

Using Watson Criteria for Analyzing Student Errors: Systematic Literature Review (SLR)

Aswin ^{1*}, Dadang Juandi ²

^{1,2} Universitas Pendidikan Indonesia, Indonesia.

*Corresponding Author. E-mail: aswin@upi.edu

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Abstract

This study aims to analyze the distribution of research related to the use of the Watson criteria in analyzing student errors at all levels of education. The method used is Systematic Literature Review (SLR). The sample consists of 42 results of qualitative research on the use of Watson's criteria in analyzing student errors. Samples were taken from indexed journals published in the 2017-2021 period. The key question of this research is how the description of the distribution of research related to the use of the Watson criteria in analyzing student errors, is reviewed based on the year of publication, level of research, methods used, number of subjects, types of questions, demographics, and types of errors made by students. Through the SLR method, it was found that there was an increase and decrease in the number of studies over the last five years. Based on the criteria for junior high school level studies, the use of descriptive qualitative methods, using story questions, with less than 30 subjects, and the demographics of research on the island of Java are the most dominant. The most dominant student errors are procedural errors and missing conclusions. This becomes very important to be considered in learning mathematics.

Keywords: Student Error, Watson Criteria, SLR

INTRODUCTION

Evaluation is a systematic, comprehensive process that includes assessment, measurement, analysis, and interpretation of data to determine the extent to which students have achieved the learning objectives that have been implemented. (Widiyanto, 2018). In other words, evaluation aims to determine the level of success of a program that has been carried out. In addition, (Pramesti, 2020) defines evaluation into three, namely, (1) evaluation is a process of retrieving information whose data is quantitative or



qualitative, (2) evaluation is a process of analysis and interpretation, (3) evaluation is a process that includes important things that form the basis for making a decision..

The evaluation implementation that is most often used in education today is the written test because it tends to be easier to carry out. However, in carrying out the evaluation, it was not fully implemented, especially in the section on analyzing student answers. This certainly attracts attention because analyzing student errors is an important thing that needs to be done so that it becomes a consideration for further learning (Oktavianingsih et al., 2019). In addition, analyzing student errors also aims to find out the causes of student errors making mistakes, so that further these factors can be overcome (Dewi et al., 2019; Islam et al., 2021). So, students' mistakes in solving math problems must be considered so that the mistakes students make do not occur continuously.

There are many ways to analyze student errors in solving math problems, including Newman, Watson, Brodie, and Fongs. This study uses the Watson criteria. There are 8 types of errors grouped by Watson (Dazrullisa & Hadi, 2021; Sarwoedi, 2019) including, (1) inappropriate data, students do not use the right data from the questions given, (2) Inappropriate procedure, (3) omitted data, (4) omitted conclusion, (5) response level conflict, where students do not understand the questions, (6) undirected manipulation, (7) Skills hierarchy problem, (8) Above other than the 7 previous types of errors. Criteria Watson is very suitable to be used to analyze student errors in solving math problems, this is supported by Permatasari (Saputri et al., 2018) To obtain complete and comprehensive information and appropriate data, researchers intend to examine more deeply related student errors in solve math problems based on Watson's criteria using the Systematic Literature Review (SLR).

Systematic Literature Review is a method used by a researcher to identify, review, evaluate, and interpret all available research in the topic area of an interesting phenomenon, with research questions that are certainly relevant (Iskandar & Juandi, 2022; Triandini et al., 2019). Then (Aliyah & Mulawarman, 2020) stated that the Systematic Literature Review method is a method used to identify, assess, and interpret findings on a research topic to answer predetermined research questions. Similar to research in general, SLR research follows the steps in its implementation, namely setting goals, concepts, and methods used (Juandi, 2021).

The main purpose of this study is to describe the results of research related to the use of Watson's criteria in analyzing student errors, reviewed based on the year of publication, level of research, methods used, number of subjects, types of questions, research locations, and journal indexes. Therefore, an important stage of the SLR is collecting data in the form of research results from analyzing student errors in solving math problems based on Watson's criteria. Through the research data that has been extracted, the researcher asks several relevant questions as follows: (1) How is the description of research results regarding the use of Watson criteria in analyzing student errors in terms of the year of publication?, (2) How is the description of research results regarding the use of Watson criteria in analyzing student errors in terms of education level?, (3) How is the description of research results regarding the use of the Watson criteria in analyzing student errors in terms of the method used?, (4) How is the description of research results regarding the use of Watson criteria in analyzing student errors in terms of the number of subjects?, (5) How is the description of research results regarding the use of Watson's criteria in analyzing student errors in terms of the type of questions used?, (6) How is the description of research results regarding the use of Watson's criteria in analyzing student errors in terms of demographics? and (7) How is the description of the research results regarding the use of Watson's criteria in analyzing student errors in terms of the most dominant errors?

