

AN INVESTIGATION ON SCHOOL STAFF'S PERCEPTION ON SOUNDS AND IDEAS ABOUT SCHOOL SOUNDSCAPE DESIGN

Hatice Kubra KURUKOSE CAL Jian KANG Francesco ALETTA

Bartlett School of Environment, Energy and Resources, University College London, United Kingdom
14 Upper Woburn Place Central House, WC1H0NN

ABSTRACT

The current focus of soundscape studies is mainly on urban or outdoor environments; however, there is an increasing interest in the soundscape of indoor spaces. Schools can also benefit from an indoor soundscape approach. The research aim to investigate school staff's perception and ratings on environmental sounds, and how these can support acoustic comfort. The structured interview data collection method was chosen to identify school staff perceptions and preferences: this paper reports on the results with 20 participants, 10 in the UK and 10 in Turkiye. The perception of school staff in the UK and Turkiye were collated for cultural differences. Preliminary findings suggest that school staff do not always want a quiet environment, and even raised a wish to hear music and natural sounds depending on activities and places. This study suggests that considering only negative sounds is not enough to provide acoustic quality in schools. School staff from the UK and Turkiye were eager for calming and relaxing sounds. School staff from Turkiye stated that they were uncomfortable with quietness more often. Bird singing, rain and water stream were the most wanted sounds in both countries. Some differences have been found between participants from Turkiye and the UK. These differences were over the identification and description of sound sources. While car horns were most annoyed sounds in Turkiye, traffic sounds were most annoyed sound in the UK.

Keywords: *indoor soundscape, school soundscape, school acoustic, teachers' perception.*

*Corresponding author: hatice.kurukose.20@ucl.ac.uk

Copyright: ©2023 First author et al. This is an open-access article distributed under the terms of the Creative Commons Attribution 3.0

1. INTRODUCTION

Teachers and students spend a substantial amount of their daytime in schools [1]. In that sense, school experiences are supposed to play a central role in their life [2] and school acoustics can be considered one of the key settings for teachers' and children's health. Inadequate acoustic comfort correspondingly, disturbance by noise could be seen as the most harmful indoor environmental factor for school staff [3]. Several studies indicated that school staff are affected by the acoustical environment [4, 5], however, research on their perception of sounds is rare [6] and these researchers generally focused on noise disturbance [7–9]. Indoor and outdoor noise perception of teachers has been investigated [10–14]. In fact, suboptimal acoustic comfort could be the result of both the presence of annoying sounds and the lack of positive sounds. From this point of view, Lee and Welch considered the use of background music in schools. Teachers using background music reported that it is helpful for the learning environment [15]. On the contrary, school acoustic literature generally ignored or disregarded the role of positive sound sources. Noise effects have arisen much attention consciously or unconsciously, because the negative effects of sounds in schools can have a significant impact on both teachers and students such as distraction and reduced concentration, increased stress and fatigue voice strain and vocal health issues, reduced speech intelligibility and decreased performance [16–22]. This causes the positive impact of sounds to be neglected. While it's essential to address the negative effects of sound stimuli in schools, it is also important to recognize and emphasize the significance of positive sounds within educational environments. Positive sounds in schools can contribute to creating an environment that is conducive to learning, well-being, and positive

Unported License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

emotional states. For instance, soothing background music, nature sounds, or ambient noise can have a calming effect and help reduce stress levels among students and teachers. They can also create a more welcoming and inclusive atmosphere that promotes engagement, creativity, and collaboration. Conducting a soundscape study for schools is vital since the existing perception studies generally investigate negative sounds.

