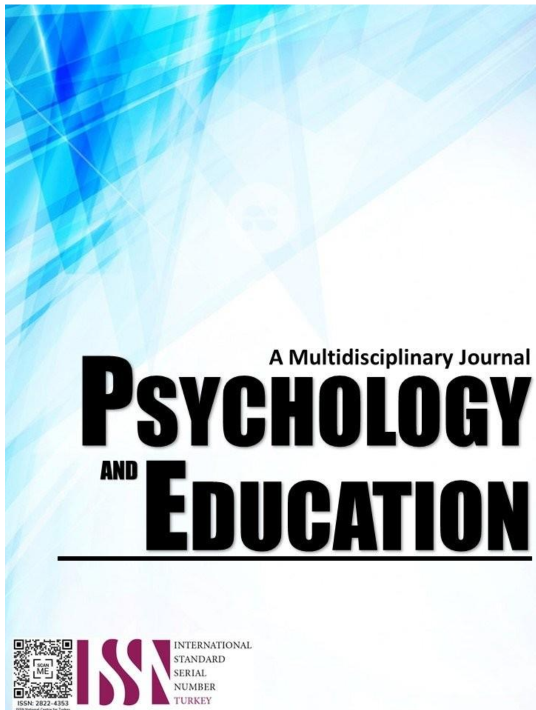
NOISE POLLUTION: IT’S IMPLICATION ON ACADEMIC ACHIEVEMENTS OF SECONDARY STUDENTS



PSYCHOLOGY AND EDUCATION: A MULTIDISCIPLINARY JOURNAL

Volume: 29
Issue 5
Pages: 650-655
Document ID: 2024PEMJ2782
DOI: 10.5281/zenodo.14546110
Manuscript Accepted: 11-22-2024

Psych Educ, 2024, **29**(5): 650-655, Document ID:2024PEMJ2782, doi:10.5281/zenodo.14546110, ISSN 2822-4353
Research Article

Noise Pollution: It's Implication on Academic Achievements of Secondary Students

Amera C. Malaco, * Rodelyn M. Dalayap
For affiliations and correspondence, see the last page.

Abstract

Various types of noise act as invisible barriers to the learning process. This study sought to explore how noise pollution impacts the academic performance of secondary school students. Conducted at Sultan Kudarat State University's Laboratory High School during the fourth grading period of the 2016-2017 school year, the study employed an experimental approach with a "Pre-test-Post-test Control Group Design." Three groups participated: one control group and two experimental groups, labeled Group A and Group B. The control group experienced normal classroom conditions conducive to learning, with a sound level maintained at 40 dB. In Experimental Group A, students were exposed to an environment with artificial internal and external noise at 60 dB. Meanwhile, students in Experimental Group B encountered recorded intermittent noise from sources such as road traffic and construction, reaching 80 dB. The findings indicated that a noise level of 40 dB is the maximum threshold in a school setting to support optimal learning outcomes. Noise exposure at levels between 60 and 80 dB significantly impairs students' academic performance. Additionally, male and female students exposed to high-intensity noise (60-80 dB) exhibited a noticeable decline in their educational achievements.

Keywords: *noise, decibel, experimental, academic achievements*

Introduction

Sound plays an essential role in our lives, enhancing our experience of the environment and daily activities; however, noise does not share these benefits, as it tends to create unpleasant effects and discomfort. Sound intensity is commonly measured in decibels, with noise pollution defined as environmental sound levels likely to irritate, distract, or even harm individuals. According to the Swedish National Board of Occupational Safety and Health (1992), teaching and other tasks that require sustained concentration or uninterrupted communication are particularly vulnerable to noise disruptions.

Today, noise pollution has become widespread due to modernization, often disrupting students' learning experiences. Contributing factors include insufficient anti-noise regulations in many educational settings, the prevalence of electronic devices that increase exposure to noisy gadgets, the growing volume of road traffic, ongoing construction activities, and technology integration. Such noise exposure is daily for students, making it challenging to assess optimal listening conditions. Consequently, the learning process of secondary students may be affected similarly to how primary school children experience noise impacts.

This research examined the effects of unavoidable noise around school environments on millennial students, particularly secondary students. The researcher aimed to assess how noise pollution impacts the academic achievements of these students, who frequently encounter high levels of noise around them. While past studies focused primarily on younger children, often conducted in times when gadgets were less prevalent, this study explores the noise tolerance of students. It identifies any noise levels that do not significantly hinder academic performance. Additionally, the research investigates whether male or female students are more sensitive to noise exposure. This study occurred during the fourth grading period of the 2016-2017 school year.

