

ANALYSIS OF CRITICAL THINKING PROCESS OF BLIND STUDENTS TO SOLVING FLAT BUILDING MATERIALS

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Received 27 March 2023; Received in revised form 20 May 2023; Accepted 15 September 2023

Abstract

Education is an element that is very important for human survival, with the regulated it in a Law of the Republic of Indonesia article 15 of Law no. 20 of 2003 regarding the National Education System this type of education is for children with special needs. Education with special needs requires attention in its application, children with low vision special needs experience many difficulties in learning and applying critical thinking. This study aims to improve the quality of learning Mathematics and improve students' critical thinking skills. Critical thinking is needed in learning, including for blind students. So that critical thinking skills are needed in the learning process so that blind students can understand the material and solve problems well so that further research is needed. The research method used is descriptive qualitative, with the object of research being blind students at SLBN Ungaran The results of this study indicate the difficulty of blind students in answering flat shape questions based on mathematical critical thinking skills. Several factors cause including: (1). Students' difficulties in understanding the types of flat shapes; (2). When doing calculations, students need help understanding the shape of a flat shape so that the calculations and work processes carried out are not quite right. This Problem happens because students still need help understanding, analyzing, and identifying the purpose of the questions; (3). Student's difficulties in connecting the relationship between the concept and the Problem so that students have difficulty in determining the completion strategy.

Keywords: Critical Thinking, Education for the Blind, Flat Shape Mathematics.

Abstrak

Pendidikan merupakan elemen yang sangatlah penting bagi kelangsungan hidup manusia, Diatur dalam Undang undang Republik Indonesia pasal 15 UU No. 20 tahun 2003 mengenai Sistem Pendidikan Nasional bahwa jenis pendidikan bagi Anak berkebutuhan khusus. Pendidikan berkebutuhan khusus memerlukan perhatian dalam penerapan nya, anak berkebutuhan khusus low vision banyak mengalami kesulitan dalam belajar dan menerapkan berpikir kritis, penelitian ini bertujuan untuk meningkatkan kualitas pembelajaran Matematika, meningkatkan keterampilan berpikir kritis siswa. Proses berpikir kritis sangat dibutuhkan dalam pembelajaran tidak terkecuali untuk peserta didik tunanetra. Sehingga dibutuhkan kemampuan berpikir kritis yang dalam proses pembelajaran agar peserta didik tunanetra bisa memahami materi dan menyelesaikan soal dengan baik sehingga perlu dilakukan penelitian lebih lanjut. Metode penelitian yang digunakan adalah kualitatif deskriptif, dengan obyek penelitian siswa tunanetra di SLBN Ungaran. Hasil penelitian ini menunjukkan kesulitan siswa tunanetra dalam menjawab soal bangun datar berdasarkan kemampuan berpikir kritis matematis. menyelesaikan permasalahan disebabkan oleh beberapa faktor diantaranya adalah: (1). Kesulitan siswa dalam memahami jenis bangun datar; (2). Saat melakukan perhitungan siswa kesulitan dalam memahami bentuk bangun datar sehingga perhitungan dan proses pengerjaan yang dilakukan kurang tepat. Hal tersebut terjadi karena siswa masih kesulitan dalam memahami, menganalisis, dan mengidentifikasi tujuan soal; (3). Kesulitan siswa menghubungkan keterkaitan konsep dengan soal sehingga siswa kesulitan dalam menentukan strategi penyelesaian.

Keywords:. Bangun datar; Berpikir Kritis; Matematika; Pendidikan Tunanetra.



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DOI: <https://doi.org/10.24127/ajpm.v12i3.7475>

INTRODUCTION

Children with Special Needs (ABK) are a condition with special characteristics/characteristics that are different from normal children. In other words, they have extraordinary abilities or limitations, both emotionally, socially, physically, mentally, and intellectually. Types of ABK are mentally retarded, deaf, deaf and quadriplegic children, one of whom is a blind child. According to (Martyanti, 2019; Astuti, 2015) Blind children are eyes that do not function as blind eyes in daily activities. The reality of educating blind people cannot be compared to educating ordinary children. Some teachers can teach math to the blind using special techniques.