The concept of soundscape was developed by R. Murray Schafer in the 1960s [23]. Soundscape is based on context, people, and acoustic environment[24]. Although context refers to the reciprocal relationship between the person and the place (outdoor or indoor), it is seen that urban soundscape studies are more common than indoor ones [25, 26]. The intricacy of places and activities makes each building's indoor soundscape unique. Amneh Hamida, Dadi Zhang, Marco A. Ortiz, and Philomena M. Bluysen conducted a review on the acoustical preferences and requirements of students in educational buildings. The findings of this review revealed a scarcity of studies focusing on the soundscape of schools [27]. Moreover, there are limited studies specifically on the indoor soundscape of educational buildings. Early studies focused on libraries, computer labs and classrooms [28–30]. A school soundscape study which examines schools as a whole has not been found. For this reason, the current study investigates school indoor soundscape. Furthermore, individual factors of occupants influence their perception. Socio-cultural background, expectations and attitudes could be related to the perception of sounds [31]. Places' national or cultural characteristic creates persons' demographics, perceptions and preferences [25]. For that reason, how different the perceptions of teachers from different cultures are not clear. This study aims to answer this.

2. METHODOLOGY

The structural interview was chosen as a methodology because it allows participants to identify factors. This qualitative data collection method provides the opportunity to discover themes or responses. Interview questions are planned and asked the responders in a particular order by the researcher. As participants asked the same question it was easier to analyze equally and fairly. At the end of each interview, participants were asked to give a range of 1 to 5 to specific sound sources.

2.1 Participants

Structured interviews are conducted with 10 school staff in the UK and 10 school staff in Turkiye. The interviews held a

number of job titles, including “teacher, head teacher, teaching assistant, and admin team member” (having experience of working in schools). The participants were from different regions of Turkiye and England.

In this study, it is important to note that we did not specifically inquire about the schools where the participants were teaching. Therefore, we lack information regarding the exact number of schools represented in our sample. While this limitation restricts our ability to provide a precise quantitative analysis at the school level, it does not undermine the validity of our findings at the individual level. The focus of our research primarily revolves around exploring the perceptions and experiences of the participants regarding positive and negative sound stimuli in schools, rather than conducting a comprehensive survey across multiple schools.

2.2 Data collection

Each interview began with a quick introduction describing the purpose of the interview, lasted from 15 minutes to 30 minutes. Interviews are conducted over the phone or Microsoft team calls individually by a researcher. Open ended questions were asked to interviewees to describe their lived experiences such as “describe a situation you pleasure/annoyed from a sound while you are working”. Table 1 demonstrates interview questions.

Table 1. Interview Questions

1	What are the first three sounds when you think school soundscape?
2	What are your thoughts about negative sounds in your school?
3	How does exposure of these sounds affect you during the day?
4	What are your thoughts about positive sounds in your school?
5	How does exposure of these sounds affect you during the day?
6	What sounds do you want to hear in school? / What sounds you do not want to hear in school?
7	Could you tell me about a situation which you extremely annoyed / pleased from a sound source when you are working?
8	Can you describe a school design which is acoustically satisfying?

9	When you closed your eyes which sounds can be heard from this school?
10	Could you give a number between 1 to 5 to following sounds sources? 5 means you like this sounds in school, 1 means you do not. Bird singing, Rain, water stream, sea sound, laughing, music, school bells, wind, speech, sounds coming from next classroom, footsteps clock sound, technological sounds, ventilation, car horn, traffic (these sounds were mixed)

2.3 Analysis

Each interviews' verbatim transcription was read through several times to obtain a sense of content. A set of initial codes which represent the patterns of the data were created. Initial codes were sorted into potential themes. These potential themes were revised and reviewed; similar themes were merged together. The relationships between themes have been investigated by reading interviews again and again and taking notes. All over, it is used representative quotes from respondents to support our relationships claims. The computer software 'NVivo' was used to assist with storage, coding and searching of data.

3. RESULTS

The results of our study highlight the influence of cultural background on the school soundscape. We found that the types of sounds present and desired in educational settings varied across different cultural backgrounds. Table 2 provides an overview of the relevant quotations of the staff members from the United Kingdom (UK) and Turkiye in the study.

