Original Research Article

# The Sound of Distraction: Perceived Noise Exposure, Concentration, and Academic Functioning Among Seattle High School Students: A Mixed-Methods Cross-Sectional Study

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## ABSTRACT

Noise is a common environmental exposure in urban communities, yet little is known about how high school students perceive its association with learning and well-being. This mixed-methods cross-sectional study examined self-reported perceptions of noise exposure and their associations with concentration, sleep, stress, and academic functioning among Seattle-area high school students. Participants included 31 students in Grades 9–12 who were recruited through snowball sampling across multiple Seattle-area high schools. Data were collected using an anonymous online survey that included demographic questions, perceived noise exposure measures, 10 Likert-scale items that assessed concentration, sleep, stress, and academic functioning, as well as open-ended questions. Quantitative data were analyzed using descriptive statistics and exploratory Spearman rank-order correlations. Most participants reported experiencing noticeable noise on most days (mean = 3.55/5) and high agreement for difficulty concentrating in class (mean = 3.27/5), compared to lower perceived academic functioning (mean = 2.10/5) and sleep disruption (mean = 1.90/5). In addition, qualitative responses reinforced the quantitative findings by providing additional context. These findings suggest that students perceived noise as being more closely associated with immediate concentration issues rather than poorer self-reported academic functioning. However, because this study relied on self-reported perceptions that were obtained from a cross-sectional survey, the findings should only be interpreted as exploratory rather than causal. Future studies may use larger samples and objective noise measurements to further examine these relationships.

**Keywords:** Perceived noise exposure; academic functioning; social noise; environmental noise; high school students; student perceptions; mixed-methods

## INTRODUCTION

In modern metropolitan environments, noise exposure has become an important yet frequently overlooked environmental health risk. Noise is an environmental health risk that is characterized by any unwanted or disturbing sound that affects the health and well-being of humans and other organisms. Increased stress and cognitive impairment have been linked to noise exposure levels above 70–85 decibels (dB), a unit of measurement for sound intensity (1). Prolonged noise exposure has also been associated with numerous short and long-term health effects (2).

Additionally, increased urban noise can influence

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adolescent learning. Because students spend a large portion of their day within school environments and are frequently exposed to different types of noise, understanding how learning conditions can be related to student experiences is pivotal (3).

Furthermore, in the specific city context of Seattle, environmental exposures are not distributed evenly across neighborhoods. Prior studies have found that higher population density is associated with greater environmental noise (4). Public health researchers have described geographic disparities in environmental conditions across Seattle communities, suggesting that students may experience different levels of perceived noise exposure depending on their residential and school environments (5). Such variation may be associated with students' perceived concentration, stress, sleep quality, and academic functioning, although objective academic performance was not measured in the present study (6).

Accordingly, this study examined the following research question: To what extent are students' perceptions of noise exposure associated with self-reported concentration, sleep, stress, and academic functioning among Seattle-area high school students? In this study, perceived noise exposure refers to both environmental noise and social noise students report experiencing in their school environments.

Previous research has suggested that prolonged exposure to environmental noise is associated with sleep disturbance, stress, reduced well-being, and cognitive functioning (7). Much of this literature has focused on objective environmental noise sources such as traffic, aircraft, and urban infrastructure, with comparatively less attention given to social noise within school environments such as classroom conversations.

While these studies provide valuable insight into the causes and effects of noise exposure, several key gaps still remain within the current body of knowledge. First, many existing studies have been conducted outside of the United States, limiting their applicability to Seattle-area school environments (8). Second, many studies focus on university populations rather than adolescents, despite the differences in learning environments and development stages (9). Third, previous research has emphasized objective environmental noise sources while giving comparatively less attention to social noise within classrooms (10). Finally, studies frequently rely on objective sound measurements rather than students' own perceptions of noise exposure and school experiences (11). These gaps support the need for an exploratory study examining self-reported perceptions of both environmental and social noise among Seattle-area high school students.