The process of learning mathematics requires understanding and reasoning because mathematics is an abstract science that blind children encounter when learning mathematics. Due to their physical limitations, they need to achieve maximum learning results. He has difficulties in learning mathematics because of his condition. A learning disability is a problem where a student cannot participate in the learning process like other students, is late in a section, and does not achieve the learning goals that have been set. (Irham. 2013) The obstacles they encounter cause them to experience failure or less success in achieving their learning goals. Students who fail in certain learning situations are given the term learning disability (learning difficulties), Nathan said (Ghufron Nur & Rini Risnawati, 2015) To avoid misperceptions in mathematics, blind students need special teaching aids to help them visualize the material.

In addition, the obstacle for blind students to learn mathematics is the need for an active role of sight to absorb

mathematical material such as Cartesian coordinate system material, so aids are needed. They help change its visual character. Blind people can only obtain information through other senses (except the eyes) because their vision is limited or ineffective (Muthmainnah, 2015).

Mathematics for blind students requires a process of interaction between students and teachers. The branch of mathematics that must also be given to blind students is one of the flat shapes. This is because by studying flat shapes, students learn various objects' forms and properties, which will be useful for giving blind students an idea of their surroundings (Nisa, 2020; Martyanti, 2019a). However, in the learning process, vision plays an important role in learning plane shapes because students can accurately and carefully analyze every part of the plane. the sides of the plane shape. Are the sides the same length? Comparable and in what form.

Weak students' critical thinking skills have an impact on students' lack of understanding of the material and make it difficult to learn mathematics. Students' critical thinking skills are very important in the learning process, students remember things they don't understand, but if their thinking skills are weak then learning outcomes will be poor. research result Wijayanti et al. (2015) shows that the average critical thinking ability in learning in schools is very low.

Students' critical thinking skills are low because in learning the teacher focuses more on students memorizing, without paying attention to the development of thinking skills (Martyanti & Suhartini, 2018; Wijayanti et al., 2015). Learning that only emphasizes memorization will not be

DOI: <https://doi.org/10.24127/ajpm.v12i3.7475>

able to optimize students' critical thinking skills. Meanwhile, Wijayanti dkk., (2015) It also states that students' critical thinking skills are influenced by several factors, namely (1) reduced physical fitness of students which causes students to focus less on answering questions; (2) lack of student motivation in learning activities; (3) anxiety that appears automatically; (4) intellectual development and (5) the interaction between teachers and students causes the learning atmosphere to become uncomfortable. Critical thinking skills cannot emerge by themselves but require the teacher's efforts to gain meaningful experience in learning. Kurniasih dkk. (2016) To meet their academic needs, writing requires three principles, including (1) concrete experience, (2) conceptual integration, and (3) learning by doing.

The findings of SLB N Ungaran researchers are that the ability to think critically in children with special needs, especially children with visual impairments, is still deficient on flat objects because their blindness prevents students from achieving maximum learning outcomes. Obstacles Blind students learn to count with flat stimulus material, like pictures of things. Blind students find it challenging to solve problems. 4 Students have not mastered the concept of flat wake, which can hinder students in answering flat wake questions. The teacher tries to explain the subject matter sufficiently to students. However, the material provided by the teacher still needs to be made more accessible for students to understand, and they pay less attention to the teacher in explaining the lesson's content.

Therefore, this problem needs to be addressed because learning mathematics is one of the subjects that needs

attention, and mathematics is a subject that develops students critically and creatively. To improve the quality of learning mathematics and improve students' critical thinking skills. Students must actively participate in learning activities in class so that the quality of education continues to meet academic goals.

Blind students also need critical thinking processes in learning. More research is required to ensure that critical thinking is included in the learning process so that blind students understand the content and solve problems well.

METHODS

This research uses descriptive qualitative research utilizing interviews, observation, documentation, and test techniques. Methods of collecting and analyzing data in understanding opinions, attitudes, and behavior directly by research subjects (Sugiyono, 2020). A qualitative approach is applied for a deeper and more complete understanding of students' critical thinking processes in problem-solving. Descriptive research prioritizes process over results, is limited between review and focus, and has several provisions for verifying the accuracy of the data. The direction of this research is only focused on the theoretical basis of crystallization. Authors can check or re-evaluate the information provided to complement new details.

