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COMPARING TEACHERS' AND STUDENTS' PERCEPTIONS OF SCHOOL SOUNDSCAPES THROUGH A QUESTIONNAIRE-BASED STUDY

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ABSTRACT

This study explores differences in how teachers and students perceive school soundscapes, highlighting their distinct acoustic needs and preferences. Conducted at St. Oscar Romero Catholic School in Goring-by-Sea, Worthing, the study involved 87 students (aged 11–14) and 18 staff members (aged 25–66), who completed questionnaires evaluating the school sound environment. Using a circumplex model to map soundscape attributes, the findings reveal that teachers predominantly reported positive perceptions of their soundscapes, with 50% falling into the "Engaged" quadrant, characterized by high Comfort and Content levels. Conversely, students were primarily concentrated in the "Detached" quadrant (47.7%), reflecting negative experiences of both dimensions. Statistical analyses, including independent t-tests, confirmed these differences, with significant p-values for Comfort ($p = 0.0083$) and Content ($p = 0.0075$). These findings highlight the need for targeted interventions to enhance students' auditory experiences within educational spaces. Recommendations include implementing acoustic treatments, introducing positive sound elements (e.g., nature sounds or calming music), and allowing students with control over their auditory environments. These findings highlight the need for future research on the long term impacts of tailored soundscapes on wellbeing and academic performance.

Keywords: *school soundscapes, acoustic preferences, teacher-student differences, educational environments, wellbeing.*

1. INTRODUCTION

Human perception is a pivotal aspect of soundscape studies, shaping how individuals experience and interpret their acoustic surroundings. Yang and Lu (2022) highlight that demographic factors, particularly age, play a key role in influencing soundscape perception [1]. They note that older adults often demonstrate unique auditory sensitivities and preferences compared to younger individuals, affecting their interactions with natural soundscapes. Similarly, Liu and Kang (2015) underscore the importance of personal and social factors, including age, in shaping soundscape experiences [2]. Their findings suggest that older adults tend to have a heightened appreciation for natural sounds, likely influenced by life experiences and changing preferences over time. Aletta et al. (2018) also emphasize this connection, reviewing studies that link positive health outcomes with perceptual aspects of soundscapes and stressing the importance of considering age-related differences in such research [3]. Furthermore, Erfanian et al. (2020) explored the psychological dimensions of soundscape perception, noting that older adults may derive varying levels of satisfaction from their acoustic environments [4]. Collectively, these studies demonstrate that age is a critical factor in soundscape research,

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impacting auditory preferences, emotional responses, and overall experiences in acoustic settings.

The design of indoor sound environments must account for age-related factors to ensure acoustically comfortable spaces. Yörükoğlu and Kang (2017) emphasize the importance of understanding user characteristics, such as age, as a key element in effective indoor soundscape design [5]. Additionally, the psychological dimensions of soundscape perception are significantly influenced by age. Erçakmak and Yörükoğlu (2019) highlight the necessity of integrating age-related factors into soundscape studies, noting that older adults may exhibit distinct psychological needs and reactions to sound compared to younger individuals [6].

The school indoor soundscape presents unique challenges due to the coexistence of two distinct age groups: adults and children. Although staff and students occupy the same physical spaces, their perceptions and experiences of the soundscape often differ because of their varying roles, age-related sensory differences, and responsibilities. Despite schools striving to create supportive learning environments, the comparative acoustic needs of these groups remain underexplored.

Visentin et al. (2023) focused exclusively on primary school students, emphasizing the significant influence of student-generated sounds on the classroom soundscape [7]. Further research by Pellegatti et al. (2023) examined the effects of natural sounds, revealing that positive sound elements can improve cognitive performance and overall soundscape evaluations [8]. In contrast, studies on school staff indicate a preference for quieter environments, highlighting the necessity of soundscape designs that reduce disruptive noise and incorporate positive auditory elements to support their wellbeing [9]. Another study found that teachers frequently describe schools as chaotic and dynamic, stressing the need for improved acoustic conditions within classrooms [10]. Additionally, a scoping review on methodological approaches in school soundscape research identified age as a critical factor, underscoring the importance of age-specific considerations in the acoustic design of schools [11].

Teachers and students often experience school soundscapes differently. This study aims to address the question: What are the differences between teachers' and students' perceptions of sounds in the school environment? By conducting a comparative analysis, the research seeks to uncover how these differing soundscape needs influence satisfaction in schools. The findings could inform the development of more effective soundscape designs, fostering a balanced environment that supports educational activities and promotes the wellbeing of all school occupants.