Research Questions

Generally, this study aimed to determine the implication of the different levels of noise on academic achievements of students' of Sultan Kudarat State University, Laboratory High School. Specifically, the study sought to answer the following questions:

1. What is the level of academic achievement in pre-test and post-test of the students expose to different noise levels namely?
   - 1.1. 40 dB;
   - 1.2. 60 dB; and
   - 1.3. 80 dB?
2. What is the mean gain score, of the students exposed to the different levels of noise namely:
   - 2.1. 40 dB;
   - 2.2. 60 dB; and
   - 2.3. 80 dB?
3. What is the mean gain scores of students exposed to different noise levels when classified according to sex?
   - 3.1. male; and
   - 3.2. female?
4. Is there a significant difference between the pre-test and post-test mean scores of the students exposed to different levels of noise?
5. Is there a significant difference in the mean gain scores of students exposed to the different levels of noise?

6. Is there a significant difference in the mean gain score of students subjected to the different levels of noise (40 dB, 60 dB, 80 dB) when classified according to sex?

Literature Review

General Effects of Noise on Children

In the early 1990s, research indicated noise negatively impacts primary school children's learning and academic achievements. Two significant reviews of prior studies concluded that chronic noise exposure adversely affects young children's reading abilities.

Noise Exposure in Classrooms

Classrooms often accommodate up to 30 students and a teacher working collectively. Modern teaching methods, which emphasize problem-solving over traditional lecturing, encourage group work and project-based learning, leading to a more interactive and collaborative environment. In this setting, the teacher is a guide rather than a lecturer. Consequently, much of the noise in classrooms is generated by human activities. A Danish study by Bredo (2000) identified familiar sources of classroom noise that disturb students, such as talking and laughter, sounds from chairs and tables, and noise from adjoining classrooms.

Effects of Classroom Noise

Hetu, Truchon, and Bilondean (1990) observed a noticeable decline in children's learning performance, particularly in reading, when background noise interfered with speech clarity. In a study by Mackenzie (2000), children in primary school classrooms with acoustic treatments, which reduced background noise levels and reverberation, performed better in word comprehension tests than those in untreated classrooms. The improvement was especially evident when other students were talking in the school. Similar findings were reported by Maxwell and Evans (2000), who studied preschool children exposed to noise levels around 75 dB in classrooms and observed a positive effect from reduced noise exposure.

Noise and Student Achievement

Since the 1970s, numerous studies have compared students' reading skills in schools exposed to transportation noise with those in quieter schools. An early 1970s study investigated students' performance in a New York school adjacent to an elevated train track. Over three years, aggregate scores of students in grades two, four, and six revealed that those on the noisy side of the school were, on average, three to four months behind in reading skills compared to students on the quieter side. After noise-reducing modifications were made to the train tracks, students' reading levels on the formerly noisy side of the school improved (Bronzaft, 1981).

Methodology

Research Design

This study employed an experimental research design, specifically the pre-test-post-test control group design, to assess the effects of noise pollution on secondary students' academic achievement. Three groups of high school students were randomly assigned: Experimental Group A, Experimental Group B, and the Control Group. Each group completed a common pre-test at the start of the topic and a post-test at the end, following the same instructional strategy. The Control Group experienced a normal classroom environment with a noise level of 40 dB. In Experimental Group A, students were exposed to both internal and external noises at 60 dB, while Experimental Group B was subjected to recorded intermittent noise from sources such as traffic and construction at 80 dB.

Respondents

Conducted during the fourth grading period of S.Y. 2016-2017, the study involved 90 high school students equally distributed across the three groups according to third-quarter grades and gender. Each group consisted of 30 students, with the Control Group and Experimental Group A comprising 22 females and 8 males, and Experimental Group B including 21 females and 9 males.

Instrument

The testing questionnaire was adapted from the Department of Education's Integrated Science Learner's Manual. Test questions and noise disruption recordings were prepared to align with the desired sound levels. A sound meter ensured accurate measurement of noise levels throughout the study.