One notable finding from our study was the divergence in the definition and perception of sound sources among participants from Turkiye and the UK. While Turkish staff did not mention train sounds, UK staff expressed their discomfort with such sounds repeatedly (Q5). This discrepancy could reflect the differential use of outdoor spaces in schools between the two countries. Participants from Turkiye highlighted the sounds of playing children, both positively and negatively (Q1), indicating a greater reliance on outdoor or semi-outdoor areas during breaks and physical education (PE) times. In contrast, UK staff focused on traffic sounds, potentially indicating a higher dependence on indoor spaces and gyms for recreational and physical

activities. These findings suggest that the utilization of outdoor spaces and the availability of alternative indoor facilities differ between Turkiye and the UK, leading to distinct soundscapes in school environments.

Furthermore, the participants also indicate the presence of sound marks. Sound marks refer to distinctive sounds associated with a specific location or community [23]. The call to prayer (Azan) can be considered as an auditory symbol for Turkiye. The teachers discussed this particular sound during the interview and also mentioned culturally significant musical instruments (Q2).

The urban environments encompassed diverse cultural backgrounds, which influenced the perception of sound stimuli in schools. Within certain cultural contexts, quietness was not universally perceived as a positive attribute. Rather, in some instances, a bustling soundscape was associated with liveliness, productivity, and a sense of community. These cultural perspectives challenged the notion that a quiet environment is universally desired in educational settings. For instance, in Turkiye, individuals developed a tolerance and even a preference for constant auditory stimulation. This cultural inclination towards a vibrant auditory environment indicates that the desirability of quietness in schools is subjective and dependent on the cultural context in which they are situated. Interestingly, some staff members in Turkiye found the quietness to be dull and empty, whereas in the UK, they found it comforting (Q3, Q6). It is worth noting that a quiet environment does not always guarantee a positive acoustic experience [31, 32]. The participants expressed a desire for certain sounds to be present in schools in both countries. Music was a common request in both countries, but in Turkiye, there was also a desire for more lively and enjoyable music. Both sets of participants believed that designers could utilize sound sources to create a more conducive learning and teaching environment (Q4, Q7).

Table 2. The related quotations of the staff from the UK and Turkiye.

Quotations	Turkish staff
Q1	Children's sounds are very loud enough to disturb the others. There is a constant hum at the background, there are children talking and shouting which makes as tired. The sounds of other children coming from outside distract the children who are in class at that time. Although children sound is sometimes disturbing, I can still say that their voices are the most

	positive sounds in school. Schools. Without their sounds schools would be so empty. The sounds of children laughing and playing make me feel very young.
Q2	While I am teaching, we sometimes hear the call to prayer. In such cases, we stop the lesson and listen to this sound with the students. This is a rest and relaxation time for both me and the students. I believe that the ney (a traditional flute-like instrument, is known for its soothing and meditative sound) sound has a very calming effect. Maybe we can use it in schools.
Q3	I wouldn't want a completely quiet school. We tried this during the time of the pandemic. We had to teach empty classes. This has caused me to lose the purpose I had for coming to school. I think schools become schools with the children's chatter and it is unthinkable for them to be completely silent. Whenever the class is completely silent, I observe that the students are getting sleepy and bored. This situation also reduces our motivation.
Q4	We all felt more positive that day when we played music. The annoying noises have decreased as everyone is focused on the music. As we enjoyed ourselves, even going down the stairs became more enjoyable. Since there was no teacher for a period, I was doing the music class, I had the opportunity to listen to many wonderful works, for example, I spend the days with that music lesson very peacefully. For example, music, I think, it can be a good music once before school starts, of course, this thing we call music is very relative. I think it would be good for me to hear the music
	UK staff
Q5	Train line passes individually right next to the school that I can hear from the playground. Train noise from outside. It can be quiet distracting for the students I think one of the key things are that it is quiet distracting. So, it prevents us from staying on topic or on task during lessons. Train line as well, you can hear that. This is a sort of sound that is very distracting and disruptive for the children. The cars and other noises from the outside, all of them is distract my attention. I don't want to hear any traffic sounds or any beeping off cars.