In this study, the data collection strategy included: (1) a mathematical critical thinking test to identify students' difficulties in solving flat shape problems, (2) interviews with students to obtain more detailed information about students' abilities in having difficulties solving flat shape questions and their causes student difficulties. The

DOI: <https://doi.org/10.24127/ajpm.v12i3.7475>

object of research was 3 blind and low vision SLB students. Interviews were also conducted with class teachers to obtain information about the situation, conditions, motivation, and difficulties of teachers in teaching and learning activities at school.

The data analysis technique used in this study is a qualitative data analysis technique as said by Miles and Huberman, namely by means of data reduction, data presentation and drawing conclusions. (Sugiyono, 2020).

Data reduction is the process of selecting important things that are in accordance with the focus of the research being carried out, presenting the data, and drawing conclusions from the results of the description of the data on students' critical thinking skills in data structure material. The following indicators of students' critical thinking skills are presented in Table 1.

Table 1. *Critical thinking ability indicator*

No	Critical thinking ability indicator	Indicator	Percentage
1	Clarification	Students can formulate problems precisely such as understanding problems by determining points that support each other to solve problems	25%
2	Assessment	Students can look for the truth value or not of a problem by looking back at the known and asked points.	25%
3	Inference	Students can solve problems with correct problem solving steps and write reasons based on relevant criteria and standards.	25%
4	Strategy	Students can find other alternatives	25%

Based on Table 1, there are 5 indicators of critical thinking skills in problem solving, therefore the researcher determines the criteria for achieving critical thinking skills with

the achievement values adopted from (Setiana & Purwoko, 2020). The following levels of critical thinking skills are presented in Table 2.

Table 2. Levels of critical thinking skills

Levels of critical thinking skills	Criteria Based on Critical Thinking Indicators
Very Critical (81-100%)	Students can formulate problems precisely such as understanding problems by determining points that support each other to solve problems such as being able to write down known and asked points and analyze flat shapes properly and in detail. Students can look for the truth value or not of a problem by looking back at the known and asked points, such as being able to devise a problem-solving plan. Students can solve problems with correct problem solving steps and write down reasons based on relevant criteria and standards such as correct work flow and correct results. Students can find other alternatives such as students cannot work in other ways.

Levels of critical thinking skills	Criteria Based on Critical Thinking Indicators
Critical (61-80%)	Students can formulate problems precisely, such as understanding the problem by determining points that support each other to solve problems, such as being able to write down points known and asked but still lacking in detail. Students can look for the true value or not of a problem by looking back at the known and asked points as being able to structure the problem solving process correctly. erroneous and imprecise results. Students have not been able to find other alternatives such as not understanding in other ways.
Moderate Critical (41-60%)	Students can formulate problems precisely such as understanding the problem by determining points that support each other to solve problems such as being able to write down points known and asked but still lacking in detail. Students can look for the truth value or not of a problem by looking back at the known and asked points as being able to structure the problem solving process correctly. erroneous and imprecise results. Students cannot find other alternatives such as not understanding in other ways
Low Critical (21-40%)	Students can formulate problems precisely such as understanding problems by determining points that support each other to solve problems such as writing down known and asked topics. Students cannot look for the truth value or not of a problem by looking back at the known and asked points, such as not looking back at what was asked and not being able to arrange the solution process correctly. Students need help to solve problems with correct problem solving steps and write down reasons based on relevant criteria and standards such as not understanding the concept of solving, errors in the solving process and error results. Students cannot find other alternatives such as not understanding the concept in another way
Not Critical (0-20%)	Students need help to formulate the problem precisely, such as understanding the problem by determining points that support each other to solve the problem such as not understanding the problem and not being able to write down what is known and what is asked in detail. Students cannot find the actual value or not of a problem by looking at return points that are known and asked, such as not understanding the concept and being unable to do it. Students cannot solve the problem with the correct problem-solving steps and Write reasons based on relevant criteria and standards such as incomplete and incorrect answers. Students cannot find other alternatives, do not understand the problem, and do not know how to do it.

