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# Analysis of Noise Intensity with Communication Disorders and Hearing Impairment ot Students of SDN 1 Siwalankerto Surabaya in 2025

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## ABSTRACT

**Background:** Noise is a form of physical environmental pollution that can interfere with students' health and learning processes. SDN 1 Siwalankerto Surabaya is located near a highway and railroad tracks, which poses a risk of communication and hearing impairments. **Methods:** This study employed quantitative research with an analytical design. A crosssectional approach was used, involving 5th and 6th grade students selected through purposive sampling. Noise levels were measured using a Sound Level Meter (SLM), communication disorders were assessed using a questionnaire, and hearing examinations were conducted with an audiometer. Data were analyzed using the Chi-Square test with a 5% significance level. **Results:** The average noise level in Grade 5 reached 80.7 dB, while in Grade 6 it was 77.25 dB, both exceeding the quality standard set by Permenkes RI No. 2 of 2023. A total of 46.1% of students experienced communication disorders (p = 0.042). Meanwhile, 30.5% of students had moderate to severe hearing loss (p = 0.003 in the right ear; p = 0.016 in the left ear). **Conclusion:** There is a significant relationship between noise and both communication and hearing disorders. It is necessary to reduce noise levels in schools by planting natural vegetation and installing soundproofing materials.
**Keywords:** Noise, Communication Disorder, Hearing Loss

## BACKGROUND

Noise is a form of physical environmental pollution that is commonly found in urban areas and has a negative impact on public healthy (WHO, 2018). It can be defined as unwanted sound that may cause hearing loss, reduce comfort, and negatively affect mental health (Petri et al., 2021). In urban environments, the main sources of noise typically originate from motor vehicle and train traffic, with sound intensities often exceeding environmental quality standards. Primary schools play a crucial role in supporting students' cognitive, social, and communication development. A quiet and comfortable learning environment enhances students' focus, enabling them to better understand the material being taught (Haslianti, 2019). However, a noisy school environment can impair concentration, hinder communication, and lower academic achievement (Petri et al., 2021). Surabaya, as one of the major cities in Indonesia with a population of 3,009,286 in 2023, experiences high noise levels, particularly in schools located near major roads and railway lines (BPS Surabaya City, 2023). According to the Decree of the Minister of Environment No. 48/MENLH/11/1996, the maximum permissible noise level in school areas is 55 dB (Keputusan Menteri Negara Lingkungan Hidup Nomor : KEP-48/MENLH/11/1996 Tentang Baku Tintang Kebisingan, 1996).

Research by Mahardika (2021) found that noise levels at SDN 1 Rajabasa Raya, located near railway tracks, averaged 66.84 dB well above the threshold. Similarly, Anggela, (2024) reported that noise levels in classrooms adjacent to highways reached 63.79 dB in the morning. Noise levels exceeding the quality standard can lead to various health issues, such as stress, sleep disturbances, increased blood pressure, communication disorders, and a heightened risk of permanent hearing loss with prolonged exposure (Sari & Nurgahayu, 2021). SDN 1 Siwalankerto Surabaya is among the schools at high risk of noise exposure, situated only about 8 meters from the Ahmad Yani highway and 10 meters from railway tracks. Preliminary measurements taken in February 2025 showed that noise levels reached 79.05 dB in Grade 5 and 68.05 dB in Grade 6 both above the acceptable standard. These conditions pose potential risks for communication difficulties between teachers and students, as well as among students themselves, and increase the likelihood of hearing impairment if not properly addressed.

Continuous exposure to noise above 70 dB can lead to sensorineural hearing loss due to damage to cochlear hair cells in the inner ear (Zahrany et al., 2022). Moreover, noise can reduce students' ability to absorb instructional content, disrupt classroom communication, and contribute to mental fatigue. If left unaddressed, communication and hearing disorders in elementary school students may negatively impact their academic performance.