Q6	I like the sound of silence in school when that sort of slow hum of people working. I like soothing sounds and quite silent environment.
Q7	Music teachers open relaxing music on the background when children read something or drawing something I don't remember exactly. And I realized that that time I feel more pleasure. Calming music, which is nice for that, that'll be good for children, as well. I think maybe, that when they're doing exams and stuff, they could have like, classical music, it's supposed to help with memory, which is good.

Figure 1 illustrates the outcomes derived from the 10th interview question and presents the preferences of teachers from the United Kingdom (UK) and Turkiye regarding various sounds. The results show that UK participants expressed a strong preference for the pleasant sound of birds singing, considering it as the most liked and desired sound. Similarly, Turkish teachers also highly desired the sound of bird singing in their schools. On the contrary, the sound of traffic was found to be the most annoying and undesirable among UK teachers. In contrast, car horns were identified as the most unwanted sound in Turkiye. Additionally, school bells were perceived as more disruptive in Turkiye compared to the UK.

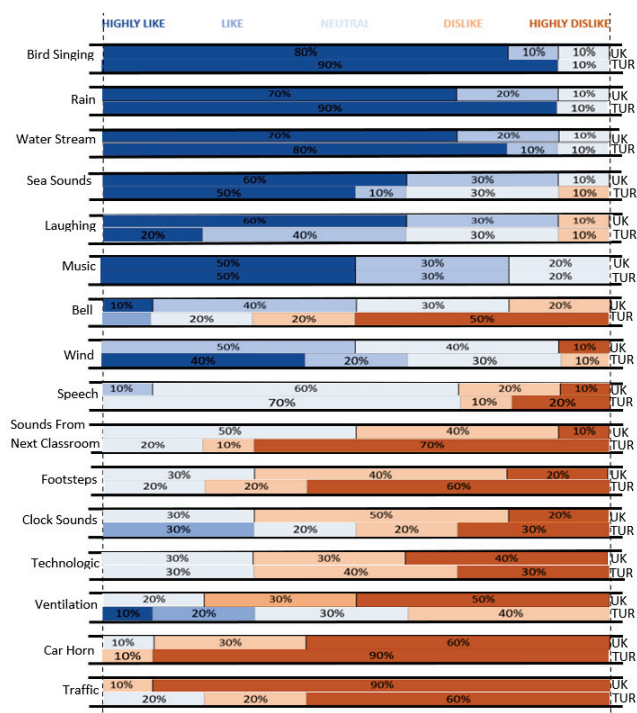


Figure 1. UK and Turkiye school staff perception of sounds

4. DISCUSSION

Indoor soundscape studies attract more and more attention every year [33]. Since the soundscape is based on human perceptions and expectations, it is expected that the indoor soundscape of each building type will be handled separately. School is one of the building types which is extremely important in terms of acoustics. However, previous school acoustics research on the effects of acoustic comfort on teachers focused on negative effects and ignored the soundscape approach. The main concern was related the voice disorder [3, 5, 10]. Many studies reported noise and acoustic conditions are leading uncomfortable factors in schools [34, 35]. Self-reported positive sound effects are disregarded. Each individual has his or her own perception of sounds like every space has its own sound environment and acoustic needs [25]. Besides this, as sound perception is influenced by cultural background, studies should also take this issue into consideration.

Considering the changeable human perception, school indoor soundscape was investigated in this paper. Cultural background is expected to bring about changes in people's perception. Differences on perception and preferences have

been found between participants from Turkiye and the UK. However, a limitation of this study is the lack of information regarding the specific schools represented by the participants. Consequently, it is challenging to distinguish whether the observed differences in sound experiences are attributable to specific urban contexts or more generalized cultural factors.

