The Need Analysis of Developing Ethnomathematics and Tri-N (Niteni, Nirokke Nambahi) in Improving Critical Reasoning Dimensions Through Mathematics Learning in Inclusive Schools

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Abstract. The character of students with intellectual disabilities requires learning to be carried out continuously with repeated material. Students with intellectual disabilities have cognitive abilities far below average so their memory is short. The use of Tri-N (niteni,nirokke, nambahi) forces students to help students in mathematics learning. Application of the Tri-N concept in learning Mathematics emphasizes the development of critical reasoning dimensions. This study aims to analyze Ethnomathematics and Tri-N in improving critical reasoning dimensions through mathematics learning in inclusive Schools. This study uses a qualitative descriptive research method. This research result is through the three stages of Tri-N, students are trained to develop critical reasoning dimensions for students with special needs. It is important to develop critical reasoning dimensions for students with special needs Implementing ethnomathematics and Tri-N in mathematics learning creates a different learning atmosphere and has the impact of developing critical reasoning dimensions in students, even at a small level. This effort must be carried out continuously with simple material so that students can remember learning material longer. This research concludes that the ethnomathematics approach and the Niteni, Nirokke, and Nambahi educational concepts from Ki Hajar Dewantara are relevant and can continue to be applied in mathematics learning. The implication of this research as a reference for teachers and other research.

Keywords: Critical Reasoning, Ethnomathematics, Tri-N

How to Cite: Kurniati, A. W., Pardimin, & Khosiyono, B. H. C. (2025). The Need Analysis of Developing Ethnomathematics and Tri-N (Niteni, Nirokke Nambahi) in Improving Critical Reasoning Dimensions Through Mathematics Learning in Inclusive Schools. Proceeding The 7th International Conference Elementary Education, 7(1) 73 – 83.

INTRODUCTION

Inclusive schools are places where students with special needs can learn together with other regular students (Lautenbach, & Heyder, 2019). In essence, regular students and students with special needs have the same rights while studying at inclusive schools. In terms of facilities and infrastructure, inclusive schools have facilities that help students with special needs while studying at school. In terms of the curriculum used, inclusive schools use one school curriculum but certain parts must be modified to suit the needs of students with special needs (Maylamirsyah, & Khosiyono, 2023). During their studies, students with special needs can be accompanied by a special assistant teacher if necessary.

Inclusive schools are schools that can accommodate and support the self-development of students with special needs in the learning process (Hermann-Wilmarth & Ryan, 2019). with various approaches presented. Various facilities and teaching materials used are always changing, which refers to the interests of students (Israel et. al., 2021). This is done because the learning motivation of students with special needs is different from other regular students. In 2008, with the Decree of the Yogyakarta City Education Office, SD Negeri Giwangan was appointed as one of the inclusive schools. The journey to an inclusive school began with an

integrated school with a specialization for the blind. Starting from this integrated school, SD Negeri Giwangan was then appointed as an inclusive school that accepts students with special needs with various specifications.

The existence of inclusive schools is currently highly expected by the wider community to educate students with special needs in their environment (Choi, et. al., 2017). This is because students with special needs have complex uniqueness. Not all students with special needs can receive education in special schools. In addition to the small number, special schools only want to accept students who need special treatment. Not all students with special needs can follow the learning in the classroom, this is because their academic abilities they have are below average, even approaching mild mental retardation and some are also categorized as autism, however, educators always try to make all students able to learn together in the classroom. The learning strategies created in the classroom are attempted to be understood by all students including students with special needs (Khosiyono & Irawan, 2022). During learning in the classroom, students with special needs follow all the lessons taught in the classroom including mathematics.

Mathematics learning is categorized as a subject that is considered difficult and less popular by some students (Rahmaningrum, & Khosiyono, 2023). Mathematics learning is a process of gaining new knowledge and experience about mathematics with a series of planned and structured activities. Mathematics has a potential role in the development of thinking, including critical thinking. The role of teachers is very potential in helping students develop their critical thinking skills and dispositions.

Mathematics learning for students with special needs should be adjusted to the obstacles and needs of each student with special needs, in other words, students with special needs should receive different treatment according to their needs (Nurrohmah, Irfan, & Khosiyono, 2024). Educators in inclusive schools must realize the importance of modifying or creating creativity that supports the needs of students with special needs and creating an atmosphere and comfort in mathematics learning. one of which is by developing mathematics learning materials using certain learning approaches or media. The limited number of special tutors makes the development of mathematics learning not be carried out optimally so that students with special needs follow mathematics learning according to their abilities. The assessment results obtained by students with special needs are of course below the completion criteria.

