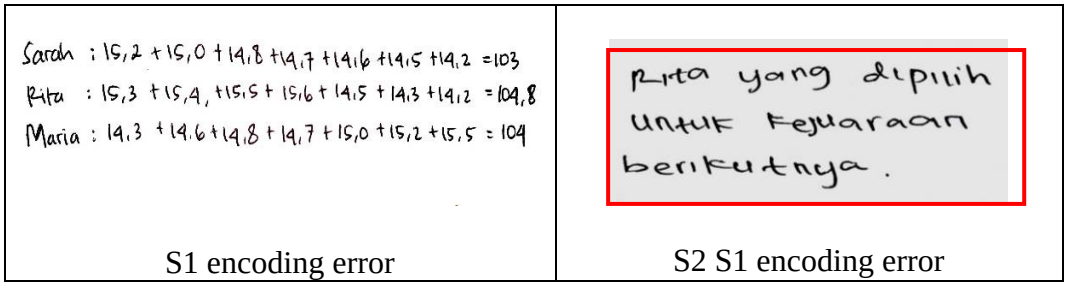
R : Are you sure about your calculation? *(S1.PS.79)*
S1 : I think not as expected. I don't know sis *(S1.PS.80)*
I don't understand *(S1.PS.81)*

R : Are you sure about your calculation? (S2.PS.84)
S2 : Oh, sis, I'm not very careful
Sarah's data count should be equal to one hundred and three, Rita one hundred four point eight, and Maria one hundred four (S2.PS.85)
R : Didn't you check it again? (S2.PS.86)
S2 : I don't have time sis. Sorry (S2.PS.87)

The quote above shows that S1 does not know how to solve the literacy problems presented. Meanwhile, S2 was wrong in calculating because he was not careful when the calculation process was carried out. From the results of the master's work, it appears that the subject did not write down the problem-solving process and carry out the procedure correctly. Based on the reinforced results interview above, it shows that the subject does not have enough time to write down the answer. If viewed from Newman's perspective, S1 and S2 are included in the category of making errors. S1 did not understand how to solve the problem, while S2 was less thorough and did not write down the steps in solving the problem in detail and clearly. This is in line with previous study that often students do not calculate correctly and are not aware of the process carried out to solve problems correctly (Fauzi & Diansyah, 2021; Prayitno, Purwanto, Subanji, Susiswo, & As'ari, 2020; Septiahani et al., 2020).

5. Encoding Errors

The errors of encoding S1 and S2 is not writing the final answer correctly. S1 not writing the final answer when solving statistical literacy problem. Meanwhile, S2 errors in writing the final answer made in solving statistical literacy problem. They works are presented in Figure 4 below.



S1 encoding error | S2 S1 encoding error

Figure 4. Subject Errors in Encoding Errors Solving Statistical Literacy Problems

In Figure 4, S1 made a errors by not writing the conclusion from the answer given, while the subject of S2 did not write the conclusion correctly. This is reinforced by quote interviews as follows.

R : Why you don't write the conclusion? *(S1.EE.113)*
S1 : I'm forget it *(S1.EE.114)*

R : So, the conclusion is.. *(S2.EE.126)*
S2 : Rita selected for the next championship *(S2.EE.127)*
Because Rita's most results *(S2.EE.128)*

From the quote above, S1 did not write down the conclusion due to forgetting. But S2 did not write it down correctly but it was clarified through interviews. S2 thinks that with the most results as the most appropriate candidate to take part in the championship, the shortest travel time should be chosen. According to Newman's perspective, students who do not conclude correctly are included in the category of making errors. In line with the previous study often students do not write down the final answer according to the situation of the questions given (Ampur et al., 2021; Fitriatien, 2019; Mutianingsih et al., 2020). This is an assumption from students that the results of the calculation are the desired final answer.

CONCLUSION

Based on results of the analysis and discussion above, it can be concluded that an errors in understanding the problem because they did not write down the information that was known and asked from the problem. Subject made a transformation error by using the arithmetic operation incorrectly in solving the problem. Then, the subjects made a process skill error because their calculations incorrectly and the procedure to solve the problem incorrectly too. The subjects write down the final answer incorrectly, S1 did not write down the final answer but S2 giving errors final answer. Suggestions that researchers can give are that teachers need to familiarize students with solving literacy problems. So that when implementing the minimum competency assessment evaluation, satisfaction results can be obtained. When students have difficulties, the teacher can provide scaffolding to their students so that students can overcome the difficulties they face.

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