
Article

Classroom Noise and Its Impact on Communication Disruptions and Students' Academic Performance

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Abstract

Noise in classrooms can disrupt communication between teachers and students, potentially affecting learning outcomes. Previous research indicates that noise exceeding environmental health standards may contribute to communication difficulties during lessons. This study aimed to analyze the effect of classroom noise and communication disruptions on students' learning achievement. An observational analytic study with a cross-sectional design was conducted among 4th and 6th grade students at one of the elementary schools in South Surabaya. Noise levels were measured in the classrooms, and students were assessed for communication disruptions and learning achievement. Logistic regression was used for data analysis. All classrooms exceeded the environmental health noise threshold of 55 dB(A), with an average level of 67.45 dB(A). Noise was significantly associated with communication disruptions (OR = 5.118; p = 0.012). Classroom noise increased the risk of communication disruptions but did not directly affect students' learning achievement. It is recommended to install soundproof partitions and double-glazed windows to reduce noise. Future studies should investigate the interaction between teaching methods and student achievement.

Key words:

1. Academic performance
2. Communication disruptions
3. Learning environment
4. Noise

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Introduction (required)

The school environment plays a crucial role in shaping students' learning and character, but exposure to noise—especially from external sources like traffic or commercial areas—poses significant challenges to academic success. Numerous studies and meta-analyses have shown that both environmental and classroom noise have a moderate to strong negative impact on students' cognitive and academic performance, particularly in areas such as attention, memory, reading, and mathematics. These effects are especially pronounced in younger children and those at higher risk for learning difficulties [1], [2], [3], [4], [5], [6], [7], [8].

Noise not only disrupts concentration but also impairs communication in the classroom. High background noise levels reduce speech intelligibility, making it harder for students to understand teachers and absorb information. This leads to communication disruptions, which further hinder

learning and academic achievement [9], [10], [11]. Students exposed to chronic or acute noise report more subjective complaints, such as fatigue and stress, and consistently perform worse on standardized academic tests [2], [5], [6], [7], [8].

Classroom noise levels often exceed recommended standards, with many studies documenting noise far above WHO guidelines, resulting in measurable declines in academic performance and increased communication difficulties [8], [10], [14], [15]. Younger students are particularly vulnerable, and the negative effects of noise are more pronounced during complex or moderately difficult tasks [7].

Despite extensive evidence linking noise to reduced academic performance and communication problems, few studies have directly examined the combined impact of noise exposure and communication disruptions on student achievement. Therefore, this study aims to address this gap by specifically investigating the relationship between noise, communication disruptions, and students' learning outcomes.

Materials and Method

Research Design and Approach: This study is an observational study with a cross-sectional analytical approach that aims to analyze the effect of noise and communication disruptions on student learning achievement. This approach was chosen because it allows the measurement of independent and dependent variables to be carried out simultaneously at one time without direct intervention from the researcher.

Location and Time of Research: The study was conducted at one elementary school in South Surabaya which is geographically close to the external noise source, namely the outside air conditioning unit from shopping center. The study was conducted from January to May 2025.

Population and Sampling Technique: The population in this study consisted of all students from one elementary school in South Surabaya, totaling 497 students. The sample in this study included students from grades 4 and 6, as their classrooms were located near the noise source. The sample size was determined using the Lemeshow formula with the inclusion criteria being students in classrooms situated close to the noise source, resulting in 62 samples. The sample was selected using the Simple Random Sampling technique.

