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The Teacher's Ability to Develop Diagnostic Instruments in Elementary School Mathematics Education

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ABSTRACT

The purpose of this research is to explain teachers' ability to develop diagnostic instruments in elementary school mathematics education. Mathematics education in elementary school is very important for building students' mathematical understanding and logical and analytical thinking skills. The implementation of the independent curriculum for mathematics lessons in elementary schools aims for students to be able to solve mathematical problems in their daily lives. The diagnostic instrument for mathematics learning is designed to diagnose the strengths and weaknesses of students as well as to identify their learning needs. The teacher's ability to develop diagnostic instruments greatly influences the quality of the evaluation conducted. This research uses a descriptive qualitative method, which collects data through interviews, observations, and documentation of teachers at schools. The research results indicate that teachers' ability to create diagnostic instruments in elementary school mathematics education is very low, because some teachers still do not understand the diagnostic instrument, making it difficult to implement it in mathematics learning using the independent curriculum. Therefore, teachers need in-depth training and socialization regarding diagnostic instruments.

Keywords: Diagnostic, Elementary School, Teacher's Ability

INTRODUCTION

Diagnostic instruments are designed for the implementation of the independent curriculum at various educational levels, including elementary schools. Teachers must master diagnostic instruments from the concept of knowledge to implementation learning. The teacher's ability to develop diagnostic instruments in elementary school mathematics education is very important to ensure guarantee that the learning process is effective. In current era of education, quality educational assessments are increasingly prioritized, with diagnostic instruments serving as crucial tools in identifying students' learning needs and evaluating their understanding of the material taught. Diagnostic assessment aims to diagnose the basic abilities of students and understand their initial conditions. (Kurniawan et al., 2021).

To create lessons that are specific to each student's skills and traits, teachers must perform diagnostic tests on their pupils to determine their strengths, limitations, and abilities. Diagnostic assessment has two types: cognitive assessment and non-cognitive assessment

(Ayuni et al. 2023). Cognitive assessment is an evaluation used to determine students' abilities, adjust classroom lessons to their average capabilities, and provide additional or remedial lessons to students who need them. According to Cerah (2023), The goal of cognitive diagnostic evaluation is to give a general picture of students' starting skill levels in a subject. Next, Supriyadi et al. (2022) explain that the benefits obtained by participants after attending this training are the enhancement of knowledge about diagnostic assessments conducted in classroom; in the classroom; comprehend the latest curriculum changes and master instructional strategies in accordance with the relevant curriculum; and technically obtain knowledge about diagnostic assessment evaluation so that it can be utilized in everyday learning, at least the reference is quite apparent. Hadziq et al (2023) mention that "In its application, the assessment has many results of consideration in measuring and improving the competence of students, so that there will be many solutions in directing students according to their ability level". Based on the above opinion, Thus, it can be concluded that cognitive diagnostic assessment can be used in the independent curriculum serves as a basis for teachers to understand the initial abilities of students along with their strengths and weaknesses.

Non-cognitive assessments conducted to assess social welfare and psychological students with observing habits their learning at home and their family conditions. Hendayani et al (2023) explain that results of their research show level of teachers' readiness in preparing diagnostic assessments non-cognitive students' results are very varied, with readiness in preparing non-cognitive diagnostic assessments categorized as good, sufficient, and poor in planning, implementation, and evaluation. Hasna (2023) mentioning that the results of the analysis of the implementation of non-cognitive diagnostic assessments for class students class IIIA at SDN Gayamsari 02 Semarang City students of class IIIA at SDN Gayamsari 02 having sufficient development or needing improvement as evidenced by 16% of students showing very good emotional development. 48% of students' emotional development is good and 36% of students' emotional development is sufficient or needs improvement. Students' learning motivation is very good, as evidenced by 52% of students having very good learning motivation, 32% of students having good learning motivation, and 16 students having sufficient or needing improvement in their learning motivation. While students' learning styles tend to vary, 8 students have an auditory learning style, 10 students have a visual learning style, and 7 students have a kinesthetic learning style. Meanwhile, Rahman et al. (2023) mention that the results non-cognitive diagnostic assessments form of data can serve as a reference for the Principal in making policies. Some school policies based on diagnostic assessments are cooperation between schools and community health centers, parent associations at schools, the provision of gardens for outdoor learning, and counseling guidance. From the previous research above, it can be concluded that non-cognitive diagnostic assessment is very necessary for students as an effort to support the potential of students and this is important for teachers to possess as part of pedagogical, social, and professional competencies. Non-cognitive assessment of students includes motivation, attitude, and self-confidence, while cognitive assessment includes basic mathematical knowledge and critical thinking skills.

