

# Exploring the learning barriers in mathematics for hearing-impaired students in inclusive classrooms

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**Abstract.** This study aims to identify the barriers and difficulties encountered by students with hearing impairments in learning mathematics in an inclusive classroom. This research employed a descriptive qualitative approach, involving students from SMP Negeri 2 Sewon, Bantul, and the inclusive class teacher as research subjects. Research instruments in the form of interviews and observations were used to collect data on the learning challenges faced by students with hearing impairments. Data analysis was conducted through data reduction, which involved filtering important information obtained from interviews and observations. The reduced data was then presented in a narrative form before drawing conclusions. The results indicate that the inclusive classroom setting provides both opportunities and challenges for students with hearing impairments, who often face difficulties in understanding mathematical concepts due to limitations in verbal communication and insufficient instructional strategies. Teachers reported the necessity of using clear lip movements and personalized teaching strategies, such as cooperative learning and differentiated instruction, to bridge these gaps. Additionally, the inclusive classroom fosters empathy and collaborative skills among all students, while the assessment standards for students with hearing impairments are adapted to align with their unique needs and abilities. This study is expected to provide a deep understanding of the barriers faced by students with hearing impairments in learning mathematics in an inclusive classroom..

**Keyword:** Learning barriers, Mathematics difficulties, Students with hearing impairments

## Introduction

The development of a nation is fundamentally reliant on the quality of its human resources. Enhancing this quality requires effective and well-optimized learning processes [1]. Indonesia's Law No. 2 of 1989 on the National Education System, specifically Article 5, asserts that every citizen is entitled to equal access to education, including individuals with disabilities. Education for children with disabilities is further governed by the Ministry of Education Regulation No. 70 of 2009, which allows for the provision of inclusive education for students with disabilities and/or those with exceptional intelligence or talents. Inclusive education is defined as a system that enables students from diverse conditions and backgrounds to learn together in a shared environment, with services adapted to meet their specific needs and abilities. This model underscores full integration, the removal of barriers, and the principle of education for all [2]. The diverse conditions and backgrounds of students with disabilities, including those with hearing impairments, are a central focus in inclusive education.

An individual with hearing impairment is referred to as "deaf" or "hard of hearing" [3]. The causes of hearing loss can include genetic factors, infections in the mother such as chickenpox

during pregnancy, complications during childbirth, or childhood diseases like mumps or chickenpox [4]. Children who are deaf have specific characteristics, such as limited vocabulary, difficulty understanding words with figurative meanings or idiomatic expressions, and lack of regularity in grammar [4]. Their intelligence levels are comparable to their peers, ranging from high, average, to low. Typically, they possess normal or average intelligence. However, their academic achievements are often lower due to limitations in understanding lessons that are delivered verbally [5]. Such challenges can hinder their ability to develop their potential during classroom learning. In addition to communication and knowledge limitations, students with hearing impairments also face challenges in learning mathematics [6].

In learning mathematics, common obstacles include difficulties in understanding the material, which often lead to errors in solving mathematical problems [7]. Factors contributing to students' learning barriers include ontogenetic barriers [8], which arise from lack of motivation or reluctance to engage in learning as well as psychological factors affecting their development process. Another factor is didactic barriers, which refer to how the teacher delivers the material or employs teaching methods [9]. Epistemological barriers, which pertain to students' understanding of context, may also contribute to their difficulties [10].

A study conducted by Regita Cahyani, Andi Husniati, and Andi Ardillah Wahyudi explains that some students with hearing impairments experience difficulties in solving mathematical problems presented as verbal or story problems [6]. The study also highlights challenges in understanding mathematics materials that involve numerous numbers. Based on these findings, this research aims to identify other learning barriers that students with hearing impairments might face in mathematics education.

## **Research Methods**

This study employs a descriptive research design with a qualitative approach. The purpose of this research is to identify the learning barriers and difficulties faced by students with hearing impairments in schools, specifically in inclusive classrooms. The subjects of this research are students from SMP Negeri 2 Sewon, Bantul, who are part of inclusive classrooms with hearing impairments. In addition to these students, the inclusive classroom teacher also serves as a research subject.