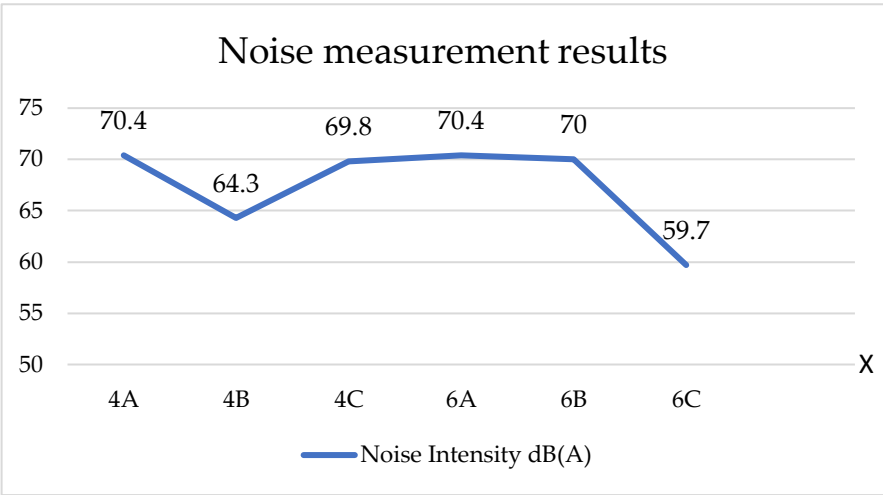
Research Variables: The independent variables in this study consisted of noise and communication disruptions and dependent variable is student learning achievement.

Data Collection Method: Noise measurement was carried out using straightforward methods in accordance with [16] and the gold standart based on Indonesian Nasional Standard (SNI) 8427;2017 [17] concerning environmental noise level measuremet. In particular, by positioning the Sound Level Meter (SLM) at approximately 1.2 meters above the floor or ground and aiming it towards the loudest source, measurements were conducted for 10 minutes [16], leading to a total of 120 data completes. Complaints of communication disruptions were measured using a questionnaire, where the questionnaire had previously been tested for validity and reliability before the research was carried out. Learning achievement data was obtained from secondary data of odd semester report cards for the 2024-2025 academic year. The use of the data was based on the results of the preliminary survey which showed that the noise level in the odd semester was consistent, where the noise level was at 62.4 -72.2 dB(A).

Data Analysis: The data was analyzed using Logistic Regression Test to analyze the presence or absence of a significant effect between independent variables and dependent variables. The independent variables in this study consisted of noise and communication disruptions and dependent variable is student learning achievement, the statistical software used is version 16.

Research Ethics: This study has been declared ethically feasible based on 7 (seven) WHO Standards 2011 issued by the Health Assessment Ethics Commission (KEPK) of the Surabaya Ministry of Health Polytechnic with approval number EA/3410/KEPK-Poltekkes_Sby/V/2025. During the course of the study, ethical standards such as respect for participants, the principles of beneficence and non-maleficence, and justice were strictly maintained. All individuals involved received comprehensive information regarding the study’s objectives, potential benefits, and procedures before being asked to provide their written informed consent. The confidentiality of participants’ personal information was rigorously protected, ensuring that data was used exclusively for research purposes. These measures were implemented to safeguard participants’ rights and well-being throughout the research process, in accordance with established ethical guidelines.

Results
Noise Measurement



Source: Primary Data, 2025

Figure 1. Noise Measurement Results

Based on **Figure 1**, It was known that the noise levels of classes that fell into the high category were in classes 4A, 6A, and 6B, each of which had noise values of 70.4 dB(A) and 70.0 dB(A). In addition, class 4C also fell into the high category with a value of 69.8 dB(A). Meanwhile, classes 4B and 6C fell into the low noise category, with each class having noise levels of 64.3 dB(A) and 59.7 dB(A), respectively. The average noise level of all measured classes was 67.45 dB(A).