The development of mathematics learning must continue to be carried out, one of which is making the surrounding environment a source of learning. Ethnomathematics can be used as one approach to mathematics learning in inclusive schools. The ethnomathematics use as an approach is expected to change the critical thinking dimensions of students in general and

students with special needs. Ethnomathematics is a learning approach that is carried out in the following ways: teaching mathematics by linking mathematics to the cultural works of the nation itself and also involving it with the needs and lives of its people (Zaenuri, et al.,2018). It is further explained that Ethnomathematics in the process of learning mathematics can be seen as an approach to motivate students in learning mathematics by involving or linking the mathematical material taught with real examples of mathematical models that are by the material taught with everyday life, with existing local culture, or with existing or existing cultural practices.

The integration of ethnomathematics approaches through mathematics learning is carried out in various ways: introducing the natural beauty, culture, and art production of Yogyakarta, as well as utilizing the natural beauty, culture, and art products into learning or integration into questions that can develop the critical thinking dimensions of students with special needs (Zaenuri, et al.,2018). In addition to ethnomathematics, the development of mathematics learning in inclusive schools can be done by applying the concepts of Niteni, Nirokke, and Nambahi (Tri-N) According to Indah Rahayu, et al. The concept of 3N learning (Niteni, Nirokke, Nambahi) is that Niteni means paying attention, observing, or listening. In this case, students pay attention, make observations, read or listen carefully, feel, feel with their five senses. Niroke means to imitate. Students imitate, imitate, and do something the same as the thing or something observed. While Nambahi means to add. Students try to add, adjust, make changes, or reduce the model that is imitated according to their respective creativity. The concept of Tri-N (Niteni, Niroke, and Nambahi) Ki Hajar Dewantara can be applied (Nisa, Prasetyo & Istiningsih, 2019; Pardimin, Nisa, & Hikmah, 2023).

Several relevant studies on the implementation of ethnomathematics in mathematics learning that have been conducted by previous researchers obtained results that the ethnomathematics approach can improve students' learning outcomes in the material on the properties of flat shapes (Ajmain & Masrura, 2020). The application of the niteni, nirokke, nambahi methods in learning based on research by Pramudya, Harini, & Istiqomah (2020) provides results that can increase student activity. in students. The difference between this study and this study is that it will examine the implementation of ethnomathematics and the Tri N method (niteni, nirokke, nambahi) in developing critical reasoning dimensions in mathematics learning in inclusive schools. Based on this study, researchers are interested in research to find out how the application of ethnomathematics and Tri-N (niteni, nirokke, nambahi) can develop critical reasoning dimensions. critical in mathematics learning in inclusive schools (Yuniharto, Pardimin & Nisa, 2024). This study aims to analyze the development of ethnomathematics and Tri-N (Niteni, Nirokake, and Nambahi) in developing critical thinking dimensions of the mathematics learning process for students with special needs in inclusive schools.

METHODOLOGY

This study uses a qualitative descriptive research method. Data collection uses observation and interview techniques. Events faced by students are then described through a descriptive approach. The subjects in this study were class teachers, special guidance teachers, and students with special needs in grades I to VI AB. This study's qualitative data analysis procedure followed the steps, which included gathering data, condensing data, displaying data, and then making conclusions (Miles, Huberman, & Saldana, 2014).

RESULTS AND DISCUSSION

When researchers conducted observations of the mathematics learning process before the implementation of the ethnomathematics approach and the Tri-N approach (niteni, nirokake, nambahi), the mathematics learning carried out in the classroom was during the initial activities of mathematics learning in inclusive school classes, most of them do not start with a pre-test. Class IA begins with apperception, class IB begins with questions and answers about previous learning Class IIA begins with counting class IIB begins with matching/discussing homework, class IIIA begins with counting, class IIIB begins with explaining the material class IVA begins with doing assignments, class IVb begins with questions and answers class VA begins with matching/discussing homework class VB begins with counting multiplication and division, class VIA begins with matching homework, class VIB begins with matching/discussing homework. Students with special needs who are accompanied by a special assistant teacher can participate in activities delivered by the class teacher. Unlike students with special needs who are not accompanied by a special assistant teacher, they will do activities that they like, such as drawing, playing, or sleeping. Secondly, during the core learning activities, what teachers do in inclusive school classes are: Classes I-VI all explain the material and continue working on questions after students have completed the assigned tasks. If there is still time, the teacher will discuss it. If there is no time, the discussion will continue the following week. The last, at the end of a math lesson, most teachers end the lesson by giving homework or other independent tasks.