## RESEARCH METHODS

The study employed a cross-sectional design, involving 5th and 6th grade students selected through purposive sampling. Noise data were collected using a Lutron SL-4001 Sound Level Meter (SLM) during classroom activities. Communication disorders were assessed using a structured questionnaire, while hearing examinations were conducted with an Amplivox audiometer. Data were analyzed using the Chi-Square test in the latest version of SPSS software, with a significance level set at 0.05. The study underwent ethical review and was deemed to pose no risk to human subjects; therefore, no further ethical approval was required.

## RESULTS AND DISCUSSION

### A. Noise intensity measurement results

The results of noise level measurements conducted on May 14, 2025, in Classrooms 5 and 6 of SDN 1 Siwalankerto Surabaya at 08:00 and 11:30 are summarized in Table 1. below:

**Table 1**.
Noise Measurement Results of SDN 1 Siwalankerto Surabaya

| No. | Sample Point | Noise Intensity Measurement Result | | Mean Noise Intensity | Category |
|---|---|---|---|---|---|
| | | Morning | Noon | | |
| 1. | Classroom 5 | 83,5 dB | 77,9 dB | 80,7 dB | High |
| 2. | Cassroom 6 | 78,1 dB | 76,4 dB | 77,25 dB | Medium |

Based on Table 1., the noise intensity in Classroom 5 falls into the moderate category with an average of 80.7 dB, while Classroom 6 falls into the high category with an average of 77.25 dB. According to the Regulation of the Minister of Health of the Republic of Indonesia No. 2 of 2023 concerning Implementation Regulations of Government Regulation No. 66 of 2014 concerning Environmental Health (2023), the noise levels in both

classrooms exceed the permissible quality standard for educational areas.

**B. Communication Disorders of Students of SDN I Siwalankerto Surabaya**

The results of the assessment of communication disorders in students at SDN 1 Siwalankerto Surabaya tested on 39 students can be seen in Table 2. below:

**Table 2.**
Communication Disorder Measurement Results

| No | Communication Dissorder | Classroom 5 | | Classroom 6 | | Total | |
|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % |
| 1. | Not Disturbed | 16 | 76,2% | 7 | 23,8% | 23 | 100% |
| 2. | Distracted | 5 | 38,9% | 11 | 61,1% | 16 | 100% |
| | Total | 21 | 53,9% | 18 | 46,1% | 39 | 100% |

According to Table 2, out of a total of 39 students at SDN 1 Siwalankerto Surabaya—consisting of 23 students from Grade V and 16 students from Grade VI—21 students (53.9%) reported no communication difficulties due to noise in the school environment. Meanwhile, 18 students (46.1%) stated that they experienced communication problems. These results indicate that although more than half of the respondents did not feel disturbed in communicating, a significant proportion still experienced communication barriers. This suggests that noise in the school environment can negatively affect students' ability to interact and communicate effectively.

**Hearing loss in students**

1. Right ear hearing loss

The results of right ear hearing measurements using audiometry to 39 students in grades V and VI at SDN 1 Siwalankerto Surabaya as found in Table 3:

**Table 3.**

Right Ear Hearing Loss

| No. | Right Ear Hearing Loss | Classroom 5 | | Classroom 6 | |
|---|---|---|---|---|---|
| | | n | % | n | % |
| 1. | Not disturbed-mild | 15 | 65,3% | 2 | 13% |
| 2. | Moderate-severe distress | 8 | 34,7% | 14 | 87% |
| | **Total** | 23 | 100% | 16 | 100% |

Based on the results of right ear hearing measurements using audiometry on 39 students from Grades V and VI at SDN 1 Siwalankerto Surabaya, as presented in Table 3, differences were found in the levels of hearing loss between the two grades. Among Grade V students, 15 (65.3%) were categorized as having no impairment to mild impairment, while 8 students (34.7%) experienced moderate to severe impairment. In contrast, among Grade VI students, the majority—14 students (87%)—were found to have moderate to severe impairment, while only 2 students (13%) were categorized as having no impairment to mild impairment. This data indicates that

right ear hearing loss is more prevalent among Grade VI students compared to those in Grade V. One possible contributing factor is the difference in the duration or intensity of exposure to noise in the school environment.