Table 1. Distribution of Communication Disruptions and Learning Achievement (n = 62)

Variable	Category	n	%
Communication Disruptions	With complaints	33	53.2
	No complaints	29	46.8
Learning Achievement	Good (A: 91–100)	60	96.7
	Fair (B: 85–90)	2	3.3
	Deficient (C: <85)	0	0

Based on the noise measurements in several classrooms presented in table 1, it is known that the noise level in all classrooms is above the environmental quality standard threshold of 55 dB(A). The lowest noise level was recorded in classroom 6C at 59.7 dB(A), while the highest was in classrooms 4A and 6B at 70.4 dB(A). The overall average noise level was 67.45 dB(A), indicating that the learning

environment was in the high noise category. The majority of classrooms, such as 4A, 4C, 6A, and 6B, were classified as high noise, while only two classrooms, 4B and 6C, were classified as low noise. This pattern shows that most classrooms were exposed to noise levels that exceeded environmental health standards, which had the potential to interfere with communication between teachers and students during the learning process. These findings illustrate the dominance of noise exposure originating from external activities, such as the central air conditioning units of shopping centres surrounding the school.

Table 2. Relationship Between Noise Level and Learning Achievement with Communication Disruptions (n = 62)

Variable	Category	Communication Disruptions		Total (n)	OR	95% CI	p- value	Interpretation
		Complaints (n / %)	No Complaints (n / %)					
Noise Level	High	29 (63.0)	17 (36.9)	46	5.118	1.42– 18.41	0.012	Significant
	Low	4 (25.0)	12 (75.0)	16				
Learning Achievement	Good	31 (93.9)	29 (100)	60	0.875	0.05– 14.64	0.092	Not significant
	Fair	2 (6.1)	0 (0)	2				

The results of the distribution of respondents based on communication disorders and learning achievement presented in **Table 2** show that more than half of the students, namely 33 students (53.2%), experienced complaints of communication disorders during the learning process, while 29 students (46.8%) did not report similar complaints. This condition indicates that communication disorders are a fairly dominant phenomenon in noisy learning environments. In terms of learning achievement, most students performed well, with 60 students (96.7%) obtaining a *good* grade in the range of 91–100, while only 2 students (3.3%) were in the *fair* category (85–90), and no students performed poorly. These data confirm that even though more than half of the students experienced communication difficulties due to noise, their academic achievement was generally still high. This may indicate that internal factors such as learning motivation, family support, and students' adaptability also play an important role in maintaining achievement in an unfavourable learning environment.

Discussion

The results of this study showed that the noise level in the classrooms of one elementary school in South Surabaya reached an average of 67.45 dB(A), exceeding the Environmental Health Quality Standard >55 dB(A) according to the Minister of Health Regulation Number 2 of 2023. The logistic regression test results showed that noise has a significant effect on communication disorders (p-value = 0.012) with an Odds Ratio (OR) value of 5.118. This supports the initial hypothesis that noise increases the risk of communication breakdown. This phenomenon can be explained through the masking effect of noise, which masks the voice of the teacher or friends, thus inhibiting the delivery and reception of information in the teaching and learning process. These results are in line with research [18] where almost 89% of experiments showed that noise in the classroom can reduce student comprehension.

Interestingly, although most students (53.2%) experienced complaints of communication disruptions, statistical tests showed no significant effect of communication disruptions on learning achievement (p-value = 0.092) with an Odds Ratio (OR) value of 0.875. Although students experience communication disruptions due to noise, this factor is not the only one. The only thing that can affect academic achievement.

Student learning achievement is influenced by a complex interplay of internal and external factors. Recent research highlights that internal factors such as learning motivation, interest, self-efficacy, emotional intelligence, and cognitive abilities play a crucial role in academic achievement [13], [19], [20]. Additionally, external factors like family support, learning environment, instructional quality, technology use, and socioeconomic status also significantly affect student outcomes [12], [20], [21], [22], [23]. Meta-analyses and machine learning approaches reveal that the interaction between

learning behaviors, pedagogical environments, active learning strategies, and social and family support can optimally enhance academic achievement [12], [20], [22], [23].

Therefore, efforts to improve learning achievement should consider a dynamic and contextual multifactorial approach, adapting to technological advancements, social changes, and the evolving needs of students (Mao et al., 2025; Schneider & Preckel, 2017; Dechavez, 2024). Research [24] found differences in learning achievement in mathematics and Indonesian language subjects in *stunting* and *non-stunting* students. In addition, students who have high motivation and interest in certain subjects tend to be more active and focused in learning, so they can achieve better results [25]. Another study also mentioned that student attitudes, such as learning discipline, also have a relationship with learning achievement [26].