Procedure

Permission was first obtained from the College of Graduate Studies. A formal request was then submitted to the College of Teacher Education through the Dean and Laboratory High School Chairman. Upon approval, the researcher coordinated with the Department Chairman to commence the study. Data were analyzed with statistical guidance from a statistician.

Data Analysis

The mean was calculated to assess the academic achievements of each group based on pre-test and post-test results. ANOVA was employed to identify any significant differences among the three groups. Additionally, a t-test was applied to compare academic achievement between male and female students.

Rating Scale for Student Achievement

To evaluate students' academic achievement under varying noise levels, a descriptive rating scale based on DepEd Order No. 8, s. 2015, was used. Scores from both pre-test and post-test assessments served as indicators of student achievement across different noise conditions.

Ethical Considerations

In conducting a study on Noise Pollution: Its Impact on Secondary Students' Performance Achievement, several ethical considerations were observed to ensure the safety, rights, and well-being of the respondents. First, informed consent must be obtained, with clear explanations provided to respondents regarding the study's purpose, procedures, and potential risks. Protecting confidentiality and privacy is also observed; students' personal information and academic records must remain secure and anonymous to prevent identification in published results.

Results and Discussion

This section shows the level of academic achievement of the Control and Experimental Groups. It also gives adequate and significant analysis and interpretations of the data generated from the study. The sequence of the discussion follows the order of the statement of the problem indicated.

Table 1. *Academic achievements in pre-test and post-test of the students exposed to different levels of noise*

Groups	*Mean Score*	*Equivalent*	*Description*
Control Group (40 dB)			
Pre-test	20.43	70.65	Did not meet expectations
Post-test	29.87	84.00	Satisfactory
Experimental Group A			
Pre-test	20.57	70.85	Did not meet expectations
Post-test	27.10	80.65	Fairly satisfactory
Experimental Group B (80 dB)			
Pre-test	22.67	74.00	Did not meet expectations
Post-test	22.67	74.00	Did not meet expectations

Table 1 is the tabulated results of the pre-test and post-test mean scores of students exposed to three different noise levels. The pre-test mean scores of Control, Experimental Group A, and Experimental Group B are equivalent to 20.43, 20.57, and 22.67, respectively. The pre-test results indicate that the students in all three groups lack prior knowledge of the subject matter, as shown in the equivalent ratings of their scores, which are described as "Did not meet expectations." Among the three groups, only the Experimental Group with an 80 dB noise level had higher academic preparations, with the equivalent of 74 in the pre-test. However, they still did not meet the expectations indicated in their mean score's equivalent rating.

Table 2. *The mean gain scores of the students in different levels of noise*

Levels of Noise	*Mean Gain Scores*
Control Group (40 dB)	9.43
Experimental A (60 dB)	6.53
Experimental B (80 dB)	0.00

Table 2 compares the mean gain scores of the students exposed to different levels of noise, which resulted in mean gain scores of 9.43, 6.53, and 0 for the Control Group (40 dB), Experimental A (60 dB), and Experimental B (80 dB), respectively.

The results indicate that the students in the Control Group (40 dB) have the highest mean gain score compared to Experimental Group A and Experimental Group B. This implies that students exposed to 40 dB noise levels understood and learned the discussion of the topic being taught to them compared to those exposed to higher noise levels in experimental groups. Further, it is shown that between the two experimental groups, only Group A, who were exposed to 60 dB of noise, showed an indication of little understanding and learning. In contrast, Group B, exposed to 80 dB of noise, showed no understanding or learning as their mean gain score was zero.

Hence, these results proved that the acceptable noise level during classes is at most 40 dB if the maximum level of understanding and learning is desired. Teachers can only expect a minimal level of understanding if the noise level in their classes reaches 60 dB. School classes having noise levels of at least 80 dB would result in zero understanding or no learning for all students.

The World Health Organization (WHO) stated in 1995 that noise pollution of different type's affects human health and reduces cognitive performance. The permissible noise level in a school environment should not exceed 35 dB. Exposure of school children for more than six hours a day to sound more than 85dB is potentially hazardous to health.

