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Assessing the Connection between Noise Pollution and Students 'Intellectual Performance in Class

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ABSTRACT

This study investigates how noise pollution negatively affects students' cognitive abilities, particularly their attention, memory, and academic performance. It highlights that both internal (e.g., classroom noise) and external (e.g., traffic and construction) noise disrupt learning, especially for children and adolescents who are more vulnerable to environmental stress. Using a quantitative approach, data were collected from 120 secondary school students across three tehsils in the Multan District. Statistical analyses revealed that noise pollution significantly impairs focus, communication, emotional well-being, and motivation to learn, with students from under-resourced areas like Jalalpur being most affected. A notable correlation ($r = 0.263$, $p = 0.004$) confirmed the link between noise exposure and reduced academic performance. The study concludes that noise pollution is a critical yet often overlooked barrier to education and recommends targeted interventions such as infrastructure upgrades, noise management training for teachers, and student support strategies to foster quieter and more effective learning environments.

Keywords: Noise Pollution, Student Concentration, Academic Performance, Environmental Stress, Learning Environment.

Introduction

The Latin word "nausea," which means "unwanted sound" or "sound that is loud, unpleasant, or unexpected," is the source of the word "noise." Human actions, notably urbanization and the growth of transportation and industry, are the source of the disturbance. Nevertheless, this issue also affects small towns/villages alongside roadways or industries, while cities are disproportionately impacted by such pollution (Singh & Davar, 2004).

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Noise, which is any unwanted sound, has become an increasing problem in today's culture. It is thought to be the third most urgent environmental issue, behind air and water pollution. Given that children and adolescents are especially susceptible to the effects of noise, it is crucial to take into account how noise affects their learning and cognitive functioning in this context. It is essential to combine this data given the increasing amount of study being done on the effects of noise in order to have a complete picture of how noise affects academic achievement. The impacts of classroom and environmental noise on learning are examined in this meta-analysis, with a particular emphasis on the cognitive and academic achievement of elementary and high school children (Blasco et al., 2025).

Because of the high noise levels caused by traffic, construction, and other causes, it can be challenging to set a setting in urban areas, which can seriously impair effective communication and concentration (Fayyaz et al.,2023). Teachers encounter several challenges in the ever-changing environment of urban education, which have a significant impact on the educational environment and the teaching and learning process (Pervaiz et al., 2024).

Increasing transportation needs have made noise exposure an unavoidable urban environmental risk, and it is currently believed to be the second leading environmental factor contributing to poor health in Western Europe. Moderate exposure to environmental noise can have a wide range of non-auditory effects on both children and adults (Roche et al., 2024).

Environmental noise has negative impacts on a variety of health outcomes. Despite documented disparities in certain environmental exposures, such as air pollution, the degree to which certain groups are disproportionately impacted by noise is still poorly understood and unclear (Hayward & Helbich, 2024).

Excessive noise is unpleasant and has a variety of physical and psychological consequences. Humans, especially those who are constantly exposed to noise pollution for long periods of time during the day over many years, are at risk from it. The purpose of this study is to analyze the different auditory and non-auditory consequences of prolonged exposure to noise pollution (Mehrotra et al., 2024).

Background noise refers to noises that interfere with a person's capacity to hear what they want or need to hear. Background noise in the classroom can come from a variety of sources, including outside noise (like traffic noise), inside noise (students running in corridors), and room noise (like students talking). According to research, noise has a direct detrimental impact on student learning, notably affecting language and reading development. Additional issues with focus, memory, and drive exist as well (Chanet al., 2015).

Attention and focus are related variables. According to Ortiz, concentration is the capacity to filter out extraneous information, concentrate on what's important, and sustain that ability for extended periods of time. In the classroom, students are bombarded with a variety of stimuli, both external and internal, that they are often unable to handle. They will be drawn to acts that are unexpected, unique, or that address a need. Therefore, it can be seen that teachers' interventions are beneficial as facilitators of classroom dynamics that promote active student involvement (Maiztegi et al., 2024).

From individualized learning experiences to smart tutoring systems that offer

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customized direction, support, and feedback based on individual learning styles and knowledge levels (Hwang et al., 2020), AI has the ability to transform education (Holmes et al., 2019) and cater to the wide range of needs of students (Vieriu & Petrea, 2025).

Because cognitive abilities like memory, reasoning, and problem-solving are so related to learning outcomes, a student's academic achievement is significantly influenced by their intellectual capacity. Greater intellectual capacity frequently results in superior performance in challenging academic assignments and problem-solving situations. The study's goal was to assess the impact of students' intellectual ability (Cognitive Development, Language Proficiency, Working Memory, Processing Speed, and Attention and Focus) on their academic achievement at the university level (Kausar et al., 2024).