The teaching and learning process, learning motivation, and learning environment had a simultaneous effect on learning achievement, another study states that the learning model used had an influence on student learning achievement [27]. Another study states that the learning model used has an influence on student learning achievement [28]. This finding rejects the initial hypothesis that suspects a direct impact of communication disruptions on decreased learning achievement, indicating that student learning achievement is highly influenced by various complex and interrelated variables. The findings on the effect of noise on communication disruptions are in line with studies [29] and [30], which showed a high prevalence of communication disruptions in students exposed to traffic or industrial noise. However, the result about the absence of a direct effect of communication disruptions on learning achievement contradicts the study of [8] which showed that math scores decreased as noise increased and based on the results of [1] the effect of noise on reading and calculation skills, with an effect size range of 0.29-0.62.

High levels of noise could indeed have auditory effects (like temporary hearing loss) and non-auditory effects (such as stress or increased blood pressure). However, student learning performance appeared to depend not just on aspects of verbal communication. Internal factors like interest, motivation, and students' learning approaches were significant. This was backed by the theory that effective learning did not rely solely on oral communication, but also included visualization, literacy, and hands-on practice [31], which may not be completely disrupted by noise.

Theoretically, this study reaffirmed the importance of physical environmental factors to classroom communication. The findings extend the understanding that noise impacts the communication process more than directly on academic outcomes. This study has some limitations that need to be examined. Learning achievement data was only taken from report cards, which do not fully represent students' overall academic ability or practical skills.

Conclusions

This study shows that noise in the classroom has a significant effect on the emergence of communication barriers between teachers and students during the learning process. A noisy learning environment has been proven to hinder the effectiveness of information delivery and reception, thereby reducing the quality of teaching and learning interactions. However, the communication disruptions that occur do not directly impact students' academic performance, which remains good thanks to internal factors such as motivation, study discipline, and social support. These findings emphasize the importance of controlling physical factors in the school environment as part of efforts to create a healthy and productive learning atmosphere. Further research is recommended to explore the influence of noise on students' psychological aspects and concentration longitudinally, as well as to evaluate the effectiveness of technical and pedagogical interventions in minimizing the impact of noise on the learning process.

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Informed Consent Statement (optional)

Informed consent was obtained from all subject involved in the study.

Conflicts of Interest (required)

The authors declare no conflict of interest.