Cognitive and non-cognitive diagnostic assessments are implemented in all learning, including mathematics learning. Mathematics learning can influence the development of critical and analytical thinking skills. Therefore, a deep understanding of basic mathematical concepts is very necessary. Many elementary school students face difficulties in learning mathematics, which can be caused by various factors, including ineffective teaching methods, lack of basic understanding, and mistakes in handling mathematical concepts. The implementation of character education programs in mathematics learning in schools is considered adequate. One of the obstacles is the lack of teachers' knowledge about the

implementation of character education in mathematics learning. Another obstacle is the lack of conventional teaching methods that do not facilitate students to be more active; attitude assessments are still not well documented; limited infrastructure in supporting character education, and shortage of parental support in implementing character education at home. That aligns with the opinion of Anggraini, et al. (2022) the review showed that the implementation of character education programs in mathematics learning at schools categorized as sufficient. One of the obstacles is the lack of teachers' knowledge about implementing character education in mathematics learning.

Diagnostic instruments prepared by teachers can help identify students' learning difficulties more accurately, with the right instruments, teachers can determine which areas need special attention and design appropriate interventions. The teacher's ability to design this instrument includes an understanding of the characteristics of the students, learning objectives, and appropriate evaluation techniques. However, not all teachers have adequate skills and knowledge to develop diagnostic instruments. Many teachers still rely on summative assessments without conducting an in-depth analysis of the difficulties faced by students. The technical ability of teachers in designing diagnostic instruments is also a challenge. Not all teachers have adequate training or experience in question creation. Therefore, the enhancement of teachers' capacity through training and professional development becomes very important. Therefore, this article will delve deeper into teachers' ability to develop diagnostic instruments in elementary school mathematics education, including the stages of development, the challenges faced, and the role of technology in the process. Thus, research on observing teachers' ability to develop diagnostic instruments in elementary school mathematics education is important to conduct, as it can provide valuable insights and recommendations for improving the quality of education.

Through the integration of diagnostic tests that are both cognitive and non-cognitive, educational practices can refined to promote a more comprehensive approach to student development and academic achievement. In line with Siregar (2024) stating that these findings underscore the critical role that non-cognitive factors play in shaping students' cognitive performance. Relevant research conducted by Herliana (2024) mentions Therefore, this study aims to develop a valid and reliable five-tier diagnostic test instrument to identify students' misconceptions about fractions effectively. Bakhitjanovna (2024) mentions a functional model for improving diagnostic correctional activities of primary school students. Serta Shakabrina, et al (2024) mention that the development of pedagogical creativity will be effective provided that innovative educational technologies are implemented into the educational process. Mathematical data processing methods and Statistics software package were used to analyze the results obtained and to objectively consider the dynamics of changes in active, cognitive, motivational, emotional and personal components. Based on the results of the research above, it can be concluded that misunderstandings of elementary school students in mathematics learning can be detected through diagnostic assessment from an early age to avoid misconceptions about learning in the future, and of course with innovative learning strategies and methods.

Based on the background description above, this study aims to present teachers' abilities in developing diagnostic instruments in elementary school mathematics education. Through this research, the actual phenomenon will be revealed, and if any problems arise, alternative solutions can be provided.

METHODS

This research method uses descriptive qualitative with data collection techniques through interviews, observations, and documentation of teachers at SDN 4 Suka Agung, Bulok District,

Tanggamus Regency. This approach was chosen because it allows researchers to understand and delve into the qualitative phenomena related to observing teachers' abilities in developing diagnostic instruments in elementary school mathematics education. With this method, researchers can explore teachers' views, experiences, and perceptions regarding the process of developing diagnostic instruments, as well as the challenges they face. The research instrument used is an interview guide related to teachers' ability to develop diagnostic instruments in mathematics learning, covering preparation, implementation, evaluation, and follow-up. Based on the results of interviews, documentation, and observation, the data is further processed through 1) Data reduction, the process of simplification, categorization, and elimination of parts of the data that are deemed unnecessary and do not affect the data analysis results. 2) Data display, presenting data by systematically organizing it in an easily understandable manner. 3) Conclusion and verification, which is the final step of the data analysis process. However, the conclusions drawn may change if supporting evidence is found during the data collection stage.

RESULTS AND DISCUSSION

The Teachers Ability to Develop Diagnostic Instruments

Based the results of observation of the teachers' ability to develop diagnostic instruments as follows: The teacher demonstrates ability by choosing the "Agree" category, indicating a fairly positive level of ability from the teacher. However, the observation results also indicate that teachers lack knowledge of the techniques to implement diagnostic instruments, The teacher has difficulty interpreting the assessment results to design appropriate follow-up learning strategies. There are also teachers who are not yet ready and lack confidence in using diagnostic instruments and utilizing the results to improve the learning process, as well as a lack of facilitation and system support, teachers rarely use diagnostic instruments and teachers face limitations in tools or technology as well as difficulties in implementing diagnostic instruments. The teachers hope for socialization or training activities to enhance their knowledge about the concept of diagnostic assessment and its implications for learning, especially in mathematics. Diagnostic assessment in use of the independent curriculum for teaching mathematics requires a very precise design because it is directly related to learning needs and the subsequent learning process, said the second-grade teacher. The teacher will have difficulty delivering the lesson material if they do not conduct a diagnostic assessment first.