Modern educational institutions argue that children's experiences in sport and physical education help develop the mental agility, abilities, and tactics necessary for overcoming obstacles throughout life. The perceived significance of physical education and its role in children's academic achievement has changed dramatically over the course of the history of the modern educational system (Donnelly et al., 2016).

For learning to be successful, there must be effective communication between students and instructors, but outside noise may interfere with classroom acoustics and impede this interaction. Despite increasing study on classroom acoustics, there are still unanswered questions on how variables such as environmental noise, classroom acoustics, and building design combine to impact learning environments (Mendhe et al, 2025).

Due to expanding traffic and infrastructure construction, several towns in the developing world are experiencing excessive noise pollution. To lessen the possible negative impact of noise pollution on the educational achievements of young people living in developing economies, urban planning interventions may be required (Adbi et al, 2025).

Statement of the Problem

Students are frequently exposed to different sources of noise pollution both inside and outside the classroom, particularly in urban locations, as a result of the growing noise levels in our society. These disruptions may have a major impact on their capacity for intellectual work, information processing, and attention. Although the effects of environmental variables on academic results are a growing concern, the precise link between noise pollution and students' cognitive performance particularly their capacity to concentrate is still understudied. Numerous schools are located in areas where traffic, building, or other interruptions cause constant background noise, which may make it difficult to learn effectively. By analysing how this type of noise pollution affects students' attention span in the classroom, this study aims to shed light on a frequently disregarded obstacle to academic achievement.

Objective and Research Question of the Study

The objective of this study was to investigate how noise pollution affects students' ability to maintain attention in class. In alignment with this objective, the central

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research question that guided the study was: How does noise pollution impact students' attention in the classroom?

Research Methodology

Using a quantitative research approach, this study examined the connection between noise pollution and students' capacity to concentrate in class. The goal was to acquire measurable data that may statistically explain how environmental noise affects cognitive functioning, with a particular emphasis on attention. The study focused on all secondary school and students in Multan District. The official school data included specific information on the total number of secondary schools, the gender balance of these schools, and the student enrolment numbers for grades 9 and 10.

About 120 pupils were necessary to attain a 95% confidence level and a 5% margin of error in this experiment. As a result, data was gathered from 120 different secondary schools for boys and girls in the Multan District in order to obtain a representative and useful sample that would support rigorous analysis and trustworthy conclusions in this study. Individual pupils were chosen using simple random sampling based on availability and accessibility. The reliability and validity of the information gathered were maintained by using this combination of sampling methods, which also enabled comparative insights between different school types.

Data Analysis

The collected data were analyzed using both descriptive and inferential statistical methods. The data were summarized using descriptive statistics, such as mean and standard deviation. The Pearson correlation comparative analysis and factor analysis were used in the study's inferential analysis to investigate the connections and differences between variables. To improve clarity and readability, tables were used to display the findings.

Table1 Noise Pollution & Student Concentration

SR No.	Statements		SA	A	N	DA	SDA	Mean	SD
1	A noisy classroom hinders my ability to finish tasks	f	50	17	15	22	16	3.53	1.506
2	School noise reduces my interest in learning	f	56	24	19	12	9	3.88	1.304
3	Noise interferes with my ability to hear the teacher	f	44	19	21	17	19	3.43	1.494
4	Outside sounds (traffic, markets) divert my attention	f	47	26	15	17	15	3.61	1.44
5	I often have to reread or relisten because of noise	f	50	16	12	27	15	3.49	1.517
6	A quiet classroom enhances my focus	f	45	23	22	17	13	3.58	1.394

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According to the analysis in Table.1, noise pollution significantly hinders students' ability to concentrate on their academic work. The data reveals varying degrees of concern, with a classroom noise pollution mean of 3.53, indicating that many students find it challenging to focus due to noise. A higher mean of 3.88 for general school noise pollution suggests a broader impact, potentially leading to decreased student interest in school activities. Communication between teachers and students is moderately affected (mean = 3.43), while external noise further disrupts focus during class (mean = 3.61). Students also report moderate difficulty in reading or listening to lectures amid noise (mean = 3.49). Overall, a strong agreement (mean = 3.58) supports the view that a quieter classroom environment would enhance students' ability to concentrate.