Based on previous literature, the study proposed one primary hypothesis and two secondary hypotheses. Primary Hypothesis: Students reporting greater perceived noise exposure would report greater difficulty concentrating during classroom learning and homework activities. Secondary Hypothesis 1: Students reporting greater perceived noise exposure would report higher levels of perceived sleep disruption and stress. Secondary Hypothesis 2: Students reporting greater perceived noise exposure would report poorer self-reported academic functioning. Because this study employed an observational cross-sectional design using self-reported survey data, these hypotheses were intended to examine associations rather than causal relationships.

## METHODS AND MATERIALS

This study employed mixed-method research design using a survey that combined quantitative and qualitative data. A mixed-methods survey approach was selected to effectively capture both measurable trends through Likert-scale measures and in-depth responses from participants.

### Research Design

A cross-sectional survey was administered using Google Forms from December 27, 2025 to February 5, 2026. The survey remained open throughout this period and required approximately 8–12 minutes to complete. The questionnaire was developed by the researcher based on themes identified in previous literature examining noise exposure, sleep, stress, and academic functioning among students. Although informed by prior research methodologies, the instrument was newly developed for this exploratory study and was not adapted from a previously validated questionnaire. The survey combined both structured quantitative questions with open-ended qualitative prompts to better capture students' perceptions and experiences regarding perceived noise exposure in school environments. The complete survey instrument, which includes the full wording of all questions and response options provided in Appendix A.

### Participants and Sampling

Participants were eligible if they were enrolled in Grades 9–12 at a Seattle-area high school and voluntarily agreed to participate after reviewing the informed consent form. Students who did not provide consent or

who indicated that they were not enrolled in a Seattle-area high school were excluded from participation. For participants younger than 19 years old, parental or guardian permission was obtained prior to participation, and students provided their own informed assent through the electronic consent process before beginning the survey.

Snowball sampling was used to recruit participants. The researcher initially invited 10 students from existing academic and community networks because they attended different Seattle-area high schools and could distribute the survey to additional eligible students through their peer networks. Recruitment occurred through voluntary sharing of the anonymous survey link rather than direct recruitment through the researcher. Initial student recruiters were instructed only to distribute the anonymous survey link, rather than recruit classmates or persuade others to participate. Neither teachers nor school administrators recruited participants or monitored participation. Data collection concluded after approximately six weeks with 31 completed responses representing 11 anonymized high schools.

However, because recruitment occurred through anonymous peer-to-peer distribution, the total number of students who received the survey invitation could not be determined. Therefore, participation and response rates could not be calculated. The original survey instrument was distributed to one institution before expanding to additional Seattle-area High Schools.

**Ethical Considerations**

This study was reviewed and approved through the North Creek High School AP Research approval process in accordance with the Northshore School District (NSD) Research and Assessment Department procedures for student research involving human participants. Prior to data collection, the study procedure, survey instrument, informed consent, and recruitment process were all reviewed by the AP Research teacher, the school principal, and the AP Coordinator before approval was provided to distribute the survey. The project was determined to present minimal risk because participants were only asked to reflect on their existing experiences and perceived impact of noise, sleep, stress, concentration, and school functioning without any experimental intervention. The survey was administered anonymously through Google Forms. Because responses were anonymous, Google Forms was configured not to collect email addresses, IP addresses, or other identifying information. The survey was limited to one response per participant to reduce duplicate submissions. Demographic information collected included grade level, school attended, and residential area classification (urban, suburban, or rural). Age, biological sex, gender identity, race/ethnicity, and socioeconomic status were not collected in order to minimize identifiable information and encourage voluntary participation. Individual schools reported were anonymized as "High School 1" through "High School 11," and no personally identifying information was collected. Survey responses were stored in a password-protected Google Sheets file accessible only to the researcher.