The instruments used in this research include interviews and observations. Interview guidelines and observation sheets were utilized to gather information regarding the learning barriers and difficulties in mathematics experienced by students with hearing impairments. The interviews were conducted with Mrs. Hesti, an inclusion assistant teacher at SMP Negeri 2 Sewon, Mrs. Wagiyem, a mathematics teacher, and students with hearing impairments through WhatsApp. The research was carried out on Tuesday, November 19, 2024, in the afternoon.

The data analysis technique applied in this study is data reduction [11]. This process includes filtering key information considered important through observation and interviews regarding the learning barriers and difficulties faced by students with hearing impairments. The reduced data is then presented, providing a structured set of information that enables comprehensive conclusions to be drawn [12]. The presentation of data in this study is conducted in a narrative form. After completing the data reduction and presentation stages, the research proceeds with drawing overall conclusions to determine the findings aligned with the research objectives.

In addition to data reduction, the researcher also employed observation techniques. This approach allows the recording of behaviors or events during the process. After observation, interviews were conducted using structured interview guidelines to ensure that discussions remain focused on the topic [13].

## **Results and Discussion**

The research was conducted to analyze the learning barriers experienced by students with hearing impairments at SMP Negeri 2 Sewon, Bantul, Yogyakarta. The interview process took place on Tuesday, November 19, 2024, at 2:00 PM WIB. The interview was conducted with Mrs. Hesti, the inclusion assistant teacher, and Mrs. Wagiyem, the mathematics teacher.

Based on the research conducted, data was obtained about the students, with a breakdown of 31 inclusive students, and 5 students with hearing impairments. The students are spread across grades 9

and 8. One student is in class 8F, two students are in class 9C, and two other students are in class 9D. The hearing-impaired students in the school mostly experience both hearing and speech impairments.

The classroom organization at SMP Negeri 2 Sewon involves including students with hearing impairments in regular classes. SMP Negeri 2 Sewon is an inclusive school, meaning that the school integrates normal students with students who have special needs. There are no restrictions on grouping students with special needs in one class. The inclusion assistant teacher at the school instills in students from the beginning that the school they attend is an inclusive school, meaning that normal students must care for all students, both normal and those with special needs. The inclusion assistant teacher always teaches students to pay more attention and show more understanding to students with special needs. This attention and understanding are not meant to be sympathy, but rather empathy. Students are encouraged to involve other inclusive students in group projects, even if the task division is adjusted to the capabilities of the students.

The criteria for students with hearing impairments at SMP Negeri 2 Sewon vary. According to the inclusion assistant teacher, students with hearing impairments are usually also accompanied by speech impairments. Additionally, some students with hearing impairments also have intellectual disabilities. Due to the variety in the criteria of hearing-impaired students, teachers face several challenges, obstacles, methods, and strategies to address them. Below is a more detailed explanation.

### 3.1. Teacher Challenges in Teaching Students with Hearing Impairments

Teaching students with hearing impairments certainly presents unique challenges for mathematics teachers when delivering lessons in the classroom. Based on the interviews with the mathematics teacher at SMP Negeri 2 Sewon, the main challenge faced when teaching students with hearing impairments is the necessity to use clear lip movements because the school does not use sign language. Teaching using clear lip movements can help hearing-impaired students understand the material being taught. This requires mathematics teachers to employ various strategies and to repeat lessons several times to achieve the learning objectives. Another challenge faced by mathematics teachers during class is the need to give more attention to students with hearing impairments, as these students are less likely to ask questions during the lesson. This can lead to a lack of communication, making it difficult for hearing-impaired students to understand the material conveyed verbally, and they may feel reluctant to participate [15]. Therefore, mathematics teachers must be proactive in asking students with hearing impairments.