2. METHODS

This study was conducted at St. Oscar Romero Catholic School in Goring-by-Sea, Worthing (BN12 5AF), in collaboration with the school administration. A quantitative approach was adopted, utilizing a questionnaire to evaluate perceptions of the school sound environment among both students and staff. To ensure consistency in assessing perceptions of the sound environment and wellbeing across the two groups, the questionnaires were distributed within the same week and in the same school setting. This method facilitated a comparative analysis of perceptions within a shared acoustic environment.

2.1 Participants

A questionnaire was administered to both students and staff to explore their perceptions of the school sound environment. After data cleaning, the sample included 87 students aged 11–14 and 18 staff members aged 25–66. The staff participants represented a wide age range, with a mean age of approximately 45 years, encompassing both younger individuals in their 20s and 30s and older participants in their 50s and 60s. The student participants were primarily early adolescents, with the majority aged 12 and 13, offering valuable insights into the experiences and perceptions of students in this developmental stage. This diverse sample provided a comprehensive perspective on how different age groups perceive the school sound environment.

2.2 Data Collection

To evaluate perceptions of the school sound environment, participants responded to a series of questions on a 5-point Likert scale, ranging from "Strongly Disagree (1)" to "Strongly Agree (5)." The questionnaire, detailed in Table 1, was designed based on eight bipolar soundscape descriptors proposed by Axelsson et al. (2010) [12]. Since schools are indoor environments, the scores for these eight attributes were converted into circumplex model points, with coordinates mapped onto the Content and Comfort dimensions. This process followed the methodology outlined by Torresin et al. (2019), enabling a multidimensional interpretation of the soundscape data [13].

Table 1. Questionnaire Design both for teachers and students

For each of the 8 scales below, to what extend do you agree or disagree that last week school sound environment is…					
	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
Annoying					
Empty					
Detached					
Intrusive					
Comfortable					
Full of Content					
Private					
Controlled					

The transformation allowed for the analysis of perceptions along two primary dimensions—Content and Comfort—calculated as in Eqn. (1).

$$Content = (p - \alpha) + \cos 45° . (pr - i) + \cos 45° . (v - d)$$

$$Comfort = (f - e) + \cos 45° . (i - pr) + \cos 45 . (v - d)$$

In the formulas used to analyze the school soundscape, each variable represents a specific attribute of the acoustic environment. The variable α denotes "Annoying," while p corresponds to "Comfortable." Similarly, d stands for "Detached," and e represents "Empty." The variable v captures the perception of being "Engaging," and f reflects "Full of Content." Additionally, i is associated with "Intrusive" or "Uncontrolled" sounds, and pr relates to the perception of being "Private" or "Controlled."
To streamline the data collection process, selected teachers distributed the student questionnaires directly to their respective classes, while staff members completed their questionnaires independently. The questionnaires were administered at the end of the school week, specifically on Friday during the last five minutes of the final lesson. This timing ensured that participants had experienced the full range of school sounds throughout the week before providing their responses, capturing a more comprehensive and reflective assessment of the sound environment.

2.3 Ethical Considerations

Before commencing data collection, strict ethical procedures were followed to prioritize the rights and comfort of participants. A detailed information sheet was provided, outlining the study's purpose and procedures. Informed consent was obtained from all participants, while a parental opt-out form was distributed for student participants. These steps ensured that both students and staff were fully aware of the study's aims and their rights, promoting transparency and voluntary participation throughout the research process.

2.4 Data Analysis

Firstly, the data analyzed systematically using Python. Due to concerns about the normality of the data and potential outliers in the Comfort and Content levels for both staff and students, a non-parametric approach was chosen for analysis. Specifically, the Mann-Whitney U test was employed to compare differences between the two independent groups: staff and students. This test is an appropriate alternative to the t-test when the data does not follow a normal distribution, and it evaluates whether the distributions of the two groups differ significantly.
The Mann-Whitney U test was conducted separately for the Comfort and Content levels of the participants. A p-value less than 0.05 indicating a significant difference in the perception of comfort or content between staff and students.
Secondly, questionnaire responses were analyzed by mapping each attribute onto the coordinates of an indoor soundscape perceptual circumplex model, which represents two primary dimensions: Comfort and Content. Using Equation 1, the scores for Content and Comfort were calculated. To enable comparability, the resulting coordinates for each attribute were standardized by dividing them by $(4+\sqrt{32})$. This standardization ensured that all values fell within a range of -1 to +1, allowing for a more straightforward interpretation of how the soundscape attributes influenced comfort and contentment levels, particularly among students [14].