The results of the interviews with teachers revealed that they often have difficulty determining the appropriate indicators to measure the achievement of basic competencies, teachers still heavily rely on multiple-choice questions, which tend to be limited in exploring students' understanding in depth. Teachers rarely conduct in-depth analyses of diagnostic results. Some teachers only look at the number of correct and incorrect answers without examining the existing patterns of mistakes. In fact, understanding the patterns of students' mistakes can provide valuable insights for teachers in designing appropriate interventions. The teacher stated that they are having difficulty translating diagnostic results into teaching plans.

The ability of teachers to develop diagnostic instruments in elementary school mathematics education includes planning, implementation, evaluation, and follow-up.

Planning

Planning is the initial stage in developing a diagnostic instrument, where the objectives, format, and content of the instrument are determined. According to Suparno (2020), instrument planning must consider the competencies of students, the applicable curriculum, and potential obstacles in classroom implementation. The planning of diagnostic instruments includes identifying learning objectives, formulating the competencies to be measured, and

preparing relevant items or questions. This aims for the instrument to effectively uncover information regarding the obstacles and abilities of the students. The next step in the planning process is to design the instrument itself. This includes selecting the appropriate question format, such as multiple choice, short answer, or essay questions. For example, for the purpose of measuring conceptual understanding, essay questions are often more effective because they allow students to explain the reasoning behind their answers.

Implementation

At this stage, the designed instrument is applied in the classroom to collect data. Djamarah (2021) mentioned that the implementation needs to be carried out in a conducive atmosphere so that students feel comfortable and the results obtained truly reflect the actual conditions. In implementation, educator must also pay attention the method of delivering the instrument so that it is easily understood by the students. Before implementation, good preparation is necessary, including providing objectives to the learners and demonstrating how the instruments will be used. This research shows that when teachers inform students about the purpose and importance of using diagnostic instruments, students are more interested in participating. It is also important for teachers to create a supportive atmosphere so that students feel comfortable working on the instrument. Before starting, the teacher must ensure that all the necessary equipment such as paper, writing tools, and a comfortable space are ready. The teacher uses various methods in the implementation of the instrument.

Evaluation

Evaluation is the process of analyzing data obtained from the implementation of instruments to understand the difficulties and needs of learners. Arikunto (2021) states that the purpose of evaluating diagnostic instruments is to identify elements of learning that need improvement. The evaluation aims to identify patterns of errors, levels of understanding, and areas that require improvement from the learners. This stage is important to ensure that the data obtained is truly accurate and can be used for decision-making in learning. Understanding the patterns of students' mistakes can provide insights for teachers in designing appropriate interventions. Identifying the types of mistakes made by students, such as difficulties in addition or understanding word problems, is very important for improving teaching strategies in the future.

***Follow*-up**

Follow-up is a continued effort based on the evaluation results. Follow-up done with preparing the program or appropriate learning strategies to address the identified problems. According to Nurhadi (2022), follow-up aims to provide appropriate interventions so that students who are experiencing difficulties can achieve the expected competencies. This follow-up can take the form of additional tutoring, remedial learning, or adjustments to teaching methods. Remedial Activities Based on diagnostic results, teachers must be able to plan remedial activities for students who are experiencing difficulties with student difficulties. Improving Interaction with Students, good follow-up also requires better interaction between educators and students. Through discussions and questions, teachers can better understand students' difficulties and listen to their problems directly. reflection on the teaching practices that have been carried out. Teachers need to evaluate the methods and instruments used to determine whether the approach is effective.

CONCLUSION

The conclusion of this study shows that teachers' ability to develop diagnostic instruments in elementary school mathematics education is an important factor that affects the effectiveness of learning. This research identifies that the process of developing diagnostic instruments involves several stages, namely planning, implementation, evaluation, and follow-up, which are interconnected with one another. At the planning stage, it was found that many teachers understood the basic competencies they wanted to teach. However, they often face difficulties in determining specific indicators for instruments to be created. In planning, the design and format of the questions are very important. Teachers usually use multiple-choice questions as the main method, but the question format that demonstrates students' deep understanding is less varied. Furthermore, it has been shown that consulting with colleagues is beneficial for improving confidence and the quality of instrument design. The use of diagnostic instruments in the classroom greatly depends on how prepared the teacher is to explain the purpose of the instruments to the students. The results of the observation show that a comfortable and supportive learning environment contributes to the active participation of students. Variation in implementation methods, whether individual or group, also affects the results obtained.

Based on the research that has been conducted, it is hoped that there will be a reciprocal response for teachers to continuously receive guidance and training in developing diagnostic instruments, especially at the elementary school level, by involving experts in the field.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in conducting and publishing this research. This research contributes to the improvement of human resources in the field of education, particularly for elementary school teachers.

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