**Survey Components**

Participants reported perceived daily noise exposure, perceived loudness, and commonly experienced noise sources using predefined response categories. Because the survey did not include a 3–5-hour response category, participants selected the closest available option when reporting daily exposure. Ten Likert-scale items assessed perceived noise exposure, concentration, homework focus, sleep disruption, daytime sleepiness, stress, coping strategies, academic functioning, and classroom support using a five-point response scale. Individual items were analyzed separately using descriptive statistics because multiple constructs were measured. Five open-ended questions explored participants' experiences regarding stress, concentration, schoolwork, timing of noise exposure, coping strategies, and additional comments. The survey concluded with contact information for the 988 National Suicide and Crisis Lifeline if participants experienced emotional distress.

**Operational Definitions of Study Variables**

The primary exposure variable was perceived noise exposure, which referred to participants' self-reported experiences with environmental noise (e.g., traffic, construction, aircraft, household appliances) and social noise (e.g., classroom conversations). The primary outcome variable was self-reported academic functioning, defined as participants' perceptions of how noise influenced their ability to complete school assignments. This construct referred to perceived academic functioning rather than objective academic achievement such as grades, test scores, or attendance. Secondary outcome variables included self-reported concentration during classroom learning, homework focus, sleep disruption, daytime sleepiness, stress or irritability, coping strategies, and perceived classroom support.

### Data Collection and Analysis

Responses were automatically recorded in Google Forms and then exported to Google Sheets for coding and analysis. Quantitative data from Likert-scale questions were numerically coded on a five-point scale ranging from 1(Strongly Disagree) to 5 (Strongly Agree). Descriptive statistics including frequencies, means, medians, modes, and standard deviations were calculated to summarize participants' responses. Exploratory Spearman rank-order correlations were conducted to explore associations between perceived noise exposure and self-reported concentration, sleep, stress, homework focus, and academic functioning. Correlation coefficients (ρ) and two-tailed p-values were reported. Qualitative responses were analyzed using an inductive thematic analysis because the study aimed to identify patterns that emerged directly from participants' responses rather than applying provided categories. All qualitative responses were coded by the researcher using initial open coding to identify recurring ideas, which were then organized into a codebook with operational definitions (Appendix B).

Multiple codes were assigned when a participant's response reflected more than one theme. Themes were developed through repeated review of the coded responses and refined iteratively to improve consistency across the dataset. Frequency counts then represent the number of participants who referenced a particular theme rather than the total number of coded segments. Responses representing minority viewpoints were also retained throughout the analysis and reported alongside the dominant themes to ensure a balanced interpretation of participant experiences. Quantitative and qualitative findings were initially analyzed independently before a full integration during the interpretation stage by using a convergent mixed-methods approach. Areas of agreement across data were used to strengthen interpretation, while discrepancies between quantitative trends and qualitative responses were also examined to provide additional context regarding students' experiences.

### Method Comparison and Contribution

This research study drew methodological inspiration from a survey that was distributed among schoolchildren to examine environmental noise exposure and its effects on learning. Their findings validate the use of survey questionnaires by showing the effectiveness of survey approaches to capture participants' perceptions.[4] In addition, survey research has also been shown to explore academic, stress, and sleep outcomes.[5] These studies support the use of survey methods to examine participants' perceptions of environmental stressors such as noise. Recruiting participants through snowball sampling also increased access to students from different Seattle-area high schools while introducing important methodological limitations. Because participants were recruited through peers in their own social networks, responses were likely clustered within similar school communities rather than representing an independent sample.

## RESULTS

### Participant Characteristics

A total of 31 high school students completed the survey and provided their informed consent (n = 31). In this study, n is the number of participants who responded to a given question or item. Participants represented 11 anonymized Seattle high schools. The highest participation came from High School 1 (n = 9), High School 2 (n = 6), and High School 3 (n = 5). High Schools 4–6 each had two participants (n = 2), while High Schools 7–11 each had one participant (n = 1). Additionally, participants were enrolled in Grade 9 (n = 4), Grade 10 (n = 7), Grade 11 (n = 16), and Grade 12 (n = 4). Residential classifications included suburban (n = 20), urban (n = 9), and rural (n = 2) (Table 1).