References

- [1] G. Fretes and R. Palau, 'The Impact of Noise on Learning in Children and Adolescents: A Meta-Analysis', *Appl. Sci.*, vol. 15, no. 8, 2025, [[Crossref](#)] [[Publisher](#)]
- [2] B. M. Shield and J. E. Dockrell, 'The effects of environmental and classroom noise on the academic attainments of primary school children', *J. Acoust. Soc. Am.*, vol. 123, no. 1, pp. 133–144, 2008, [[Crossref](#)] [[Publisher](#)]
- [3] A. Shukla, B. N. Tandel, M. Parida, and H. R. Patel, 'A comprehensive study on impact of noise exposure on roadside school childrens' cognitive performance', *Ergonomics*, pp. 1–15, Dec. 2024, [[Crossref](#)] [[Publisher](#)]
- [4] F. Gheller, G. Spicciarelli, P. Scimemi, and B. Arfé, 'The Effects of Noise on Children's Cognitive Performance: A Systematic Review', *Environ. Behav.*, vol. 55, no. 8–10, pp. 698–734, Dec. 2023, [[Crossref](#)] [[Publisher](#)]
- [5] A. Gilavand and A. Jamshidnezhad, 'The effect of noise in educational institutions on learning and academic achievement of elementary students in Ahvaz, South-West of Iran', *Int. J. Pediatr.*, vol. 4, no. 3, pp. 1453–1463, 2016, [[Crossref](#)] [[Publisher](#)]
- [6] S. Bhang *et al.*, 'Comparing Attention and Cognitive Function in School Children across Noise Conditions: A Quasi-Experimental Study', *Psychiatry Investig.*, vol. 15, no. 6, pp. 620–627, Jun. 2018, [[Crossref](#)] [[Publisher](#)]
- [7] S. Caviola, C. Visentin, E. Borella, I. Mammarella, and N. Prodi, 'Out of the noise: Effects of sound environment on maths performance in middle-school students', *J. Environ. Psychol.*, vol. 73, 2021, [[Crossref](#)] [[Publisher](#)]
- [8] B. Zhang and R. Navejar, 'Effects of Ambient Noise on the Measurement of Mathematics Achievement for Urban High School Students', *Urban Educ.*, vol. 53, no. 10, pp. 1195–1209, 2018, [[Crossref](#)] [[Publisher](#)]
- [9] B. M. Shield and J. E. Dockrell, 'The Effects of Noise on Children at School: A Review', *Build. Acoust.*, vol. 10, no. 2, pp. 97–116, Jun. 2003, [[Crossref](#)] [[Publisher](#)]
- [10] A. Pervaiz, A. A. Lashari, A. Khan, and A. Bushra, 'Exploring The Challenges of Noisy Areas Faced by Teachers in Teaching and Learning in Urban Schools', *Pakistan J. Humanit. Soc. Sci.*, vol. 12, no. 1, Mar. 2024, [[Crossref](#)] [[Publisher](#)]
- [11] I. S. Schiller, A. Remacle, N. Durieux, and D. Morsomme, 'Effects of Noise and a Speaker's Impaired Voice Quality on Spoken Language Processing in School-Aged Children: A Systematic Review and Meta-Analysis', *J. Speech, Lang. Hear. Res.*, vol. 65, no. 1, pp. 169–199, Jan. 2022,

[[Crossref](#)] [[Publisher](#)]