DOI: <https://doi.org/10.24127/ajpm.v12i3.7475>

This research method consists of several stages, namely the preparation stage, the implementation stage, the data analysis stage and the data conclusion stage

RESULT AND DISCUSSION

The results of a qualitative research analysis of the critical thinking process of blind children in solving flat shape material problems at SLB N Ungaran include; 1) The results of learning mathematics for blind students at SLB N Ungaran; 2) Understanding and critical thinking processes of blind students at SLB N Ungaran.

Based on the results of the research, subjects V1 (students with low vision), B1 (students with blind vision), and B2 (students with blind vision) have different levels of critical thinking ability.

The results of learning mathematics for blind and low vision students at SLB N Ungaran

Mathematics is a field of study that will be accepted by students of all levels, from elementary school to university. The importance of learning and mastering mathematics for students is to help them solve their problems. Hakim in (Khaeroni, et. al, 2023) that one of the basic knowledge that students must master is mathematics because mathematics is in everyday life. In learning mathematics, a skill is needed. Where one of the skills that students need to have in mathematics which is contained in the standard content of the 2013 Curriculum, is that students are expected to be able to demonstrate a logical, critical, analytical, careful, and thorough attitude, responsible, responsive, and not give up easily. in solving problems. So achieving these skills requires an ability, one of which is

thinking critically in students. Critical thinking skills are important to help students overcome their difficulties in finding solutions to math or real-life problems.

The difficulties faced by students are the inability to understand the types and characteristics of flat shapes and the failure to draw accurate conclusions. Therefore, Subjects V1, B1, and B2 still need help researching the elements of a function and making conclusions (hypotheses) that relate them to the concept of flat shapes. Based on the results of the difficulty analysis above, it can be concluded that students still experience difficulties in solving mathematical critical thinking-based flat shapes, especially questions related to everyday life. Student learning outcomes are described as follows.



Figure 1. Subject V1 students with low vision limitations

According to figure 1 subject V1 is still able to carry out activities in learning to wake up flat by feeling and

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seeing from a close distance. Subjects can complete the questions given and obtain maximum results on three of the four indicators of critical thinking. Students can write on paper the solution to the problem given.



Figure 2. Subject B1 students with blind

According to figure 2 subject B1 is able to understand information about flat shapes and can explain flat shape objects in the surrounding environment, the subject can write answers to the questions given In the learning process, subject B1 can distinguish the sides of a square and rectangle, the subject is able to calculate the answers to the questions given, but the subject still needs help in writing answers on the pantule.

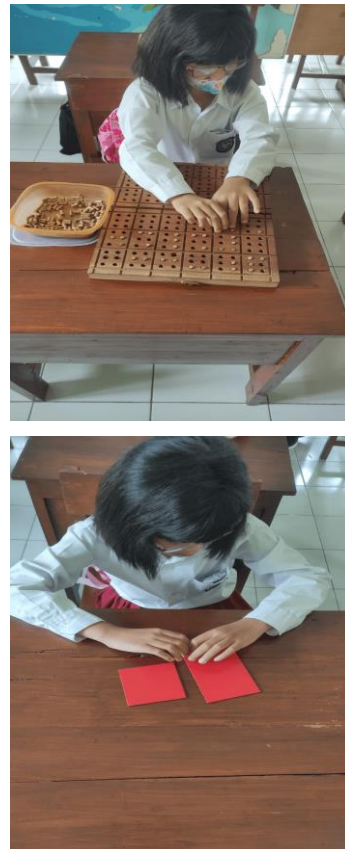


Figure 3. Subjek B2 students with blind

According to Figure 3 Subject B2 still needs help in understanding flat shape material but is already able to write answers to problems on the pantule. In the learning process, subject B2 has been able to distinguish the sides of a square and a rectangle, but the subject has not been able to calculate the answers to the questions given and still needs the teacher's help in solving the questions.

The student's difficulty lies in question 1. This question requires students to understand and express the object's meaning so that it is easier to interpret the importance of the question to get the correct answer. However, based on the results of students' responses, students needed help understanding the types and properties of flat shapes. Based on the results of the interviews, the teacher said that

DOI: <https://doi.org/10.24127/ajpm.v12i3.7475>

problems arose because students often forgot and did not know the material needed. It is based on research Kurniawan (2017) Students continued to struggle to understand the concept and explain the meaning of the pictures, which led to misinterpretation of the information in the questions. Hakim in (Sumiati & Agustini, 2020) stated that the importance of understanding the concept of triangles and quadrilaterals for junior high school students is indeed crucial, but the reality could be more fully optimal. Conditions on the ground describe the contradiction of what is desired. Students only memorize the existing plane formulas and are less able to master the properties of the shape with the concepts they have. It is known that all mathematics material in schools contains aspects of understanding concepts, because the basic ability in learning mathematics is to understand concepts first.