***Table 1.*** *Participants' distribution of grade levels and residential areas including urban, suburban, and rural.*

| Characteristics | Number of Responses | % |
|---|---|---|
| Grade 9 | 4 | 12.9 |
| Grade 10 | 7 | 22.6 |
| Grade 11 | 16 | 51.6 |
| Grade 12 | 4 | 12.9 |
| Urban | 9 | 29.0 |
| Suburban | 20 | 64.5 |
| Rural | 2 | 6.5 |

### Quantitative Results

Out of 31 responses, 16 participants reported 1–3 hours per day, 10 reported less than 1 hour, and 5 reported 5+ hours of noise per day (Figure 1).

Additionally, reported noise sources included traffic (n = 21), human conversations (n = 18), household appliances (n = 16), construction (n = 15), music (n = 15), aircraft (n = 14), and one participant reported no perceived noise

sources (n = 1). Regarding perceived loudness, most participants selected mid-range levels (n = 14), followed by lower-range levels (n = 9). Smaller groups selected higher and extreme ranges (n = 4 and n = 1), and three participants reported being unsure (Figure 2).

**Likert-Scale Measures**

Participants responded to 10 statements using a five-point Likert-scale ranging from strongly disagree (1) to strongly agree (5) (Table 2).

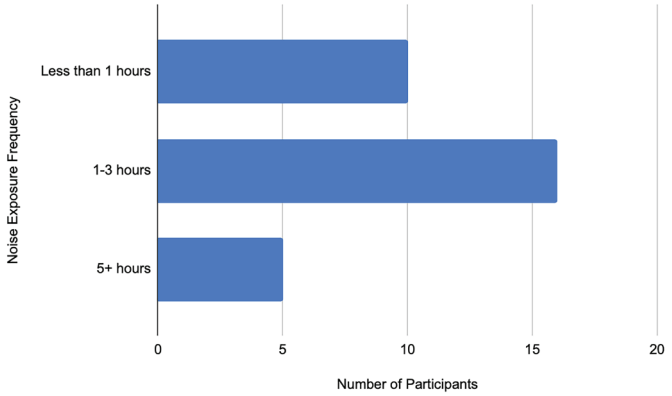


***Figure 1.*** *Self-reported daily noise exposure among participants (n = 31). Response options included less than 1 hour, 1–3 hours, and 5+ hours per day.*

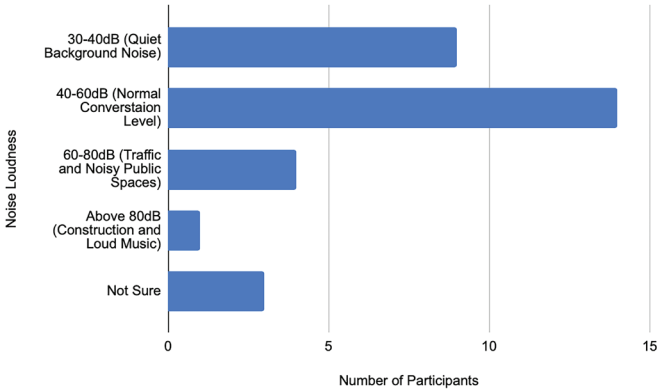


***Figure 2.*** *Participants' perceived environmental loudness categories (n = 31). Response options included predetermined categories of quiet background noise, normal conversation level, traffic and noisy public spaces, construction and loud music, and not sure.*