From the observation activities carried out by the researcher, it can be explained that mathematics learning in inclusive schools for students with special needs is not by the specifications they have so the critical reasoning dimension has not developed well. Mathematical reasoning as a cognitive aspect that supports mathematics learning and is one of the five standards of ability that students should have in learning mathematics makes mathematical reasoning ability important in the process of teaching and learning mathematics. The critical reasoning dimension is closely related to the mathematical reasoning ability

needed in mathematics learning. This happens because in the critical reasoning dimension, there are phases that can hone mathematical reasoning ability.

Mathematical reasoning ability in students starts from drawing logical conclusions to compiling direct evidence in solving mathematical problems. Critical reasoning improves students' knowledge and ability to think and solve problems with the right solution. Critical reasoning is defined as the ability to think logically to obtain correct information and evaluate the information obtained so that appropriate decisions can be made. Therefore, students often practice working on problems so that they will be trained to solve reasoning problems.

The results of observations and interviews conducted found that the critical reasoning dimension possessed by students with special needs depends on learning motivation. Many factors influence students' learning motivation, one of which is the approach used by the teacher. The ethnomathematics and Tri-N (niteni, nirokake, and nambahi) approaches in mathematics learning provide a new atmosphere. The ethnomathematics approach is used by teachers when discussing flat shapes by displaying various forms of traditional house roofs, the responses and attention of students change. When learning takes place, students are interested in the pictures displayed, then students start asking, "Which traditional house is that, Ma'am", "The house is strange" "How to make it", "What is it made of" ... and so on. The responses shown by students show that the critical reasoning dimension is starting to develop.

In addition to the ethnomathematics approach, teachers also use the Tri-N learning method (niteni, nirokke, nambahi) in this learning. The Tri-N learning method (Niteni, Nirokke, Nambahi) is a method based on the learning principles of Ki Hajar Dewantara. Niteni means to see, listen, pay attention or observe, Nirokke means to imitate or follow, while Nambahi means to add or develop. Further explained Nurhayati (2023). Niteni also means the process of searching and discovering the meaning (nature, characteristics, procedures, truth) of an object of observation through sensory means. Nirokke can be translated as to imitate. The process of imitation is a natural human nature, more precisely called the will or desire to imitate everything that attracts his attention. While nambahi can be interpreted as adding or developing (to innovate/ to add value). Nambahi is a further process of "Nirokke". In this process, there is a creative and innovative process to give a new color to the object being imitated.

The ethnomathematics approach is an approach to learning mathematics that emphasizes more on how students can understand and build mathematical concepts based on the culture that grows and develops in the local community (Waluya & Sukestiyarno, 2023). The implementation of ethnomathematics can help students understand that mathematics is not only related to formulas and numbers but is also part of our culture and daily life (Shin, Kang,

& Bryant, 2019). By implementing ethnomathematics in mathematics learning in inclusive schools, the paradigm changes from mathematics as a terrible specter to mathematics that is enjoyable.

Yogyakarta is known as a city of culture and has an extraordinary culture and artwork. Batik with various types and motifs. Typical foods such as bakpia, yangko, kipo, and so on have various forms. Traditional houses, traditional transportation, gamelan, and other forms of culture. This culture is included in mathematics learning to change students' mindsets from mathematics full of numbers and formulas to mathematics filled with various shapes and colors. From this change in appearance, there is a change in the dimensions of students' critical reasoning. Initially passive students in student learning become students who actively ask questions to find more information. This is a good opportunity for teachers to continue to create changes in active learning strategies that are fun for students.

The ethnomathematics included in this learning are the traditional houses in the Special Region of Yogyakarta, there are five traditional houses, namely Joglo Jompongan House, Sinom Joglo Traditional House, Joglo House of Pangrawit, The Joglo House of Ceblokan, and Apitan Joglo House. Through the form of the traditional house, which is connected to the material in the form of flat shapes, surface area, and circumference as well as solving mathematical problems that exist in everyday life, it is hoped that it can develop the critical reasoning dimension of students with special needs.

There are 5 students with special needs in class VB. The cognitive abilities of these students with special needs are below those of regular students. The following is the ability profile of students with special needs in class VB.