2. Left Ear Hearing Loss

The results of left ear hearing measurements using audiometry to 39 students in grades V and VI at SDN 1 Siwalankerto Surabaya as found in table 4:

**Table 4.**
Left Ear Hearing Loss

| No. | Left Ear Hearing Loss | Classroom 5 | | Classroom 6 | |
|---|---|---|---|---|---|
| | | n | % | n | % |
| 1. | Not disturbed-mild | 16 | 69,5% | 4 | 25% |
| 2. | Moderate-severe distress | 7 | 30,5% | 12 | 75% |
| | **Total** | 23 | 100% | 16 | 100% |

Based on the data obtained, 16 students (69.5%) in Grade V fall into the category of no hearing loss to mild impairment, while 7 students (30.5%) are identified as having moderate to severe hearing loss. Meanwhile, Grade VI students showed a similar pattern but with a higher percentage in the moderate to severe impairment category. Of the 16 students in Grade VI, only 4 students (25%) had hearing within the normal to mild impairment range, while the remaining 12 students (75%) experienced moderate to severe hearing loss. This data indicates that left ear hearing loss is more prevalent among Grade VI students compared to Grade V students. One contributing factor may be differences in the duration or intensity of exposure to noise in the school environment.

**C. Relationship Between Noise Intensity And Students Communication Disorder**

The results of the analysis of the relationship between noise intensity and student communication disorders at SDN 1 Siwalankerto Surabaya can be seen in table 5 below:

**Table 5.**
Results of Analysis of the Relationship between Noise and Communication Disorders

| No. | Noise Intensity | Not Disturbed | | Distracted | | Total | |
|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % |
| 1. | Medium | 16 | 76,2% | 7 | 23,8% | 23 | 100% |
| 2. | High | 5 | 38,9% | 11 | 61,1% | 16 | 100% |
| | Total | 21 | 53,9% | 16 | 46,1% | 39 | 100% |
| | *p-value=0,042* | | | | | | |

Referring to the data in Table 5, the analysis of the relationship between noise and communication disorders yielded a p-value of 0.042. This indicates that the null hypothesis H0 is rejected, meaning there is a statistically significant relationship between noise intensity and communication disorders among students at SDN 1 Siwalankerto Surabaya.

**D. Relationship between noise intensity and students' hearing loss**

1. Right ear disorders
   The results of data analysis of the relationship between noise intensity and hearing loss in the right ear. The results of the Chi Square Test of the right ear can be seen as found in table 6. below:

**Table 6.**

Results of Analysis of the Relationship between Noise and Right Ear Hearing Loss

| No. | Noise Intensity | Not disturbed-mild | | Moderate-severe distress | | Total | |
|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % |
| 1. | Medium | 15 | 65,3% | 2 | 13% | 17 | 43,5% |
| 2. | High | 8 | 34,7% | 14 | 87% | 22 | 56,5% |
| | Total | 23 | 100% | 16 | 100% | 39 | 100% |
| | *p-value=0,003* | | | | | | |

Based on the data in Table 6, the analysis of the relationship between noise and right ear hearing loss resulted in a p-value of 0.003. This indicates that the null hypothesis H0 is rejected, meaning there is a statistically significant relationship between noise intensity and hearing loss in the right ear among students at SDN 1 Siwalankerto Surabaya.

2. Left Ear Disorders
   The results of data analysis of the relationship between noise intensity and hearing loss in the left ear. The results of the Chi Square Test of the right ear can be seen as found in table 7 below:

**Table 7.**

Results of Analysis of the Relationship between Noise and Left Ear Hearing Loss

| No. | Noise Intensity | Not disturbed-mild | | Moderate-severe distress | | Total | |
|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % |
| 1. | Medium | 16 | 69,5% | 4 | 25% | 20 | 51,3% |
| 2. | High | 7 | 30,5% | 12 | 75% | 19 | 48,7% |
| | | 23 | 100% | 16 | 100% | 39 | 100% |
| | p-Value=0,016 | | | | | | |

Referring to the data in Table 7, the analysis of the relationship between noise and left ear hearing loss resulted in a p-value of 0.016. This indicates that the null hypothesis H0 is rejected, meaning there is a statistically significant relationship between noise intensity and hearing

loss in the left ear among students at SDN 1 Siwalankerto Surabaya.