METHOD

Systematic Literature Review (SLR)

This research is a *Systematic Literature Review*. Dixon-Woods in (Khalaf & Zin, 2018) defines SLR is “*a scientific process governed by a set of explicit and demanding rules oriented towards demonstrating comprehensiveness, immunity from bias, and transparency and accountability of technique and execution*”. Then Littell, Corcoran, and Pillai in (Juandi, 2021) *Systematic Literature Review*, which is survey-based research that uses a descriptive quantitative approach. The survey in this study was conducted to collect secondary data, namely data collected from the results of research on the use of Watson's criteria in analyzing student errors.

The procedure of this research is to collect data, analyze the data and draw conclusions. The data collected is primary data that has been made into articles or national journals. Data collection was carried out with the help of electronic databases registered

and indexed by Google Scholar, Garuda, and national journal URLs. Then, the data collected is sorted, so that only relevant articles or journals will be used in the research.

Inclusion criteria were carried out to filter the articles that had been obtained and choose those that would be used in the research, this was in line with what was stated by (Xiao & Watson, 2019) and (Triandini et al., 2019). The inclusion criteria in this study were:

1. Articles of research results in Mathematics Education.
2. Articles published in 2017-2021.
3. Research on the analysis of student errors in solving math problems based on Watson's criteria.

Research Instruments

The research instrument is in the form of observation sheets or matters relating to the inclusion criteria and exclusion criteria. The criteria are based on the year of research, level of research, the method used, number of subjects, types of questions, research location, and journal index.

Population and Sample

The population in this study are all studies on the use of Watson's criteria in analyzing student errors that have been published in various publishers. Based on a search using a search engine, the sample of this study is 42 articles that are relevant and worthy of a systematic review.

Data collection technique

The data collection technique in this study was by collecting articles related to the use of Watson's criteria in analyzing errors. The search engines used to collect data are Google Scholar, Garuda Portal, and Google.

Data analysis technique

The data analysis technique used in this research is descriptive quantitative.

RESULT AND DISCUSSION

1. Studies by Year of Publication

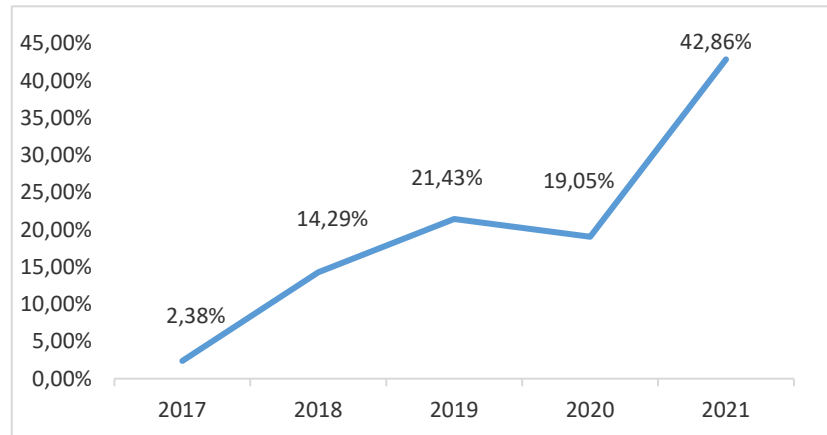


Figure 1. Study Results by Year of Publication

Based on Figure 1, it is found that, in the last 5 years, research on the use of Watson's criteria in analyzing student errors was most published in 2021, which was 42.86% (18 journals). Then, research on the use of Watson's criteria in analyzing student errors was the lowest in the last 5 years, namely in 2017 at 2.38% (1 journal). In addition, based on the picture above, it can be seen that research related to the use of the Watson criteria in analyzing student errors has increased from 2017-to 2019 and then decreased in 2020, but increased again in 2021. This increase is of course due to the importance of analyzing student errors. this is due to considering the use of the right model in the material to be taught (Suciati & Wahyuni, 2018).