***Table 2.*** *Distribution of participant responses to Likert-scale survey items measuring perceived noise exposure frequency, loudness, sleep, drowsiness, stress, concentration, study focus, academic impact, and classroom support.*

| Statements | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Number of Participants |
|---|---|---|---|---|---|---|
| Noise Frequency: "I am exposed to noticeable noise (traffic, construction, loud classmates) on most days." | 3 | 3 | 8 | 8 | 9 | 31 |
| Perceived Loudness: "The noise where I live or near my school is loud enough to distract me." | 2 | 11 | 13 | 4 | 5 | 31 |
| Sleep Disruption: "Noise I am exposed to has negatively affected the quality of my sleep in the past two weeks." | 16 | 7 | 5 | 1 | 2 | 31 |
| Daytime Sleepiness: "I feel more tired during the school day because of poor sleep." | 6 | 5 | 12 | 4 | 4 | 31 |
| Stress/Irritability: "Noise makes me feel stressed, anxious, or irritated." | 9 | 7 | 6 | 8 | 1 | 31 |
| Concentration in Class: "Noise interferes with my ability to concentrate during class." | 1 | 8 | 9 | 8 | 5 | 31 |
| Homework/Study Focus: "Noise makes it difficult for me to focus while doing homework or studying." | 3 | 7 | 10 | 7 | 5 | 31 |
| Academic Impact: "Noise has negatively affected my grades or my performance in school." | 11 | 10 | 7 | 2 | 1 | 31 |

***Continued Table 2.*** *Distribution of participant responses to Likert-scale survey items measuring perceived noise exposure frequency, loudness, sleep, drowsiness, stress, concentration, study focus, academic impact, and classroom support.*

| Statements | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Number of Participants |
|---|---|---|---|---|---|---|
| Coping Strategies: "I have strategies that help me handle noise when I need to concentrate." | 2 | 5 | 9 | 10 | 5 | 31 |
| Classroom and Teacher Support: "My teachers at school use strategies that help reduce the impact of noise on learning." | 6 | 8 | 7 | 8 | 2 | 31 |

**Qualitative Findings on Noise Experiences and Coping**

26 participants provided at least one usable response to the qualitative section. Response counts varied slightly across prompts because participants were permitted to skip individual open-ended questions.

1. "Describe how noise is associated with your stress levels."

16 participants noted that noise increases stress, particularly in classroom settings. For instance, one participant explained, "I get stressed when I can't complete my homework or classwork because of noise." Several participants described that, when exposed to noise, they experience stress when unable to "complete [their] homework," "stops [their] focus on work," and "has a perceived impact on [their] retention of learned material." Traffic, construction, and "loud classmates" were commonly mentioned as a source of noise. Some participants reported that conversations with classmates were more distracting than general background noise, whereas others indicated that they had become accustomed to traffic noise.

2. Describe how noise has an association with your concentration or ability to complete schoolwork (Give examples if possible).

22 participants described noise as interfering with their concentration during schoolwork. Among these responses, classroom conversations were the most frequently mentioned source of distraction. Several participants described that conversations between classmates interrupted their attention, whereas others reported becoming accustomed to environmental background noise such as traffic. A participant wrote, "When students are being loud while I'm trying to do my work it makes it really hard and I can't focus." On the other hand, four participants indicated that noise had little or no perceived effect on their concentration.

3. When is noise the worst (time of day and location) and what type of noise is it?

Responses commonly identified school as the most disruptive setting (n = 11), followed by conversations at school (n = 5), transportation to and from school (n = 4), and construction/traffic (n = 6). For example, one participant shared, "Probably at school due to the distracting conversations that go on around me." Midday and afternoon were most identified as the most disruptive times (n = 16) with some responses identifying morning noise as the worst (n = 3) and one response identified nighttime as the worst (n = 1).

4. What strategies do you or your school use to cope with or reduce noise?

The most frequently reported strategy was the use of headphones/music (n = 8), followed by closing doors/windows (n = 3), moving to quiet spaces (n = 1), and simply "block it out" or "focus on other things" (n = 2). One student explained, "I listened to music with AirPods." For classroom and school strategies, participants reported that teachers "tell students to be quieter" (n = 3) while others reported that their school does not have any strategies to cancel out noise (n = 3). Lastly, participants also reported that they were unaware of how to cope with noise (n = 2).

