Interpreting Skills to The Student's Mathematical Problem-Solving Process

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ABSTRACT

The objective of the study was to analyze the teacher's skills, and the interpreting skills of the teacher in identifying the student's ability to solve problems based on the stages developed by Swartz (1998), i.e. generating ideas, clarifying ideas, and assessing the reasonableness of ideas. This type of research is qualitative descriptive research. The data analysis techniques used are data reduction, data presentation, and conclusion drawing. The students involved in solving mathematical problems are named A, B, C, and D. The four teachers involved as research subjects are represented by G1, G2, G3, and G4. Each teacher is given four student answers which are then analyzed. Interpreting skills of each subject are developed by researchers in the way of interviews. The interviews conducted are semi-structured, then the results of the interviews are analyzed by the researchers. Data analysis techniques using the Miles and Huberman model are: 1) data reduction; 2) data display; and 3) concluding drawing. The results show that G2 and G4 have complete interpretation skills, whereas G1 and G3 have interpreting skills that only generate and clarify ideas.

Keywords: interpreting; noticing; problem-solving

INTRODUCTION

Teachers are the most important element in the learning process of teaching education. The primary task of a teacher is to educate, teach, guide, direct, train, evaluate, and evaluate students (Lisnawati & Rohita, 2022; Septian et al., 2022; Sugiarni et al., 2022). The success of the teaching-learning process can be influenced by the teacher's skills (Adetia et al., 2023; Asri et al., 2021). There are eight basic teaching skills that a teacher needs to have, namely basic and advanced questioning skills, explanatory skills, classroom management skills, skill using variation, small group guidance skills, reinforcing skills, small and individual teaching abilities, opening and closing skills (Mulyasa, 2010). Classroom management skills can be developed by teachers through noticing skills.

Teacher noticing skills are very important to a teacher. Teacher noticing is a skill to be aware of certain things that students do (Schoenfeld, 2014). Teacher noticing skills are defined as the skills to pay attention to the teaching-learning process (Sherin et al., 2011). About students, teacher noticing is the skill to notice and recognize changes in the student's teaching-learning process. Teacher noticing skills are a core construction in learning (Es & Sherin, 2021). According to Sherin (2017), teachers' noticing skills can be used to identify obedient interactions with teachers and have their creativity so that teachers can identify the level of student understanding in the teaching-learning process. Teacher's noticing skills comprise three components, namely: (1) attending, the teacher's skills in observing the strategy used by the student as well as the student's thinking, (2) interpreting, the teacher's

skills in interpreting students' understanding based on students' thinking, and (3) responding, the teachers skills in deciding next steps based on previous analysis (Jacobs et al., 2010).

Noting skills can improve the professionalism of teachers. Professional teachers are used to diagnose students' thinking (Sherin et al., 2008). Diagnosing a student's thinking is the same as interpreting a teacher's skills. Teacher interpretation is an activity that interprets the student's skills in solving tasks by taking a problem-solving approach based on the experience of the student. Interpreting covers three stages developed by Swartz (1998): generating ideas, clarifying ideas, and assessing the reasonableness of ideas. Teacher interpretation can be done by giving responses to the students. For example, the idea of "this student answers right/wrong" or "these students have understood nothing about the matter...".

A lot of research has been done on teacher interpretation skills. One of the studies conducted by Kurniasih (2022) teachers interpreted mathematical understanding by focusing on right or wrong, the only correct solution, deficiencies in the student's work process, how they write and draw on mesh paper and other things that are indirectly related to mathematics thinking, stated that working on the subject is easy, and compared the teacher and student thinking processes. Then Copur-Gencturk & Tolar (2022) which showed that the teacher's interpretation of events that attracted the attention of students without any basis differs from the teachers' knowledge of the student's mathematical thinking and mathematics-specific teaching actions planned by the teacher to enhance student learning. Based on these researches, research on interpreting is needed to identify students' ability to solve problems.

Solving problems is a very important thing in mathematics. Krulik & Rudnick (1988) explained that "Problem-solving is a process. It is means by which an individual uses previously acquired knowledge, skills, and understanding to satisfy the demands of an unfamiliar situation". Problem-solving is also defined as the individual process of finding unclear solutions to a problem (Siswono, 2018). Solving problems in mathematical learning indirectly trains students to be able to solve more complex problems in everyday life (Oemolos, 2021; Septian & Rahayu, 2021; Setyaningsih & Firmansyah, 2022). Students in mathematical problem solving can use strategies developed by Polya (1973) namely: understand problems, formulate plans, implement plans, and re-examine assigned responsibilities.