2. Study by Education Level

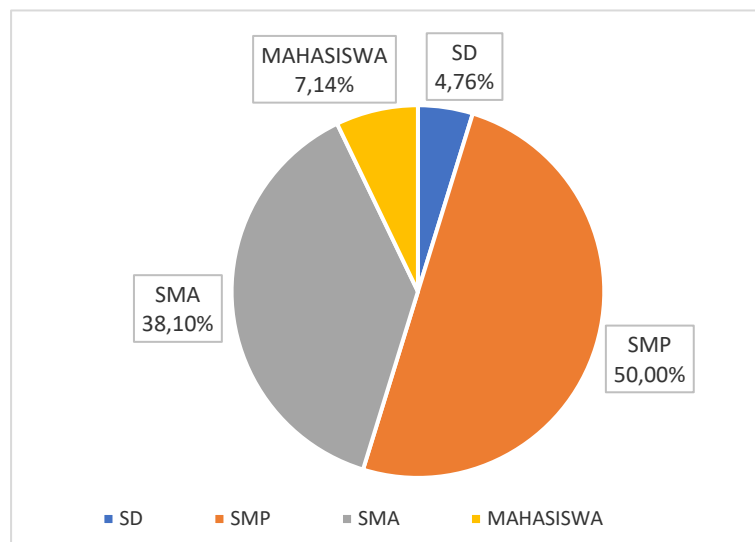


Figure 2.

Study

Results by Education Level

Based on Figure 2, it can be concluded that research on the use of Watson's

criteria in analyzing student errors is mostly carried out at the Junior High School (SMP) level. Meanwhile, at the Elementary School (SD) level, the least research has been done on the use of the Watson criteria in analyzing student errors. This is a concern because students' mathematical abilities are trained since elementary school, if students' mistakes are not analyzed since elementary school, these errors will occur continuously which will disrupt the process of developing student knowledge. (Paladang et al., 2018)

3. Studies Based on Research Methods

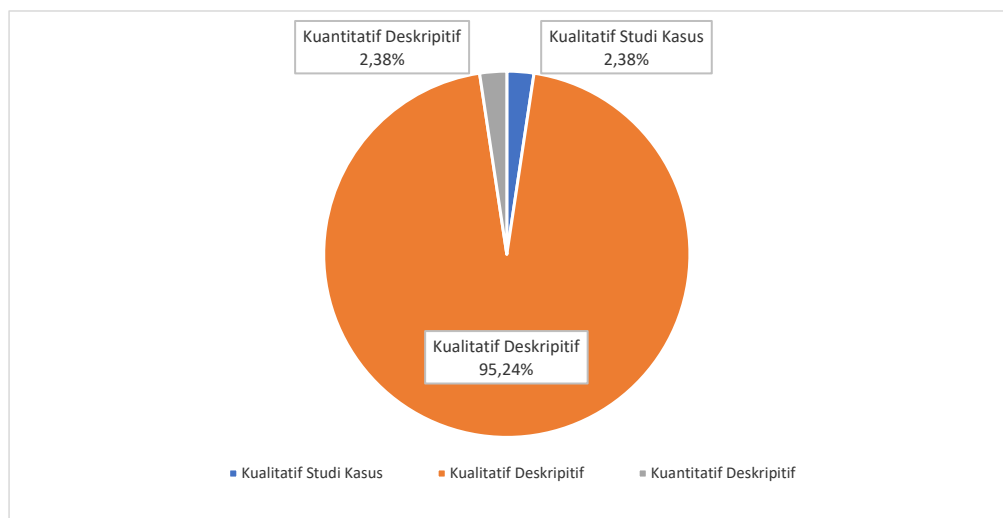


Figure 3. Study Results Based on Research Methods

Based on Figure 3, it is seen that in the last 5 years related to research on the use of the Watson criteria in analyzing student errors, it is dominated by descriptive qualitative research, meaning that research results are presented by describing students' errors in solving math problems and knowing the causes of errors made by students. In addition, there is also the use of descriptive quantitative methods which only look at the location of student errors without knowing more about the causes of errors made by students.