3. RESULTS

The comparative analysis of sound perceptions between teachers and students highlighted distinct differences in how these groups evaluate the school soundscape.
Staff reported positive averages, with a mean Comfort level of 0.139 and Content level of 0.145, indicating generally favorable perceptions. Students, however, reported negative mean values, with Comfort at -0.166 and Content at -0.059, suggesting less favorable experiences. The median values align with these trends,

emphasizing the contrast between the groups. These results demonstrate that staff experience higher levels of Comfort and Content in their soundscape perceptions compared to students.

The results of the Mann-Whitney U tests revealed significant differences in both comfort and content levels between the two datasets. For the comparison of comfort levels, the U-statistic was 1069.5, with a p-value of 0.0112. Since the p-value is less than the 0.05 threshold, it indicates that there is a statistically significant difference in the comfort levels between the groups. Similarly, for content levels, the U-statistic was 1147.0, and the p-value was 0.0014. This p-value, also below 0.05, suggests that there is a statistically significant difference in the content levels between the two groups. These findings indicate that both comfort and content levels differ significantly between the two datasets analyzed. To further understand how these differences emerge, Perceptual attributes of the soundscape were analyzed using the circumplex model.

Figure 1 provides a visual representation of participants' perceptions, with separate panels for staff (above) and students (below). The axes illustrate Comfort Level and Content Level, dividing the space into four quadrants: "Engaged," "Detached," "Intrusive (uncontrolled),"and "Private (controlled)." The scatter plots and density distributions highlight the clustering of perceptions within these categories, offering insights into where experiences are concentrated.

For staff, the most prominent clustering occurs in the "Engaged" quadrant, where positive Comfort and Content levels reflect predominantly favorable soundscape experiences. Moderate densities in the "Intrusive" and "Detached" quadrants suggest that some staff members encounter soundscapes that are either uncontrolled or disengaging, but these are less common. Minimal density in the "Private" quadrant indicates infrequent perceptions of environments that are controlled but lack richness in content.

In contrast, students' perceptions are heavily concentrated in the "Detached" quadrant, indicating experiences characterized by low Comfort and Content levels. This suggests that students are more likely to find school soundscapes disengaging and uncomfortable. The "Engaged" quadrant for students shows less density compared to staff, reflecting fewer positive soundscape experiences among the student group. The "Intrusive" and "Private" quadrants are sparsely populated, signaling fewer instances where students perceive their soundscape as either uncontrolled or isolated.

The findings highlight the need for targeted interventions to improve the less favorable soundscape experiences reported by students (see Fig 1.).

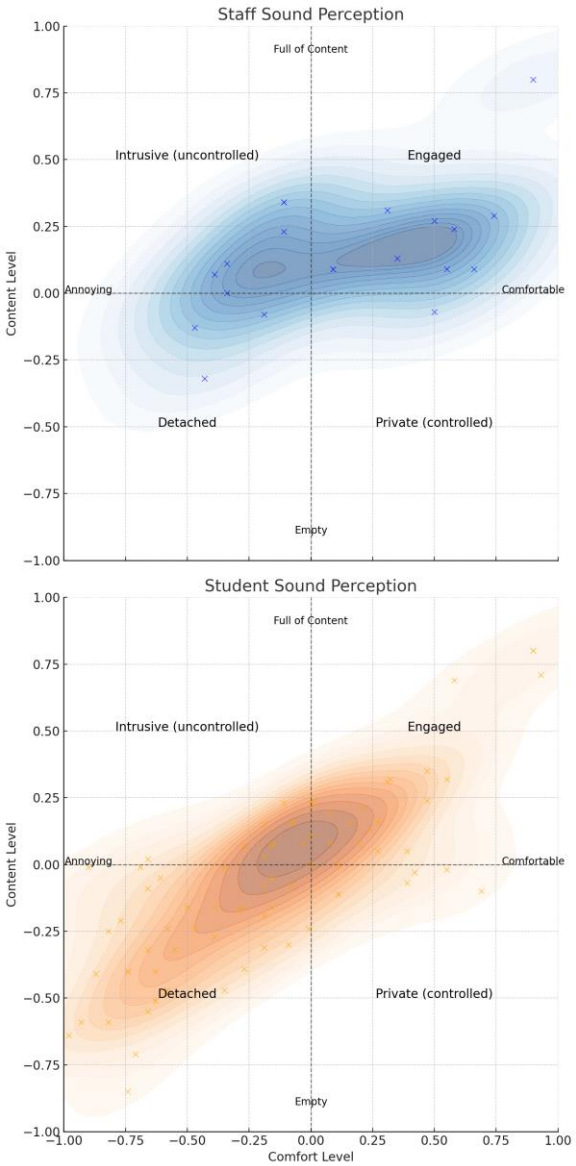

Figure 1. Teachers' and Students' Perceptions of School Soundscapes in the Indoor Soundscape Circumplex Model