5. Is there anything else you would like to share?

Most participants who responded to this question did not provide additional comments (n = 17). One participant indicated that noise had little perceived effect on their daily activities or academic functioning.

## DISCUSSION

### Quantitative Patterns in Student Perceptions

To address the primary research question, exploratory Spearman rank-order correlation analyses were conducted. Spearman's rho was selected because the variables consisted primarily of Likert-scale responses and the sample size was relatively small. Correlation coefficients, confidence intervals, and corresponding p-values are presented in Table 3.

Overall, the descriptive statistics and correlation analyses suggest that perceived noise exposure was more consistently associated with concentration difficulties, homework focus, sleep disruption, and perceived academic functioning whereas associations with stress were weaker.

### Students' Reported Noise Sources

Figure 3 shows the types of noise participants reported experiencing most frequently around their school environments. Traffic was the most commonly selected noise source, followed by human conversations, household appliances, construction, music, and aircraft noise. However, since participants could select multiple responses, these frequencies represent how often each noise source was reported rather than their disruptive effects.

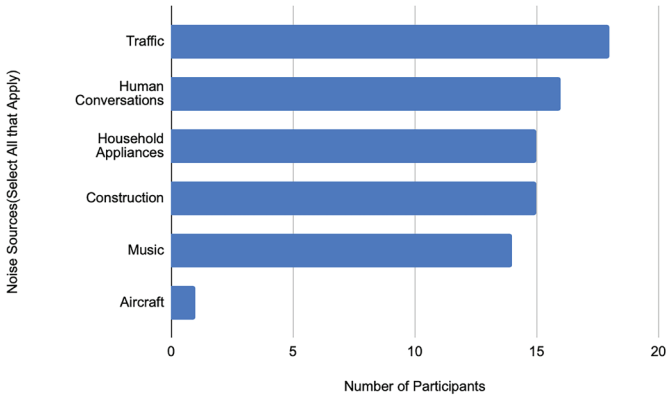


***Figure 3.*** *Reported sources of perceived noise exposure (n = 31). Response options included traffic, human conversations, household appliances, construction, music, and aircraft. Participants were permitted to select multiple response options, leading to the total exceeding the number of participants.*

### Qualitative Interpretation and Themes

26 participants completed at least one open-ended survey question (Appendix A). The number of usable responses varied across questions. Questions pertaining to stress, concentration and schoolwork, timing and type of noise, and coping strategies all received 26 responses while the additional final comment question received 19

***Table 3.*** *Exploratory Spearman rank-order correlations between perceived noise exposure frequency, loudness, and self-reported academic, concentration, sleep, and stress outcomes (n = 31). Positive coefficients indicate that higher perceived noise exposure was associated with higher self-reported agreement that noise affected the corresponding outcome.*

| Predictor | Outcome | Spearman's ρ | p-value |
|---|---|---|---|
| Noise Frequency | Concentration in Class | 0.458 | 0.011 |
| Noise Frequency | Homework/Study Focus | 0.398 | 0.027 |
| Noise Frequency | Sleep Disruption | 0.193 | 0.298 |
| Noise Frequency | Stress/Irritability | 0.200 | 0.281 |
| Noise Frequency | Academic Functioning | 0.377 | 0.036 |
| Perceived Loudness | Concentration in Class | 0.594 | <0.001 |
| Perceived Loudness | Homework/Study Focus | 0.369 | 0.041 |
| Perceived Loudness | Sleep Disruption | 0.676 | <0.001 |
| Perceived Loudness | Stress/Irritability | 0.258 | 0.161 |
| Perceived Loudness | Academic Functioning | 0.628 | <0.001 |

responses.

Qualitative responses provided a deeper understanding of the quantitative findings by explaining why several statistically significant associations emerged. While the quantitative data identified relationships, participants' written responses suggested that classroom conversations and other school-based social noise were commonly described as important sources of distraction. These qualitative findings provide contextual insight but should not be interpreted as evidence that social noise is more disruptive than environmental noise.