4. Study by Number of Subjects

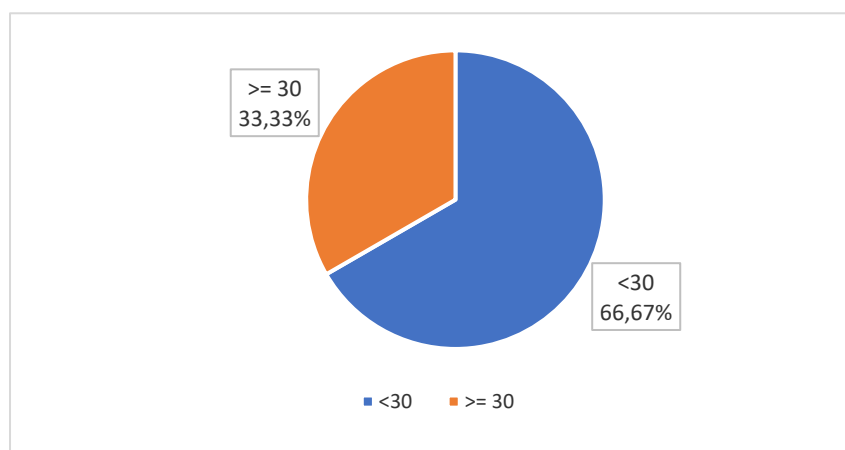


Figure 4. Study Results Based on Number of Subjects

Based on Figure 4, it can be seen that in the last 5 years the research on the use of the Watson criteria in analyzing student errors was dominated by the use of subjects with less than 30 subjects. This is because this research is dominated by descriptive qualitative research which examines more deeply related to student errors.

5. Study by Type of Questions

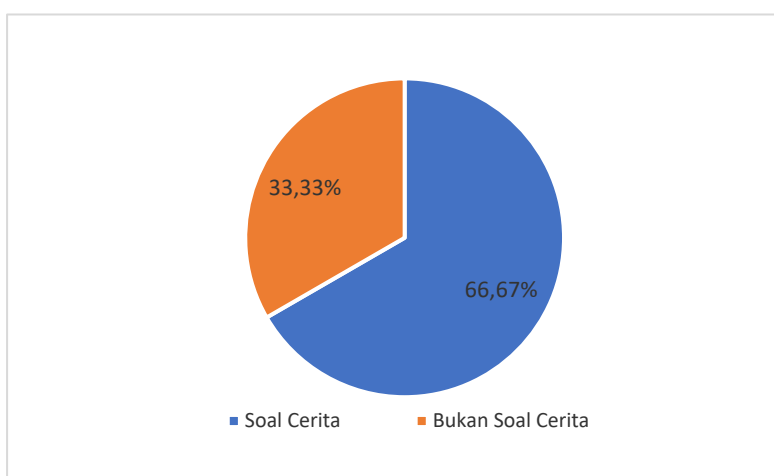


Figure 5. Study Results Based on Types of Questions

Based on pictures. In the implementation of related research, analyzing the use of Watson's criteria in analyzing student errors is dominated by the use of story questions as a test tool to find out where the mistakes made by students are. The basic reason why researchers use story questions a lot as a test instrument is because most students have difficulty solving math story problems and causing errors in the process. (Dwidarti et al., 2019)

6. Study Based on Research Location

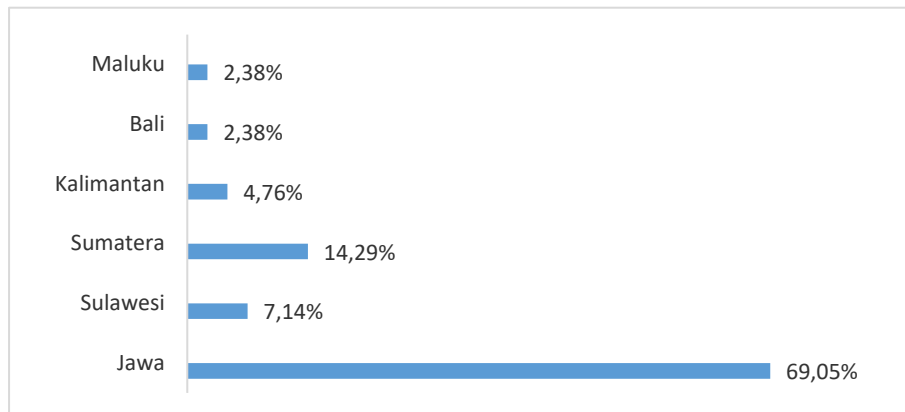


Figure 6. Study Results Based on Research Locations

Figure 6 explains where the researchers took research data regarding the use of Watson's criteria in analyzing student errors, dominated by Java, which consisted of West Java, East Java, and Central Java. In addition, it is also seen that the islands of Maluku and Bali are the islands with the least research on error analysis from the 6 islands obtained by search engines.