Question 2 requires the student's ability to identify the elements necessary for a logical and critical interpretation. From the results of student interviews, it was known that students had difficulty determining their work methods, so students only answered randomly. This indicates that students' difficulties in understanding sub-concepts have a significant impact

on problem solving and indicates that students do not yet know how to evaluate the questions posed. Analysis of question no 2 also shows that students still need to learn how to assess the questions given. Besides that, in question number 3 students have yet to be able to evaluate and make decisions in making calculations and understanding the problems given. In this question students are asked to think critically with a problem model that requires students to find the side length through a known circumference. The description is in accordance with the research Dewi dkk. (2019) difficulties in determining settlement systematically due to a lack of students' understanding of the learning material. According to Ariawan & Nufus (2016) a person's difficulty in solving evaluation indicator questions is caused by not understanding the overall learning concept so they do not understand the meaning of the answers written.

Results of understanding and critical thinking processes of blind students in Special Schools

The critical thinking skills of SLB N Ungaran students were analyzed based on the criteria for critical thinking as outlined in Table 3.

Table 3. Critical thinking skills of blind and low vision students at the Ungaran State Special School

Subject	Percentage of Critical Thinking Ability for Each Indicator				Explanation
	Clarification	Assessment	Inference	Strategy	
V1	25%	25%	23%	-	Critical
B1	20%	15%	18%	-	Moderate Critical
B2	20%	15%	15%	-	Moderate Critical

According to Table 3, subject V1 is a person with a low vision disability, obtaining a percentage of 73% supported by the results of interviews

and working on test questions. Thus, subject V1 has a critical predicate, namely being able to properly process information and organize a problem-

DOI: <https://doi.org/10.24127/ajpm.v12i3.7475>

solving process. Subject V1 was able to explain the flat side shape well but still encountered difficulties in determining it. The analysis of the questions carried out by subject V1 met the criteria for critical thinking, which was able to explain the object being taught and determine the solution to the given problem.

Subject B1 is a person with visual impairments who obtained a percentage of 53% with sufficiently critical criteria supported by the results of interviews and work on subject B1's questions. showing that he was able to solve problems subjectively but had not been able to find alternative answers, mistakes made were at the problem-solving stage where the subject had not been able to determine the shape precisely flat. When given subject matter B1, he was able to determine the sides of a plane shape accurately but still had difficulty calculating the answers to the questions given, based on the results of interviews, subject B1 showed a good understanding of the concept of plane shape so that he was able to solve the questions given, the obstacles experienced subject b1 is shown in the process of calculating and writing answers in pantule.

Subject B2 is a person with visual impairments who obtains a percentage of 50% with sufficiently critical criteria. The subject still needs help understanding the information provided and has yet to be able to find alternative answers. Subject B2 shows the ability to think critically in describing flat shapes and solving problems encountered in everyday life. Supported by the results of interviews which conducted that the subject was able to describe flat shapes precisely with examples of concrete objects. Subject B2 is able to determine the sides of a flat shape but still has

difficulty determining the length and width so that he still needs help in understanding the concept of a flat shape. based on the results of interviews subject B2 was able to explain the parts and characteristics of flat shapes, the subject had difficulty determining answers to the questions given, another obstacle was subject B2 having difficulty calculating answers and writing answers in the pantule.

Based on the overall analysis, an overview of students' critical thinking skills is obtained, so that a method of learning mathematics with different levels of critical thinking is obtained. As research by Setiana & Purwoko, (2020); Ramadani, (2017) which states that students with visual abilities tend to have higher critical thinking skills than students with visual impairments.

The results of the analysis that have been described are influenced by differences in student limitations, so that students with low vision more easily receive information than students who are blind, so there is still a need to develop instruments and visual aids that are able to help blind students in describing the information they have received.