Table 1. Profile of Cognitive and Social Abilities of Special Needs Students in Class VB According to Ability Categories

Student	**Ability Aspect**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A	SDR	SDR	SDR	SDR	SDR	SDR	DR	DR	SDR	SDR
B	R	RB	DR	DR	R	RB	RB	RB	RB	DR
C	DR	SDR	DR	SDR	DR	SDR	SDR	DR	SDR	SDR
D	DR	DR	DR	RB	DR	RB	RB	R	DR	R
E	SDR	SDR	SDR	SDR	DR	SDR	SDR	SDR	SDR	SDR

Information

Ability Aspects:

1= Thinking logical concepts

2= Understanding and Analysis of the situation

3= Memory and coherent thinking

4= Endurance and concentration

5=Visual motor

6=Absorbing verbal information

7= Delivering verbal information

8= Social understanding and responsiveness

9= Social problem solving

10= Motivation

Categorization:

R = average

RB = lower average

DR = Below average

SDR = Very below average

Mathematics learning using ethnomathematics and Tri-N (niteni, nirokke, nambahi) makes mathematics learning more concrete so that it can be understood even if only temporarily. Students with special needs in grade five are included in the category of mild intellectual disabilities. They are among those who can be educated, their attention span is also short so it is difficult to concentrate for a long period. Students with intellectual disabilities have limitations in cognitive abilities such as the ability to focus on something, remember information (short-term memory is very limited), and group objects into the same classification.

Mathematics learning with an ethnomathematics approach can increase the motivation and interest of students with special needs or intellectual disabilities (Griffin et.al., 2018). Increased motivation and interest affect learning outcomes, this can be seen from the value obtained before and after applying the ethno-mathematics approach and the Tri N method (Niteni, Nirokke, Nambahi), as in the following table.

Table 2. Comparison of Mathematics Learning Outcomes of Special Needs Students Before and After Using the Ethnomathematics Approach and Tri-N Method

No	Student	Before	After
1	A	20	50
2	B	30	70
3	C	0	40
4	D	50	80
5	E	0	50

Judging from the results of the daily assessment, there appears to be a change, but it must be remembered that students with intellectual disabilities are only able to be taught so that the changes that occur are not permanent. However, from the study, it can be concluded that learning for students with intellectual disabilities must always be modified and continuous.

Learning will be more meaningful if the learning uses media that is close and familiar to students.

Mathematics learning will attract students' interest and motivation if it is developed with interesting things (Bottge, Cohen, & Choi, 2018). The concept of mathematics in the human mind is sometimes different from mathematics in reality (Schnepel et al., 2024). Mathematics teaching in schools and mathematics faced by students in everyday life are very different. Therefore, media is needed to bridge between mathematics in real life that is based on culture and school mathematics.

CONCLUSION

Mathematics learning will attract students' interest and motivation if it is developed with interesting things. The concept of mathematics in the human mind is sometimes different from mathematics in reality. Mathematics teaching in schools and mathematics faced by students in everyday life is very different. Therefore, media is needed to bridge between mathematics in real life that is based on culture and school mathematics. The use of the ethnomathematics approach is seen as a bridge between real mathematics and school mathematics. The application of ethnomathematics as a learning approach makes the material studied related to the culture of students so that students' understanding becomes easier because the material taught is close to the students' environment.

The implementation of Tamansiswa Tri-N teachings through an ethnomathematics approach in mathematics learning can improve student learning outcomes and can develop critical thinking attitudes of students with special needs at SD Negeri Giwangan. Learning is carried out in three phases; the niteni phase is filled with students observing and paying attention to traditional house models and explanations given by the teacher related to the material to be studied. The second phase is nirukake, which is the stage where students are able to imitate what has been conveyed by the teacher according to their understanding, if understanding is not achieved, it must be repeated. The last phase is nambahi, which is students are given activities in the form of drawing a house according to the ideas and thoughts of students.

Students with intellectual disabilities experience difficulties in cognitive processes, independence and self-adjustment. The use of ethnomathematics approach using the Tri N method shows behavioral changes in the subjects. The subjects can understand the material being taught well. This change is indeed not permanent. Therefore, learning like this must be done repeatedly. The results of this study are expected to be information for schools and teachers in providing mathematics learning to students with intellectual disabilities. This study was conducted on special needs students in class V b using qualitative methods. Thus, it is necessary to continue the research by adding subjects to regular students or using quantitative

methods with experiments to strengthen the findings. The implication of this research as a reference for teachers and other research.

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