To further enhance our understanding, future studies should assess the perception of soundscapes in schools, particularly focusing on students as they constitute the primary users of these educational environments. Moreover, it is essential to address the limitations associated with qualitative data validation. Increasing the number of participants would improve the trustworthiness of results, and consideration should be given to the potential discomfort caused by the formal nature of structured interviews, as this could influence participants' responses. By addressing these limitations, future research can contribute to a more comprehensive understanding of the school indoor soundscape and its implications for educational environments.

5. CONCLUSION

The present study investigated how different the perceptions of teachers from different cultures. Our sample showed that there were differences in perceiving and describing sounds between the two countries.

- While Turkiye school staff do not always want a quietness, and even raised a wish to hear sounds, UK school staff associated silence with peace.
- Participants from each country conversed about the specific sounds of their environment time to time. These were sometimes sound marks (Azan sound), sometimes the sound of a cultural instrument.
- Different sounds induced varying degrees of discomfort. While the Turkish participants did not talk about the train sounds much, the participants from the UK talked about this sound many times. Differences were observed in sounds coming from outside the school.
- Bird singing, rain and water stream were the most wanted sounds in both countries.
- While car horns were the most annoyed sounds in Turkiye, Traffic sounds were most annoyed sound in the UK.

6. REFERENCES

- [1] ASHA. *Acoustics in Educational Settings: Acoustics in Educational Settings: Technical Report ASHA Working Group on Classroom Acoustics*, <http://www.asha.org/members/deskref-journals/deskref/default> (2005, accessed 14 January 2023).
- [2] Manca S, Cerina V, Tobia V, et al. The effect of school design on users' responses: A systematic review (2008-2017). *Sustainability (Switzerland)*; 12. Epub ahead of print 1 April 2020.
- [3] Ilomäki I, Leppänen K, Kleemola L, et al. Relationships between self-evaluations of voice and working conditions, background factors, and phoniatric findings in female teachers. *Taylor & Francis* 2009; 34: 20–31.
- [4] Lyberg-Åhlander V, Rydell R, Voice PF-J of, et al. Prevalence of voice disorders in the general population, based on the Stockholm public health cohort. *Elsevier*, (accessed 21 June 2023).
- [5] Roy N, Merrill R, Thibeault S, et al. Prevalence of voice disorders in teachers and the general population. *Journal of Speech Language and Hearing Research* 2004; 47: 281–293.
- [6] Karjalainen S, Brännström JK, Christensson J, et al. A Pilot Study on the Relationship between Primary-School Teachers' Well-Being and the Acoustics of their Classrooms. *International Journal of Environmental Research and Public Health* 2020, Vol 17, Page 2083 2020; 17: 2083.
- [7] Grebennikov L, Wiggins M. Psychological effects of classroom noise on early childhood teachers. *Aust Educ Res* 2006; 33: 35–53.
- [8] Kristiansen J, Persson R, Lund SP, et al. Effects of classroom acoustics and self-reported noise exposure on teachers' well-being. *journals.sagepub.com* 2013; 45: 283–300.
- [9] Puglisi G, Cutiva L, Pavese L, et al. Acoustic comfort in high-school classrooms for students and teachers. *Elsevier*.
- [10] Vieira B, Education DP-SAJ of C, 2020 undefined. Noise, screaming and shouting: Classroom acoustics and teachers' perceptions of their voice in a developing country. *journals.co.za*; 10. Epub ahead of print 2020.
- [11] Roy KP, Li J. Background noise in Chinese schools - Student and teacher perceptions. *Proceedings of Meetings on Acoustics*; 19. Epub ahead of print 2013.
- [12] Augustyńska D, Kaczmarek A, ... WM-A of, et al. Assessment of teachers' exposure to noise in selected primary schools. *acoustics.ippt.gov.pl* 2010; 35: 521–542.
- [13] Zannin PHT, Marcon CR. Objective and subjective evaluation of the acoustic comfort in classrooms. *Appl Ergon* 2007; 38: 675–680.
- [14] Astolfi A, Pellerey F. Subjective and objective assessment of acoustical and overall environmental quality in secondary school classrooms. *J Acoust Soc Am* 2008; 123: 163–173.
- [15] Lee Y, education GW research in early childhood, 2017 undefined. Teachers' perceptions about the use of background music in preschool free play time. *discovery.ucl.ac.uk* 2017; 11: 85–106.
- [16] Greenland E, Shield B, Dockrell J. Control of noise for speech intelligibility in open plan classrooms. In: *8th European Conference on Noise Control 2009, EURONOISE 2009 - Proceedings of the Institute of Acoustics*. 2009.
- [17] Astolfi A, Bottalico P, Barbato G. Subjective and objective speech intelligibility investigations in primary school classrooms. *Journal of the Acoustical Society of America* 2012; 131: 247–257.
- [18] Murgia S, Webster J, Cutiva LCC, et al. Systematic Review of Literature on Speech Intelligibility and Classroom Acoustics in Elementary Schools. *Lang Speech Hear Serv Sch* 2023; 54: 322–335.
- [19] Whitlock JAT, Dodd G. Speech Intelligibility in Classrooms: Specific Acoustical Needs for Primary School Children. 2008; 15: 35–47.
- [20] Greenland EE, Shield BM, Dockrell JE. Speech Transmission Index criteria for open plan classrooms in British primary schools. In: *38th International Congress and Exposition on Noise Control Engineering 2009, INTER-NOISE 2009*. 2009, pp. 1866–1874.
- [21] Budd AL, Shield BM, Dockrell J. A speech intelligibility test for use with young children in realistic classroom environments. In: *8th European Conference on Noise Control 2009, EURONOISE 2009 - Proceedings of the Institute of Acoustics*. 2009.
- [22] Yang W, Bradley JS. Effects of room acoustics on the intelligibility of speech in classrooms for young children. *Journal of the Acoustical Society of America* 2009; 125: 922–933.