### 3.2. Teaching Methods and Strategies for Students with Hearing Impairments

In the learning process, teachers generally apply a differentiated learning approach, starting with general concept delivery to all students in the class. This phase aims to ensure the initial understanding of all students. After students without impairments understand the material, the teacher provides additional interventions to the students with special needs, such as those with hearing impairments, for more personal guidance tailored to their needs. Additionally, teachers often use cooperative learning, where students who have understood the material are encouraged to help their peers who are struggling. This approach not only improves the understanding of students with special needs but also builds social skills and empathy among students.

At this school, the communication method used in learning is the oral approach, where the teacher does not use sign language in interactions with students. Instead, hearing-impaired students are trained to read lips as the primary means of understanding conversations. This approach aims to familiarize students with communicating verbally, so they can adapt and blend more easily with the wider society, which generally does not use sign language.

This approach is based on the assumption that lip-reading skills and verbal communication understanding will facilitate the social integration of hearing-impaired students in non-inclusive environments. Therefore, students are expected to develop better communication independence in various everyday life situations. However, implementing this method requires intensive practice and consistency in familiarizing students with paying attention to articulation and the speaker's expression.

The assessment standards used are differentiated between normal students and students with impairments. For students with hearing impairments, assessment standards are adjusted according to individual needs and learning abilities, so that the evaluation becomes more inclusive and focused on the achievement of development according to each student's potential.

Furthermore, teachers at this school actively communicate with the parents of students with hearing impairments. This collaboration aims to create continuity in the learning process both at school and at home. Through intensive communication, teachers and parents can share information about the students' learning progress, the challenges they face, and the effective strategies to optimize their understanding, particularly in mathematics learning.

### 3.3. Interactions, Student Responses, and Needed Support

In the learning process, interaction between hearing-impaired students and normal students is essential. Managing interactions between hearing-impaired students and other students requires an inclusive approach and empathy. For instance, creating an inclusive environment ensures that all students feel valued and accepted by educating other students about the needs and challenges of students with hearing impairments. Designing collaborative activities that encourage interaction among students is one of the activities carried out so they can understand each other and work together. Some students also use hearing aids, which help them in the learning process. Hearing aids are very beneficial in supporting daily activities, especially during lessons [16].

In addition, responses from hearing-impaired students to the learning material are also received and can be improved by the teacher. Hearing-impaired students usually have varied responses to mathematics material depending on the method of delivery, the support provided, and the degree of their hearing impairment. Hearing-impaired students tend to be more responsive to mathematics lessons that involve visualization, such as diagrams, graphs, or concrete models. This helps them understand abstract concepts. They generally find it easier to understand material presented in a structured manner, with clear steps, and supported by text or symbols to replace verbal instructions.

To address the two issues above, support from various parties is needed. The important support that can help students with hearing impairments learn mathematics more effectively includes providing more attention to them, ensuring they sit in strategic locations so they can see the teacher speaking, helping them follow the explanation better, and using simple and easily understood sentences in questions or explanations. In addition to helping students understand the material, seating arrangements also make it easier for teachers to control and supervise student behavior [17].

## **Kesimpulan**

Based on the observations regarding the learning challenges faced by hearing-impaired students in mathematics at SMP Negeri 2 Sewon, obtained through interviews with the inclusion support teacher and the mathematics teacher, it was found that students with hearing impairments face varying levels of difficulty in learning. Their responses to mathematics lessons also differ depending on their level of comprehension. The mathematics teacher at SMP Negeri 2 Sewon frequently encounters challenges in teaching, such as the necessity of using clear lip movements since sign language is not employed in the lessons. Teachers must also be more proactive in asking questions to hearing-impaired students, as they rarely ask questions during the lesson. The assessment system at SMP Negeri 2 Sewon for hearing-impaired students is different from that of normal students, using differentiated interactions as the basis for inclusive learning in the classroom. Teachers are required to provide an inclusive approach and show empathy towards students with hearing impairments, offering them specialized support in their learning process.

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