This is supported by research Sholihah dkk., (2017), that education and limitations together have a significant effect on students' critical thinking skills. Furthermore, the results of Cahyono's research revealed that students' ways and critical thinking skills were influenced by their ability to absorb information (Cahyono, 2017).

DISCUSSION

The cognitive development of blind students tends to be hampered compared to sighted students. This is because the introduction or understanding of the outside world

DOI: <https://doi.org/10.24127/ajpm.v12i3.7475>

cannot be obtained completely and intact. As a result, the formation of an understanding or concept of stimuli or objects that are outside themselves is not obtained in its entirety. This is because blind students do not have impressions, perceptions, understanding, memories, and visual understanding of the objects being observed. Blind students tend to replace the sense of sight with the sense of hearing as the main channel for receiving information, resulting in the formation of understanding or concepts based solely on sound or spoken language.

Learning mathematics for blind students faces various kinds of difficulties because learning mathematics is the most critical subject in education. The difficulties experienced by students were caused by the inability of students to recognize and analyze the meaning of the questions so that students needed help establishing the relationship between the questions and the formulas used. Students experience difficulties in doing calculations because they need to be more careful and understand the meaning of the tested questions, causing confusion in the results. Flat shape material is a prerequisite material that students must have. Studying this quadrilateral material will be a provision for students at the next level. The material for quadrilaterals and triangles is related to everyday life. But in fact, learning on flat shape material still has difficulties experienced by students, especially in solving problems.

Hoffer in (Martyanti, 2018) stated that to be successful in studying geometry, students must have good geometry skills. With the increasing number of learning references that can be used by blind students, especially in geometry material, it is hoped that this

can improve students' geometry skills. So that if students' geometry skills increase, these students will have a greater chance of succeeding in studying geometry and are expected to be able to improve their mathematics learning achievement in general.

In line with the research Liandri & Mahmudah, (2021) Develop critical thinking skills of students with special needs in solving uniform problems. In the analysis of critical thinking at SLB Ungaran, there are differences in the ability of boys and girls as measured by the necessary thinking ability score. Male students are considered more capable of interpreting and explaining material than female students. Blind students can also solve math problems, although the approach to solving these problems is slightly different from students without visual impairments. In addition, blind students can distinguish and give names to flat geometry and spatial geometry objects, but they have difficulty when asked to describe blocks. Sometimes they call it a rectangle. In addition, in exploring a new room, blind students use touch as the primary analytical tool and are assisted by their sense of hearing.

Student errors in working on flat shapes are caused by students needing to understand flat shapes and answer questions carefully. Student problems are also influenced by the fact that students need to be used to solving problems that require active, critical, and logical thinking. Therefore the teacher's task is to help students with various questions and form the first impression of students by using a teaching system that demands active learning from students. This is in accordance with research (Sumiati & Agustini, 2020) that students' difficulties in solving flat shape problems are

DOI: <https://doi.org/10.24127/ajpm.v12i3.7475>

caused by students who still need clarification in understanding the questions, so the first step of the problem that must be solved is wrong. If students ignore the teacher's explanation, don't get enough practice questions and don't understand the basic concept of flat shapes, this is the cause of student learning difficulties. It is hoped that they will know students' learning difficulties and try to reduce students' difficulties in solving math problems.

CONCLUSION AND SUGGESTION

The inability of students to solve problems depends on several factors, including: (1). Students' difficulties in understanding the types of plane shapes; (2). When doing calculations, students have difficulty understanding flat conditions, so the math and work processes are incorrect. Because students still need help understanding, analyzing, and determining the purpose of the problem. (3). There are differences in students' critical thinking abilities in solving the given problems so that they have an impact on determining problem solving strategies. Based on the results of this study, the critical thinking skills of low vision students and blind students at SLB N Ungaran have different levels of ability and students still have difficulty solving flat problems based on mathematical critical thinking criteria.

In future research, it is expected to be able to review the increase in critical thinking in blind students as a form of improving the quality of learning. For other researchers, the results of this study can serve as a reference for conducting research on the development of both instructional media and learning models that can improve the geometry skills of blind inclusion students or

conduct research that uncovers the internal factors of blind students that affect critical thinking skills.

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