## CONCLUSION

The reported findings provide preliminary evidence that perceived noise exposure may influence students' learning experiences and should be investigated further using larger and more rigorous study designs. Although no interventions were evaluated, these findings suggest several directions for future educational and environmental research. Studies could examine whether classroom management strategies, seating arrangements, teacher training, quiet work periods, or monitoring classroom noise levels can reduce students' perceived distractions during learning. As these approaches were not evaluated in the study, they should be considered as proposals for future research rather than evidence-based recommendations. Additional studies could also explore whether similar patterns are observed in different educational settings, workplaces, or urban environments.

Several limitations should be considered when interpreting these findings. First, the final sample consisted of only 31 participants, with more than half enrolled in Grade 11 and relatively few participants representing most participating schools. Second, participants were recruited through snowball sampling, which makes it likely that respondents were clustered within their own peer networks rather than independently selected from the broader Seattle-area high school population. As a result, the sample may not represent the diversity of students across schools, grade levels, or demographic backgrounds and reflect similarities within friendship groups. Third, participation was voluntary, allowing the possibility that students with stronger opinions or experiences regarding noise were more likely to complete the survey. When taken together, these factors limit the representativeness and generalizability of the findings. In addition, age, sex, gender identity, race/ethnicity, and socioeconomic status were not collected. Therefore, this study could not examine whether perceptions differed across demographic groups, and these variables should be considered in future investigations. Moreover, this study relied entirely on participants' self-reported perceptions of noise rather than objective sound measurements. Although participants were provided with categories with approximate decibel ranges, these represented perceived loudness because no objective sound level measurements were obtained. The example of sound sources accompanying each response category may also have influenced participants' selections. In addition, the survey instrument omitted a 3–5-hour category when asking about perceived daily exposure, which may have reduced the precision of exposure estimates because participants were required to select the closest available response.

Nevertheless, the survey instrument was developed specifically for this study and was not formally pilot tested. Consequently, measurement reliability and construct validity were not established, and responses should be interpreted as participants' perceptions rather than precise measurements of the underlying constructs. Given that both perceived noise exposure and perceived academic outcomes were measured using the same self-report survey at one point in time, common-methods bias may have influenced and inflated some observed associations. However, five participants did not complete the qualitative portion of the survey, resulting in fewer qualitative responses available for thematic analysis. In addition, qualitative coding was conducted by a single researcher without independent coding or formal assessment of inter-coder agreement. Although a structured coding process and codebook were used to improve consistency, the absence of multiple coders may have introduced subjective interpretation into theme development. The study also did not measure or adjust for potential confounding variables, which may have influenced students' perceptions.

Future studies could replicate this research using larger and more representative samples, validated survey instruments, objective sound measurements, and longitudinal or experimental designs. Direct comparisons between environmental and social noise sources may also help clarify which types of noise are more strongly associated with students' concentration and academic experiences.

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## FUNDING SOURCES

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## CONFLICT OF INTEREST

The author declares that there are no conflicts of interest related to this work.

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## Appendix A. Survey Instrument

### Section 1. Informed Consent

**Informed consent form: LINK**

*Consent question:**

Please select one response:

- I have read the informed consent form, obtained parental or guardian permission if applicable, and agree to participate.
- I do not consent to participate.

### Section 2. Demographic Information

*No identifying information was collected to protect participant privacy.*

*Seattle-area high school enrollment:**

High School 1; High School 2; High School 3; High School 4; High School 5; High School 6; High School 7; High School 8; High School 9; High School 10; High School 11.

*Grade level:**

9th grade; 10th grade; 11th grade; 12th grade.

**Residential area:**

Urban; suburban; rural.

### Section 3. Perceived Noise Exposure

**1. On a typical day, approximately how many hours are you exposed to noticeable noise, such as traffic, construction, or loud neighbors?**

Less than 1 hour; 1–3 hours; 5 or more hours.