**Discussion**

The results showed that the noise intensity at SDN 1 Siwalankerto, Surabaya exceeded the environmental noise quality standard for schools, which is set at 55 dB according to the Regulation of the Indonesian Ministry of Health (Permenkes RI) No. 2 of 2023. Classrooms located near highways and railroad tracks recorded higher noise levels compared to others, aligning with the theory that proximity to a noise source increases the intensity of noise exposure (Zahrany et al., 2022).

The high noise levels at this school have impacted students' hearing health. Many students reported symptoms such as ringing in the ears and difficulty hearing their teacher's voice. This supports the theory that chronic exposure to noise can damage the cochlear hair cells and lead to sensorineural hearing loss (Yanti et al., 2022). In addition to hearing issues, noise also disrupts the communication process. Data showed that nearly half of the students had difficulty understanding the speech of teachers or peers and had to rely on lip reading to follow conversations. This condition is consistent with the findings of Alfira et al. (2023) and Adha Hernayanti et al. (2018), which state that high noise levels are directly correlated with an increased incidence of communication disorders in classrooms.

An analysis of the relationship between noise intensity and communication disorders revealed a significant correlation ($p = 0.042$), indicating that higher noise levels increase the risk of students experiencing communication difficulties. This finding demonstrates that noise in schools not only causes discomfort but also directly affects the effectiveness of learning and social interaction. Communication theory in education emphasizes that effective communication requires an environment with minimal distractions, so that messages can be received and understood clearly.

The study also found a significant relationship between noise intensity and hearing loss in both ears ($p = 0.003$ in the right ear; $p = 0.016$ in the left ear). Most students exposed to high noise levels experienced moderate to severe hearing loss. This aligns with the theory of Noise-Induced Hearing Loss (NIHL), which states that continuous exposure to high-intensity noise can lead to permanent hearing damage (Basner et al., 2014).

Moreover, the duration of exposure was also identified as a risk factor. Students at SDN 1 Siwalankerto are exposed to noise for 6–8 hours per day, corresponding with school hours, due to a full schedule of learning activities and the school's proximity to major noise sources. According to Riadie (2020), prolonged exposure increases the risk of both hearing and communication disorders. These disorders can have long-term impacts, including decreased concentration, reduced ability to understand learning material, and lower academic performance.

Therefore, it is essential to implement noise control measures such as installing soundproofing materials in classrooms, relocating learning spaces away from noise sources, and planting vegetation as natural sound barriers. Additionally, regular hearing screenings and educational initiatives to raise awareness among the school community about the dangers of noise exposure are important steps to safeguard students' health and to create a more comfortable and productive learning environment.

## CONCLUSION

Based on the research conducted at SDN 1 Siwalankerto, Surabaya, it can be concluded that the noise level in the school environment is high, with an average intensity of 78.97 dB. This value

exceeds the noise threshold for educational areas, which is set at 55 dB according to the Regulation of the Indonesian Ministry of Health (Permenkes RI) No. 2 of 2023 .

High noise exposure impacts students' communication abilities. The data showed that more than half of the students (61.1%) exposed to high-intensity noise experienced communication disorders, while in the group exposed to moderate noise levels, only about a quarter of the students (23.8%) reported such issues. This indicates that the higher the noise intensity, the greater the risk of disruption to students' communication processes in the classroom.

In addition, hearing threshold examinations conducted on Grade 5 and 6 students revealed that the majority had mild hearing loss. The average hearing threshold was 37.56 dB for the right ear and 33.71 dB for the left ear, indicating a decline in hearing function that warrants attention.

Statistical analysis also demonstrated a significant relationship between noise exposure and communication disorders, with a p-value of 0.042. This confirms that high noise levels negatively affect students' ability to communicate.

Furthermore, a significant relationship was found between noise levels and students' hearing loss, with p-values of 0.003 for the right ear and 0.016 for the left ear. These findings indicate that noise not only interferes with communication but also directly impacts students' hearing heal.

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