RESEARCH METHODS

This research is qualitative. Qualitative research is used to understand the phenomena experienced by research subjects. For example, behavior, actions, expressions, and so on. Researchers act as planners, implementers, data collectors, and data analysts. Research instruments are guidelines for interviews and material story issues of the Three Variable Linear Equation System (SPLTV).

The problem was given to four students with codes A, B, C, and D. After obtaining students' answers, instruments were given to research subjects such as teachers. The four subjects were given codes G1, G2, G3, and G4. Further, the four students' answers were given to each teacher to be analyzed by each teacher. Interpreting skills of each subject are

digged by researchers in the way of interviews. The interviews conducted are semi-structured interviews, then the results of the interviews are analyzed by the researchers.

Meanwhile, data analysis techniques using the Miles and Huberman models, are: 1) data reduction; 2) data display; and 3) conclusing drawing. Data reduction is done by summarizing and encoding the data from the interview results into the sentences that are subsequently presented in the research results. The data presentation is presented in the form of tables, pictures, and interview results that can detail the results of the research. Conclusion withdrawal is done by drawing conclusions that have been presented on the data presentation. Conclusion drawings are useful to make research produce more detailed and firmly rooted results.

RESULT AND DISCUSSION

Of the four student answers, each teacher explained the response to the researcher in the form of interviews. They responded to the four students' answers to learn in depth how the teacher's interpreting skills. The responses of each teacher to solving mathematical problems can be seen in Table 1 below:

Table 1. Interpreting Skills of Each Teacher

Indicator	G1	G2	G3	G4
Generating Ideas	√	√	√	√
Clarifying Ideas	√	√	√	√
Assessing the Reasonableness of Ideas	√		√	

At this stage, the researchers analyzed the teacher's interpretation skills by looking at the ideas the teacher put forward when answering researchers' questions. Each subject arouses the ideas of each student by looking at the steps the student uses in solving mathematical problems. The ideas submitted by the subject lead to these types of students in solving mathematical problems. Like the result of an interview with G1:

G1 : *A has a simple and non-discreet character, an important type I understand. Type B students who work on matters according to the instructions of the teacher, but are not careful in their work. Type C students are detailed, systematic, and clear in the work of matters. Type D students are short, compact and clear*

The idea of G1 is that student B works according to the instructions of the teacher, but is not careful in doing it. The idea is clarified by G1 by mentioning the reason why student B takes steps such as understanding problems, drawing up plans, and implementing plans. However, student B has not yet conducted a re-examination of the answers obtained. As a result, the student still gets the wrong answer (Figure 1). The results are consistent with (Erfani et al., 2020) errors on re-checking methods if the student does not review the answers obtained and obtain less accurate answers. So G1 performs interpreting skills towards the student's problem-solving process by generating ideas and clarifying ideas.
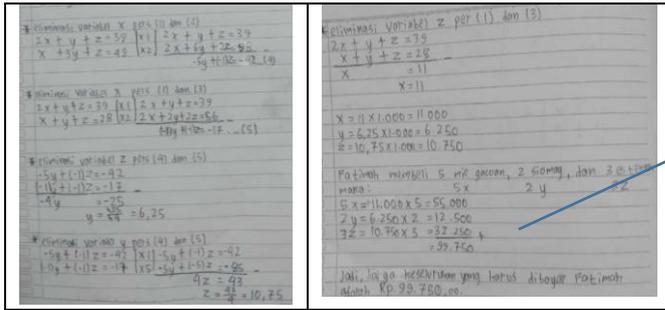
Figure 1. Student B Answer Results

Next, G2 raises the idea by identifying the calculation processes that students perform, for example, mentioning students combining two ways in solving problems. Besides, G2 also mentions the differences of each student.