**2. What types of noise do you experience most often? Select all that apply.**

Traffic; construction; household appliances; music; human conversations; aircraft noise; other: _____.

**3. How loud is the noise you typically experience?**

- 30–40 dB: quiet background noise
- 40–60 dB: normal conversation
- 60–80 dB: traffic or noisy public spaces
- Above 80 dB: construction or loud music
- Not sure

### Section 4. Likert-Scale Items

Participants were instructed to select the response that best described their experience during the previous two weeks.

**Agreement scale:**

1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly agree.

**Frequency scale:**

1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Often; 5 = Almost always.

1. I am exposed to noticeable environmental noise, such as traffic, construction, or loud classmates, on most days.
2. The noise where I live or attend school is loud enough to distract me.
3. Noise has negatively affected the quality of my sleep during the past two weeks.
4. I feel tired during the school day because of poor sleep.
5. Noise makes me feel stressed, anxious, or irritated.
6. Noise interferes with my ability to concentrate during class.
7. Noise makes it difficult for me to focus while completing homework or studying.
8. Noise has been negatively associated with my grades or academic performance.
9. I use strategies that help me manage noise when I need to concentrate.
10. My teachers use strategies that help reduce the perceived effects of noise on learning.

### Section 5. Open-Ended Questions

1. Describe how noise is associated with your stress level.
2. Describe how noise is associated with your concentration or ability to complete schoolwork. Provide examples where possible.
3. When and where is noise most disruptive, and what type of noise is it?
4. What strategies do you or your school use to cope with or reduce noise?
5. Is there anything else you would like to share about the perceived effects of noise on your learning?

### Section 6. End-of-Survey Message

Thank you for participating. Your responses are anonymous and will be used only for this research project.

If this survey raised concerns about stress, sleep, or emotional well-being, you may contact the 988 Suicide & Crisis Lifeline by calling or texting 988.

**Note:** An asterisk (*) indicates a required question that had to be completed before the participant could continue.

**Appendix B.** *Qualitative Codebook and Theme Development*

| Themes | Operational Definitions | Representative Quotes |
|---|---|---|
| Stress and Emotional Response to Noise | Many participants reported that noise increased feelings of stress, frustration, or overstimulation, especially when they're trying to focus on academic tasks. Frequently, students correlate stress with an inability to complete work efficiently when exposed to loud environments. On the contrary, some participants indicated that noise had little or no perceived effect on their stress levels. | "I get stressed when I can't complete my homework or classwork because of noise." / "It makes me more stressed if I am trying to focus." |
| Academic Distraction and Task Completion | The most frequently reported theme associated with noise was difficulty in concentrating. Students described losing focus, struggling to read complicated material, or being distracted by conversations during class. A small number of participants reported no noticeable perceived effect on concentration. | "It stops me from thinking and it distracts me when I'm trying to write or focus on complex topics." / "When students are being loud while I'm trying to do my work it makes it really hard and I can't focus." |
| Timing of Noise and Environmental Context | Participants most commonly identified school environments as the most disruptive location for perceived noise exposure. Many respondents indicated that noise was most experienced during the middle of the school day within lunch time. Common sources of noise included classroom conversations, traffic, and construction near school buildings. | "Probably at school due to the distracting conversations that go on around me." / "During the school day and conversations." |
| Coping Strategies and Noise Management | Several strategies to manage noise exposure were described by participants. The most frequently reported coping strategy involved listening to music or using headphones to reduce distractions. Some students reported environmental acts such as closing doors or windows or relocating to quieter areas. Additionally, a few participants indicated that their teachers attempt to manage noise by remindingstudents to be quieter. Lastly, others reported no specific school strategies. | "I listen to music with AirPods." / "Normally I try to go to a quieter place." |

*Note. This table and examples reflect the researcher's coding process for qualitative, open-ended survey responses. Summaries of results are presented in the Discussion section of the paper.*