- [23] Schafer R. *The soundscape: Our sonic environment and the tuning of the world*, (1993, accessed 21 June 2023).
- [24] ISO - ISO 12913-1:2014 - Acoustics — Soundscape — Part 1: Definition and conceptual framework, (accessed 14 January 2023).
- [25] Kang J, Schulte-Fortkamp B. *Soundscape and the built environment*. CRC PressTaylor & Francis Group, 2016.
- [26] Aletta F, Astolfi A. Soundscapes of buildings and built environments. *Building Acoustics* 2018; 25: 195–197.
- [27] Hamida A, Zhang D, Ortiz MA, et al. Indicators and methods for assessing acoustical preferences and needs of students in educational buildings: A review. *Applied Acoustics*; 202. Epub ahead of print 1 January 2023.
- [28] Yorukoglu PD, Kang J. Analysing sound environment and architectural characteristics of libraries through indoor soundscape framework. *Archives of acoustics* 2016; 41: 203–212.
- [29] Xiao J, Aletta F. A soundscape approach to exploring design strategies for acoustic comfort in modern public libraries: A case study of the Library of Birmingham. *Noise Mapping* 2016; 3: 264–273.
- [30] Topak SÇ, Yilmazer S. A comparative study on indoor soundscape assessment via a mixed method: A case of the high school environment. *Applied Acoustics*; 189.
- [31] Kang J, Aletta F, Gjestland T, et al. Ten questions on the soundscapes of the built environment. *Build Environ* 2016; 108: 284–294.
- [32] WHO. Constitution Of The World Health Organization .
- [33] Torresin S, Aletta F, Babich F, et al. Acoustics for supportive and healthy buildings: Emerging themes on indoor soundscape research. *Sustainability (Switzerland)*; 12. Epub ahead of print 1 August 2020.
- [34] Building bulletin 93. Acoustic design of schools: performance standards. *Building Bulletin* 2015; 17: 43.
- [35] Hagen M, Kahlert J, Hemmer-Schanze C, et al. Developing an acoustic school design: Steps to improve hearing and listening at schools. *Building Acoustics* 2004; 11: 293–307.