Table.2: Noise Effect on Academic Performance

SR #	Statements		SA	A	N	DA	SDA	Mean	SD
7	Noise makes it hard to pay attention	f	45	25	19	18	13	3.59	1.399
8	Noise in class raises my stress	f	49	21	19	17	14	3.62	1.433
9	I feel more tired after noisy classes	f	46	19	18	22	15	3.49	1.467
10	I get frustrated when I can't hear	f	51	38	16	7	8	3.98	1.184
11	I prefer sitting away from noise	f	52	21	16	17	14	3.67	1.446
12	Noise makes learning harder	f	57	21	20	11	11	3.85	1.351

Table 2 reveals that students widely perceive noise pollution as harmful to their academic performance. High mean scores indicate strong agreement that noise disrupts concentration (M = 3.59), causes stress (M = 3.62), and leads to fatigue (M = 3.49). The highest impact is reported for irritation due to difficulty hearing (M = 3.98), followed by a preference for quiet seating (M = 3.67) and a clear belief that noise disrupts learning (M = 3.85). These findings underscore the negative effects of noise in classroom settings.

Table 3: Pearson Correlation Between Noise Pollution and Academic Performance

Correlations

		NSPC	NEAP
NSPC	Pearson Correlation	1	.263**
	Sig.(2-tailed)		.004
	N	120	120
NEAP	Pearson Correlation	.263**	1
	Sig.(2-tailed)	.004	
	N	120	120

Where NSPC = Noise Pollution &Student Concentration, NEAP = Noise Effect on Academic Performance

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Table 3 shows that noise pollution has a statistically significant impact on student concentration (F = 2.157, p =.030) and academic performance (F = 2.186, p =.028), indicating that different groups experience varying levels of noise disturbance.

Table 4: Comparative Analysis

Tehsil	Noise Pollution & Student Concentration	Noise Effect on Academic Performance
	Mean ± SD	**Mean ± SD**
Multan City	21.31 ± 4.199	21.53 ± 3.958
Multan Saddar	21.49 ± 4.932	22.53 ± 4.022
Jalalpur	22.10 ± 3.865	22.75 ± 3.354
Total	21.53 ± 4.474	22.19 ± 3.898

Table 4 shows that students in Jalalpur report the highest impact of noise pollution on both concentration (M = 22.10) and academic performance (M = 22.75), suggesting greater challenges due to possible infrastructural or environmental factors. In contrast, Multan City students report the lowest mean scores (21.31 and 21.53), indicating comparatively better conditions for learning. These findings imply that urban settings may offer more effective noise control measures, positively influencing student focus and performance.

Discussion

The results of this study clearly demonstrate that noise pollution negatively affects students' ability to pay attention in class. Students frequently reported challenges in focusing on classroom tasks, particularly when exposed to both internal noise (e.g., student chatter) and external noise (e.g., traffic, playgrounds). The need to reread or relisten due to interruptions indicates increased cognitive load and reduced concentration, consistent with existing literature on environmental distractions in educational settings.

The disruption of hearing clarity in noisy environments emerged as another critical factor. Difficulty understanding instructions directly impaired students' engagement and ability to follow lessons, suggesting that auditory distractions limit both attention and comprehension. Moreover, external ambient noise especially in densely populated or urban school settings was shown to divert attention, confirming the widespread influence of uncontrolled noise sources.

A strong preference for quieter classrooms, as expressed by students, highlights their awareness of the need for a calm environment to sustain focus and mental clarity. This finding reinforces the notion that environmental conditions significantly shape students' attentional capacity during learning.

While the original intent of the study was not to compare regional or demographic trends, complementary analyses revealed that students from areas like Jalalpur reported higher difficulty concentrating, potentially due to greater exposure to environmental noise and fewer infrastructural supports. This suggests a contextual

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influence on attentional disruption that may warrant further investigation.

Conclusion

This study concludes that noise pollution has a substantial and measurable effect on students' attention in classroom settings. The findings show that distractions particularly from classroom noise and external environmental sounds significantly impair students' ability to concentrate, process information, and remain cognitively engaged during lessons. These attentional disruptions are more pronounced in schools located in noisy or under-resourced areas.

Students' expressed preference for quieter learning environments reinforces the importance of structured, calm classroom conditions to support attention and focus. Addressing noise pollution through better classroom management, infrastructure improvements, and awareness campaigns may help reduce attentional strain and enhance the overall learning experience.

Recommendations

Allocate budgetary support for noise-reduction renovations, prioritizing schools in Jalalpur and Multan Saddar where impact levels were found to be higher.

Designing lessons with quieter, more structured formats during high-noise times.

Educate students about the impact of noise on learning and well-being.

Encourage appropriate coping strategies like using earplugs, choosing quiet study spaces, and advocating for classroom discipline.

Build student confidence in communicating noise-related concerns with teachers or administrators.

Rural and semi-urban schools should receive targeted funding for infrastructure upgrades and teacher training.

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