Table 3. *Mean gain scores of students subjected to different levels of noise when classified according to sex*

Sex	*Mean Gain Scores*
Control group (40 dB)	
Male	6.25
Female	10.59
Experimental Group A (60 dB)	
Male	5.75
Female	6.59
Experimental Group B (80 dB)	
Male	-1.56
Female	0.67

The table above shows that in the Control Group (40 dB) the female students obtained the mean gain score of 10.56 while the mean gain score of the male students is 6.25. This means that, classroom with minimal noise is much conducive for learning to both male and female students. However, the mean gain scores of female students is higher compared to male students because as observed female students were more attentive and focused compared to male students. In the Experimental group A (60 dB), the mean gain scores of male and female students were 5.75 and 6.59, respectively. This means that the learning of both male and female students decreased as they were exposed to a much higher level of noise. Furthermore, in Experimental group B where the students were subjected to 80 dB of noise the mean gain scores of male and female were -1.56 and 0.67 respectively. The result showed that in 80 dB level of noise male students obtained a negative mean gain score, -1.56 which indicates deterioration of the concentration and comprehension skills of the male students which resulted to no learning occurred or even worse. The results implied that female students have a higher level of tolerance to noise compared to male students.

Table 4. *Analysis between pre-test and post – test scores of students subjected to different levels of noise*

Pair of variables	*n*	*df*	*Mean*	*t-comp.*	*t-tab.*
Control Group (40 dB)					
Pre-test	30	28	20.43	10.04	2.048
Post-test			29.87		
Experimental Group A (60 dB)					
Pre-test	30	28	20.57	8.15	2.048
Post-test			27.10		
Experimental Group B (80 dB)					
Pre-test	30	28	22.67	0.00	2.048
Post-test			22.67		

$\propto$ = 0.05 level of significance

As shown in Table 4, the pre-test and post-test mean scores of students exposed to 40 dB noise levels are 20.43 and 29.87, respectively. There is a significant difference in the results of both tests because the computed t-value is 10.04, which is higher than the t-critical value, 2.048, at a 0.5 level of significance. Thus, the results reveal that noise levels of 40 dB allow the students to understand and gain better knowledge in the classroom environment.

In Experimental Group A (60 dB), the students' pre-test and post-test mean scores are 20.57 and 27.10, respectively. The computed t-value is 8.15, which is higher than the t-critical value of 2.048 at the 0.5 level of significance. This implies that there is a significant difference in the results of the two tests.

In Experimental Group B (80 dB), mean scores obtained in the pre-test and post-test are 22.67 and 22.67, respectively. The t-computed value, 0.00, is lesser than the t-critical value, 2.048, at a 0.5 significance level. Therefore, there is no significant difference between the results of the two tests. Based on these results, when students are exposed to noise levels of more than 40 dB, their attention and comprehension are disturbed, which results in a decreased level of understanding and learning.

The results tell us that a noise level of 40 dB is allowable for class discussions, while a noise level of at least 60 dB has a detrimental effect on students' learning, and a noise level of at least 80 dB is extremely devastating because no learning can be expected from the students.

This finding is similar to the results of the study of Berglund & Lindvall (1995) and the Institute for Environment and Health (1997), which state that noise has a detrimental effect on the learning and performance of primary school children.

Table 5. *The mean gain scores of students subjected to the three different levels of noise*

Groups (level of noise)	*Mean Gain Score*
Control group (40 dB)	9.43 a
Experimental group A (60 dB)	6.36 b
Experimental group B (80 dB)	0 c

Table 5 reveals a notable difference in the mean gain scores among the Control and Experimental Groups. Comparing the mean gain scores at 40 dB, 60 dB, and 80 dB shows that students' mean gain scores decrease as classroom noise levels increase. This suggests that students exposed to 40 dB during class discussions achieved higher levels of knowledge and understanding than those subjected to higher noise levels. At 60 dB, there was a noticeable decline in students' mean gains, indicating that noise at this level negatively impacted learning. The results further suggest that noise at or above 80 dB prevents students from effectively comprehending the lesson.

This finding aligns with the World Health Organization's (2001) recommendation that noise levels in educational settings should not exceed 35 dB. WHO also cautions that exposure to noise levels above 85 dB for over six hours daily can harm children's health. Additionally, Hygge et al. (1996) reported that children from noisier environments made significantly more errors on standardized tests than those from quieter areas, supporting the current study's findings.

Table 6. *Analysis of mean gain scores of students subjected to different levels of noise when classified according to sex*

Sex	*n*	*SD*	*mean*	*t-computed*
Control group (40 dB)				
Male	8	4.10	6.25	2.17
Female	22	5.07	10.59	
Experimental Group A (60 dB)				
Male	8	4.40	5.75	0.47
Female	22	4.32	6.59	
Experimental Group B (80 dB)				
Male	9	4.69	-1.56	1.52
Female	21	3.15	0.67	

The table above indicates a significant difference in mean gain scores between male and female students in the Control group at 40 dB. However, for Experimental Group A at 60 dB and Group B at 80 dB, no significant difference was found between male and female mean gain scores.