G2 : *A processes the data first and then solves the problem by combining two methods of solution so that it accelerates the obtaining of results. B also processes data first, in solving problems B uses one type of method of solution to obtain the results with a systematic complete and clear. C processes first the data then performs the selection before elimination for efficiency and speed in getting the data. D is the same as student C. The difference lies only in the lack of explanation of each step*

Based on the exposure, G2 performs interpreting skills in more detail on students' answers. Subject G2 interprets the way students use them, students' shortcomings and advantages, and the efficiency of time in solving mathematical problems. Subjects G2 clarify each student by mentioning similarities and differences. For example, the whole student goes through data processing first, as well as the same student D as C. But there is a difference that there is less explanation on each step that D writes on the answer. Then G2 evaluates the validity by comparing the idea obtained with the student's answer. For example, in D who has less explaining on every step, G2 points to the less comprehensible part (Figure 2).
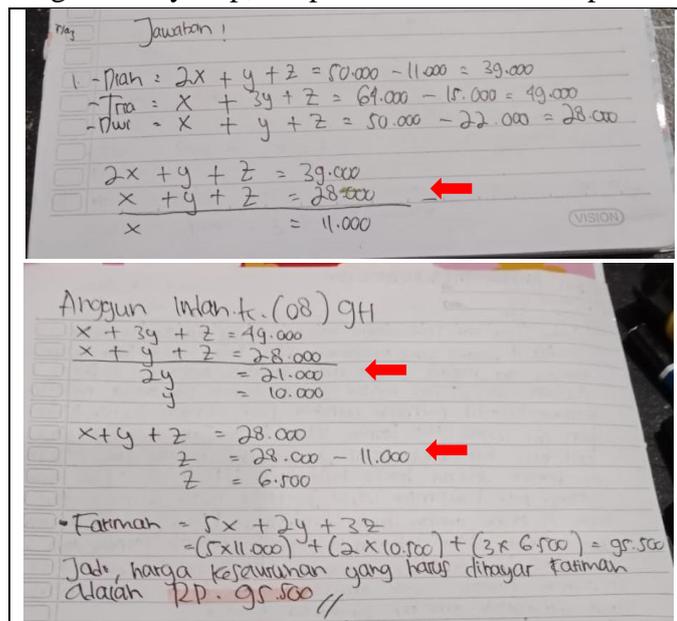

Figure 2. Student B Answer Results

This is in line with Kurniasih (2022) research that explains that one of the teacher's interpreting skills is done by focusing on deficiencies in students' answers, so that G2 performs the interpreting skill in a narrow way that is to arouse, clarify and evaluate the validity of ideas.

The next idea expressed by G3 explains the way students use and the appropriate procedures. G3 mentions that A, B, C are capable of understanding the given problem, as well as being able to determine mathematical sentences. More clearly the idea of G3 is as follows:

G3　：　*A,C,D solve problems using a quick method by looking back in detail at the existing equations in order to get results faster. Whereas B is more monotonous using the procedures that have been taught in solving the three equations. So A, C, D are more innovative than B*

The G3 idea that mentions A, C, D is more innovative than B is clarified by explaining the reasons why the idea arises. One of the ones on A, G3 shows that A performs all the rare steps of Polya (1973), that is, understand the problem, formulate the plan, implement the planning, and re-examine the answers obtained. These steps are shown by G3 through the answer A. According to G3, answer A is more interesting because it has different colours on the answer (Figure 3). In line with the Copur-Gencturk & Tolar (2022) that mentions that the teacher's interpretation of an event that attracts attention can enhance student learning. Subjects G3 perform interpreting skills towards the student's problem-solving process by raising ideas and clarifying ideas.
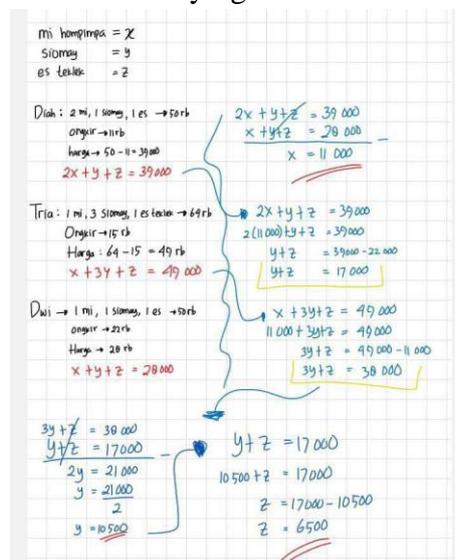

Figure 3. Student A Answer Results

While G4 performs comprehensive interpretation skills by generating, clarifying, and evaluating the validity of ideas. The ideas presented by G4 are based on the types of students in solving mathematical problems. Like the idea of G4 on A, as follows:

G4　：　*A type of student who is less detailed in explaining a step of completion and the writing of answers is also jump-and-slip. It's supposed to be a type of*

> *student like this data finds a quick response in determining an answer, but the student is too rotating in answering*

The idea A is detailed and sloppy, clarified by the statement that a student of this type of data finds a quick answer in determining an answer. Then it is evaluated with a sentence but the student is too rotating in answering. Next on B G4 gives the idea as follows:

G4   :   *Type of student that is procedural (detail in doing write down every step he's done). Students like this should rarely find calculation misunderstandings, but in addition to the way they answer that rotates on the student's answers also found calculation mistakes*

Not far apart from the idea given to A, G4 expresses the idea of B that finds confusion in the calculation. It is the same as the ideas of G1, G2, and G3 that mention that B is still doing the wrong calculation so it gets an inaccurate answer. Then on C and D, the idea given to G4 is as follows:

G4   :   *C is a type of student whose answer is structured, detailed (each step is described), quick (the answer does not rotate/can find a quick way), and accurate. D is a kind of student who does not want to be long in writing the answer. Actually the answer is the same as C, but D does not give an explanation of each step of completion.*

The G4 idea that C type of student whose answer is structured, detailed, quick, and accurate is clarified by justifying the answers and the steps taken by C. The measures used are already in line with those developed by Polya (1973), so that C gets the correct answers (Figure 4). Then G4 evaluates the validity of the ideas submitted by comparing the ideas with the answers written by the student. For example, in D who does not give an explanation of each step, G4 shows the part of the student's answers that are not explained in each step.
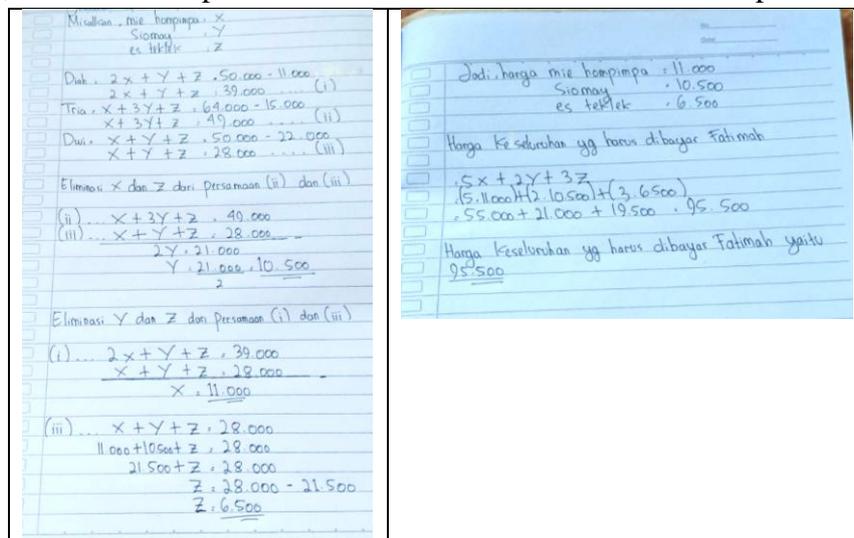

Figure 4. Student C Answer Results

Teachers develop interpreting skills based on the experience they have during teaching. Teachers need experience interacting with tasks that enable students to develop mathematical terminology in meaningful ways (Styers et al., 2020). Teacher's interpretation skills in the mathematical problem-solving process evolve differently from teacher to teacher. The differences in teacher interpretation skills are based on the individual teacher's

personal experience. Consistent with the view (Crespo S, 2000) that interpreting skills are adapted and developed taking into account the various qualifications available in teacher training program (Bakker et al., 2022) also explains that the extent to which teachers consider plans and give continuity in their reasoning is different.

CONCLUSION

Skills interpreting the student's mathematical problem-solving process through the stages of generating ideas, clarifying ideas, and assessing the reasonableness of ideas. Subject G1 and G3 perform interpreting skills towards student problem solving processes by raising ideas and clarifying ideas, while G2 and G4 do interpreting by generating ideas, clarifishing ideas, and assessing the reasonableness of ideas. Next, there needs to be teacher training on interpreting skills. So that the teacher can interpret the student's understanding to develop further student understanding.

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