- [12] C. F. J. Dechavez, 'Contextualizing Learning: A Multi-Variable Analysis of Student Characteristics, Educational Settings, and Academic Success', *Int. J. Res. Sci. Innov.*, vol. XI, no. VIII, pp. 228–243, 2024, [[Crossref](#)] [[Publisher](#)]
- [13] N. Zusmita Wasni, D. A. E. P. Sembiring, M. Yusuf, R. Hendra, and E. Febriyanti, 'The Influence of Emotional Intelligence, Self-Efficacy, and Learning Motivation on Student Achievement', *Edukasi*, vol. 18, no. 2, pp. 105–120, Nov. 2024, [[Crossref](#)] [[Publisher](#)]
- [14] AZZA MOHAMED AL-ASMAR, 'Assessment of noise pollution and specific mitigation measures to reduce it in educational settings and its impact on students' academic performance: A review', *World J. Adv. Res. Rev.*, vol. 25, no. 1, pp. 273–286, Jan. 2025, [[Crossref](#)] [[Publisher](#)]
- [15] T. M. Agaja and G. P. Akande, 'Impact Of Noise Pollution On The Academic Performance Of Students In The University Of Ilorin's Learning Environment, Nigeria', *FUDMA J. Earth Environ. Sci.*, vol. 1, no. 02, pp. 42–57, Dec. 2024, [[Crossref](#)] [[Publisher](#)]
- [16] K. Prabowo and B. Muslim, 'Noise Measurement', in *Air Sanitation*, 1st ed., Center for Health Human Resources Education, 2018, p. 171.
- [17] B. S. Nasional, 'SNI 8427-2017;Environmental Noise Level Measurement'. National Standardization Agency, Jakarta, pp. 1–10, 2017. [[Publisher](#)]
- [18] A. S. Lamotte, A. Essadek, G. Shadili, J. M. Perez, and J. Raft, 'The Impact of Classroom Chatter Noise on Comprehension: A Systematic Review', *Perceptual and Motor Skills*, vol. 128, no. 3. pp. 1275–1291, 2021. [[Crossref](#)] [[Publisher](#)]
- [19] A. Christodoulou, K. Tsagkaridis, and A.-C. Malegiannaki, 'A multifactorial model of intrinsic / environmental motivators, personal traits and their combined influences on math performance in elementary school', *Eur. J. Psychol. Educ.*, vol. 39, no. 4, pp. 4113–4135, Dec. 2024, [[Crossref](#)] [[Publisher](#)]
- [20] M. Schneider and F. Preckel, 'Variables associated with achievement in higher education: A systematic review of meta-analyses.', *Psychol. Bull.*, vol. 143, no. 6, pp. 565–600, 2017, [[Crossref](#)] [[Publisher](#)]
- [21] T. Simamora, E. Harapan, and N. Kesumawati, 'Determinant Factors Affecting Students' Academic Achievement', *JMKSP (Jurnal Manajemen, Kepemimpinan, dan Supervisi Pendidikan)*, vol. 5, no. 2, p. 191, Apr. 2020, [[Crossref](#)] [[Publisher](#)]
- [22] J. LEE and V. J. SHUTE, 'Personal and Social-Contextual Factors in K–12 Academic Performance: An Integrative Perspective on Student Learning', *Educ. Psychol.*, vol. 45, no. 3, pp. 185–202, Jul. 2010, [[Crossref](#)] [[Publisher](#)]
- [23] H. Mao, R. Khanal, C. Qu, H. Kong, and T. Jiang, 'What factors enhance students' achievement? A machine learning and interpretable methods approach', *PLoS One*, vol. 20, no. 5, p. e0323345, May 2025, [[Crossref](#)] [[Publisher](#)]
- [24] I. N. Ayuni, 'Differences in Nutrient Adequacy Levels and Academic Achievement Between Stunted and Non-Stunted Elementary School Children (Undergraduate Thesis)', Airlangga University Surabaya, 2023. [[Crossref](#)] [[Publisher](#)]
- [25] N. Rohman, 'Academic Achievement: Definition, Factors, and Ways to Improve It', Wirabuana

University. Accessed: May 14, 2025. [[Publisher](#)]

- [26] R. Anggraini, D. Sukma, and U. N. Padang, 'The Relationship Between Study Discipline and Student Academic Achievement', vol. 4, pp. 750–759, 2024. [[Crossref](#)] [[Publisher](#)]
- [27] R. F. Arisandi, 'The Influence of the Teaching–Learning Process, Learning Motivation, and Campus Learning Environment on Academic Achievement', *J. Ekon. Ef.*, vol. 3, no. 2, 2021, [[Crossref](#)] [[Publisher](#)]
- [28] R. H. Kaban, D. Anzelina, R. Sinaga, and P. J. Silaban, 'Pengaruh Model Pembelajaran PAKEM terhadap Hasil Belajar Siswa di Sekolah Dasar', *J. Basicedu*, vol. 5, no. 1, pp. 102–109, 2020, [[Crossref](#)] [[Publisher](#)]
- [29] S. A. Z. Welerubun, 'The Effect of Noise Intensity on Subjective Complaints During the Learning Process of Students at SDN 1 Siwalankerto Surabaya (Scientific Paper)', Health Polytechnic of the Ministry of Health Surabaya, 2024. [[Publisher](#)]
- [30] R. P. Atmadio, 'The Relationship Between Noise and Complaints of Elementary School Students in Nagari Nanggalo Koto XI Tarusan Subdistrict 2023 (Undergraduate Thesis)', Health Polytechnic of the Ministry of Health Padang, 2023. [Online]. [[Publisher](#)]
- [31] M. Rahimi and A. Allahyari, 'Effects of Multimedia Learning Combined With Strategy-Based Instruction on Vocabulary Learning and Strategy Use', *SAGE Open*, vol. 9, no. 2, 2019, [[Crossref](#)] [[Publisher](#)]



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