These findings suggest that female students are less impacted by a noise level of 40 dB (Control Group), likely due to environmental noise exposure affecting male hearing more than female hearing. At 60 dB, male and female students showed decreased mean gains, indicating that noise at this level interfered with learning for both sexes. At 80 dB, the mean gain scores for both male and female students showed no significant difference, suggesting that high noise intensity at this level equally disrupts learning for both groups, regardless of sex.

These observations align with research by Dr. Charles Limb, who found that men generally experience more significant hearing loss than women. However, boys and girls exhibit similar hearing abilities at birth, with environmental exposure causing the divergence. Dr. Arlene R. Taylor (2018) also noted that women typically have better hearing than men, often using both brain hemispheres to detect tonal nuances. Men rely on one hemisphere, making them less sensitive to tonal subtleties.

Conclusions

The findings of this study reveal a clear relationship between noise levels within school premises and students' academic achievement, shedding light on both the immediate and long-term impact of environmental noise on learning; according to the results, maintaining a noise level below 40 dB is academic success. In contrast, higher levels, particularly those reaching 60 dB or above, have an adverse effect. Notably, noise levels of 80 dB and above disrupt the learning process entirely, with students experiencing such significant distractions that learning ceases altogether. Furthermore, the study highlights a difference in noise sensitivity by gender, with male students showing a higher sensitivity to noise than female students. This finding suggests that environmental factors in educational settings affect students differently, which warrants further exploration.

One insight from these results is the critical importance of a well-regulated, sound environment for effective learning. It becomes apparent that noise management within schools is not merely a matter of comfort but a necessary component of academic achievement. For school administrators, the recommendation to keep noise levels under 40 dB underscores the need for proactive noise regulation measures within school grounds. Effective noise control measures may require significant changes, such as installing soundproofing materials, structural alterations, and ongoing assessments to monitor noise levels.

The finding that male students are more sensitive to noise than female students opens the door to further research on how gender differences play a role in environmental perception and academic focus. Understanding these differences could help educators implement personalized support or interventions to ensure all students have the best learning environment.

This study also raises broader implications for urban planning and policy development. Noise pollution is often associated with commercial and industrial activity near school zones. By sharing these findings with both government and private authorities, educational institutions could advocate for stricter noise control regulations in school-adjacent areas. For instance, commercial establishments near schools could be subject to sound restrictions or be encouraged to implement their own noise-reducing measures.

In future research, additional investigations into noise levels below 40 dB could provide valuable insights into the optimal acoustic environment for learning. Researchers could explore how even lower noise levels may benefit academic performance, which may be especially relevant for environments with younger or more noise-sensitive students. Finally, studies on innovative classroom designs and layouts that naturally mitigate noise could help create more sustainable and efficient solutions for noise reduction in schools, further enhancing students' academic potential.

References

Berglund, B., & Lindvall, T. (1995).Community noise. Archives of the Center for Research.

Bronzaft, A. L. (1981). The effect of a noise abatement program on reading ability. Journal of Environmental Psychology, 1, 215-222.

Hetu, R., Truchon-Gagnon, C., & Bilodeau, S. (1990). Problems of noise in school settings: A review of literature and results of an exploratory study.

Hygge, S. (2001).The effects of chronic aircraft noise exposure on child health: West London Schools Stud.

Limb, C. (2010). Advances in gender education*. Montgomery Center for Research in Child & Adolescent Development.

Mackenzie, D. J. (2000). Noise sources and levels in UK schools. In Proceedings of the International Symposium on Noise Control and Acoustics for Educational Building.

Maxwell, L. E., & Evans, G. W. (2000). The effects on pre-school children's pre-reading skills.

Taylor, A. R. (2018). Gender hearing difference. Realizations Inc. http://arlenetaylor.org/

World Health Organization. (1980). Guidelines for community noise. http://www.who.int/peh

Affiliations and Corresponding Information

Amera C. Malaco
Sultan Kudarat State University – Philippines

Rodelyn M. Dalayap
Sultan Kudarat State University – Philippines