7. Study Based on Types of Errors made by Students

Sumber: Karlina (2019)

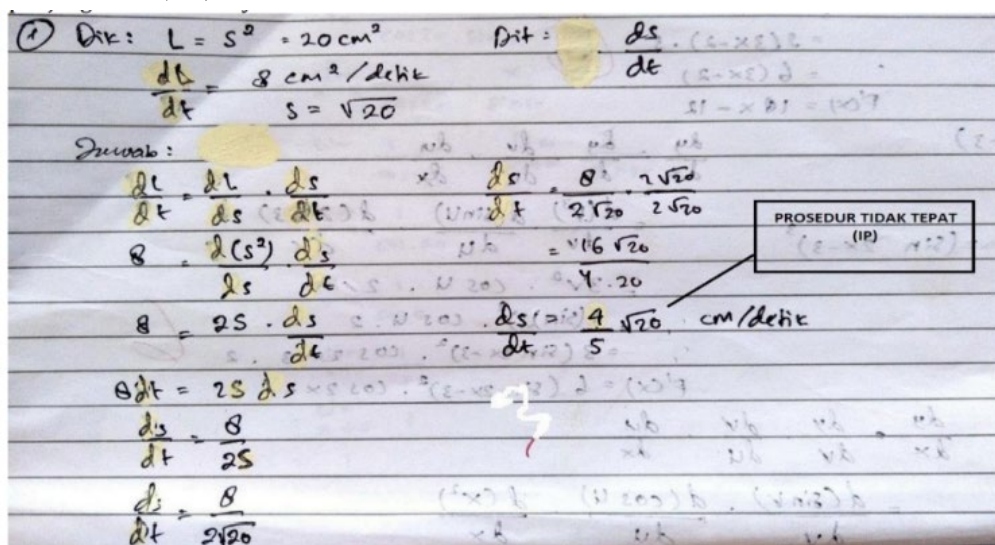
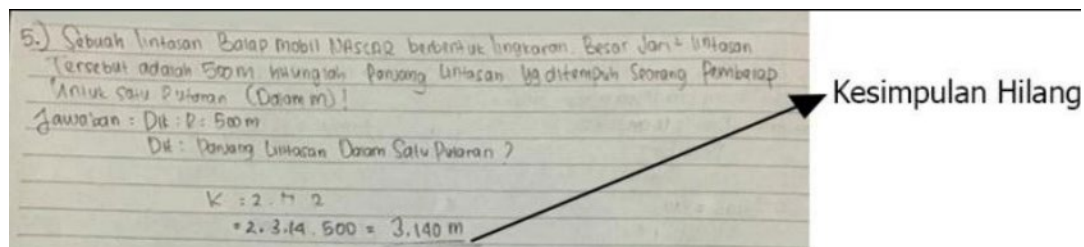


Figure 7. Inappropriate procedure

Based on the articles that have been analyzed, the types of student errors that are mostly made based on Watson's criteria are incorrect procedures and missing conclusions. Improper procedural errors are errors that occur when students try to operate at the right level, but students use inappropriate steps or procedure and solve problems with inaccurate concepts (Rahayu, 2019). Here's an example of the error

While the omitted conclusion error is an error that occurs when students solve problems, fail to conclude answers, or do not even find the final answer which is a solution (Munawaroh et al., 2018). Here is one example of the error.



Sumber: Karimawati,dkk (2021)

Figure 8. omitted conclusion

This is certainly a concern for students and especially for educators, so that they can find solutions regarding incorrect procedural errors and missing conclusions.

CONCLUSION

Research on the use of Watson's criteria in analyzing student errors has received considerable attention every year, which is marked by the publication of articles in several search engine databases. Based on the criteria for junior high school level studies, the use of descriptive qualitative methods, using story questions, with less than 30 subjects, and the demographics of research on the island of Java are the most dominant. The most dominant student errors are procedural errors and missing conclusions. This becomes very important to pay attention to in learning mathematics. This study recommends to teachers related to student errors in the procedural error section and the conclusion of a problem to be paid more attention to so that student errors in that section can be reduced.

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