4. DISCUSSION

The findings reveal notable differences in how teachers and students perceive the school's acoustic environment,

shedding light on their distinct priorities that shape soundscape design. These differences, confirmed by analysis and density plots, show staff clustering predominantly in the "Engaged" and “intrusive” quadrant, while students are primarily situated in the "Detached" quadrant.

Staff perceptions in the "Engaged" quadrant suggest that school soundscapes generally support their comfort and engagement. This may result from their ability to influence sound conditions, better awareness of environmental factors, or differing cognitive responses to auditory stimuli. However, staff also reported auditory challenges, with some clustering in the "Intrusive/Uncontrolled" quadrant, reflecting disruptions that hinder classroom management and effective teaching. For students, the high density in the "Detached" quadrant highlights negative experiences regarding both Comfort and Content. This suggests that students find school soundscapes less engaging and more distracting, often leading to annoyance and disengagement. These perceptions may arise from exposure to uncontrollable noise sources, such as peer interactions, classroom disruptions, or ambient sounds from hallways and playgrounds. Additionally, students’ limited ability to adapt or escape adverse soundscapes likely contributes to their lower scores.

The observation made highlights the differing daily experiences of teachers and students in a school environment, which could influence their perceptions of the overall soundscape. Teachers, although working in noisy and chaotic classrooms during lessons, have dedicated periods of non-teaching time, such as free periods, when they are in quieter spaces like staff workrooms. These calmer moments may lead to a more positive overall perception of the school soundscape, as they experience a blend of both noisy and calm environments. The limited presence of colleagues during these moments could contribute to a sense of calm, potentially making the overall school soundscape more favorable to teachers. In contrast, students spend the majority of their day in the classroom, which is generally a louder and more chaotic environment, especially if the class size is large or the lesson is dynamic. During breaks and lunch, students are still surrounded by others, further contributing to the less favorable perception of the soundscape. Unlike teachers, students may not have regular periods of calm throughout the day to balance out the louder classroom experiences, which may influence how they perceive the school's acoustics.

This difference in experience raises an interesting point: a further study could separate perceptions of soundscapes between times spent inside classrooms and outside classrooms (such as during break times or independent study periods). Additionally, investigating the relative amount of time spent in these different environments could help to better understand how soundscape perception changes based on context.

The findings stress the need to create soundscapes that promote comfort for all occupants of educational spaces. While staff generally find current soundscapes acceptable, further refinements could enhance their productivity and engagement. For students, interventions to reduce intrusive noise and improve auditory experiences are crucial. Strategies might include acoustic treatments, the addition of positive sound elements (e.g., nature sounds or calming music), and opportunities for students to exert control over their auditory environments. Furthermore, designing designated calming zones within schools could provide students with calm spaces for relaxation and focus, especially during break times or independent study periods. These calming zones could be equipped with soft furnishings, soothing sounds, and noise-reducing materials to create an environment conducive to mental wellbeing. By providing students with access to quieter areas where they can retreat from the typical school noise, schools could help mitigate stress and improve students' overall perception of the soundscape.

Future studies should explore the long-term effects of customized soundscapes on wellbeing and academic performance. They should also examine the role of specific auditory elements, such as nature sounds or instrumental music, in improving comfort and engagement for both teachers and students.

This study’s limitations include a relatively small sample size and its focus on a single school, which may affect the generalizability of the results. Additionally, reliance on self-reported data may introduce biases. To address these limitations, future research should involve larger, more diverse samples and adopt longitudinal methods.

5. CONCLUSIONS

Based on data collected through questionnaires administered to both staff and students within the same school and timeline, this study demonstrates clear differences in how these two groups perceive school soundscapes.

Independent t-tests confirm significant differences between staff and students in both Comfort ($p = 0.0083$) and Content ($p = 0.0075$) levels. These findings emphasize the

importance of designing adaptable soundscapes that balance the needs of both groups, fostering comfort, focus, and wellbeing in educational environments. Future research should explore the long-term impacts of these perceptions and investigate innovative acoustic strategies to bridge the gap between the differing preferences of teachers and students.

6. ACKNOWLEDGMENTS

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