



Assessment of Urban Noise in School Environments - Case Study in Batu Pahat, Johor

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Abstract: In recent decades, urban noise has become well-known as one of the critical problems affecting the quality of life in urban areas around the world. Noise assessment is becoming more common in Malaysia as many cities in this country become highly populated and industrialized with serious noise pollution issues, particularly in schools. The aims of this study are to identify the factors and effects of noise in the school environments and evaluate the acoustic comfort of the teachers during the teaching lesson in the school environment. A total of 3 schools located in the urban area of Batu Pahat, Johor, which were Sekolah Menengah Kebangsaan (SMK), Tinggi Batu Pahat, SMK Tun Aminah and SMK Semerah were chosen as study areas. In the present study, questionnaires survey using Google Form were distributed to teachers working in the selected schools. Expert reviews and a pilot study were carried out before the actual survey. The results indicated that the noise factors were coming from inside and outside the classroom, mainly from traffic noise and heavy vehicles near the school environment and noise from student activities and chattering. Teachers need to raise their voice during the teaching and learning process, and some of them had a sore throat. SMK Tinggi Batu Pahat and SMK Tun Aminah teachers were uncomfortable with the existing acoustic comfort of the school environments.

Keywords: Urban noise, noise assessment, school, acoustic comfort

1. Introduction

Urbanization considers closely related to the environmental pollutions [1]. In urban areas, the dense population with the massive ground transportation networks has led to serious environmental noise. The main sources of unwanted noise coming from traffic, large construction machines, television, dog barking, large trucks, and industrial aircraft [2]. It is one of the most significant urban environmental issues that affect daily life and health of people [3]. The negative effects have various mental and physical health consequences for people, especially in schools, residential, commercial areas, and other buildings nearby.

In schools or institutions, noise can have a negative impact on students' concentration, learning ability, communication, and continuity with teachers [4]. Poor acoustic performance in the classroom causes reduction of speech intelligibility and affects the concentration, hearing ability and communication of the students [5]-[7]. Noise levels in classrooms have an impact on students' learning and teachers' well-being where it has been linked to stress and

anxiety among students and reduced their cognitive tasks [8], [9]. In the noisy classroom, a teacher's voice typically must be raised, which can cause stress and vocal fatigue [10]. Many teachers complain of tired voices, vocal strain, and health problems because have to speak at higher volumes than in quieter classrooms where they can speak at lower volumes while still being heard throughout the room [11]. For teachers, conducting lectures in noisy classrooms was challenging and ineffective, affecting their job performance and satisfaction [12]. In general, there are two types of noise sources in a classroom: external and internal. The common sources of external noise are normally associated with traffic and street noises [13], air crafts [14], railways [15], busy housing areas [16] and crowded places, whereas internal noise are typically connected with students' activities in the classroom which include chit-chat among students, group activities, handling different items, moving chairs and tables, and walking around in the classroom [11].

The Malaysian Department of Environment (DOE) has set the noise limit for different areas of noise reception to protect the population from traffic noise [17]. Based on the guideline, school is considered as noise sensitive receiver areas where the noise limit was set at 60 dBA. However, recent studies have found that noise levels outside some Batu Pahat schools have exceeded the allowed limit set by Malaysian DOE [18]. Based on the results from previous studies, it was found that the environments of their schools studied were considered noisy because the external noise levels exceed the noise limit set by DOE and the acoustic parameters such as background noises, reverberation times and sound reduction noises were not in the recommended values. However, the acoustic comfort of students and teachers cannot be ruled out on the basis of objective measurements. Therefore, the subjective evaluation is important because it can discover the perception or feelings of the teachers regarding the school acoustic comfort. Thus, in this study, the subjective evaluation of the impacts of acoustic comfort and urban noise on teachers was evaluated.

2. Methodology

In the present study, subjective evaluation of acoustic comfort of teachers was carried out during the teaching lesson in the school environment. The assessment was carried out by distributing questionnaires to teachers in 3 Batu Pahat schools. The factors and effects of urban noise in the school environments were also investigated in this study.

2.1 Case Study Locations

Batu Pahat (BP) is a district in the Malaysian state of Johor and it is one of the main cities in Johor, Malaysia besides Johor Bharu. It is located to the south-east of Muar a town connected to Kluang and Muar, Johor. A recent study on traffic noise assessment in the town of Batu Pahat [19], found that all measured areas exceeded 65 dB. A total of 3 schools located in Batu Pahat, Johor were selected for this case study, which were SMK Tinggi Batu Pahat, Batu Pahat, SMK Tun Aminah Batu Pahat, and SMK Semerah as shown in Fig. 1. SMK Tinggi Batu Pahat was selected because it is located at the main town of Batu Pahat which recorded traffic noise level exceeded the noise limit [19]. However, another two schools were chosen as they are located further away from the main town of Batu Pahat to evaluate whether the impacts of this urban noise will also affect the acoustic conform of the teachers of the schools.

2.2 Population and Sample Size

The population of teachers from 3 schools in Batu Pahat Johor which were SMK Tinggi Batu Pahat (58 persons), SMK Tun Aminah (53 persons) and SMK Semerah (52 persons). The average number of population size of the schools is 54 teachers. Therefore, based on Krejcie and Morgan, the total sample of this study should be at least 44 respondents [20]. The subjective survey was carried out in December 2021 using GoogleForm. Questionnaires were distributed to the teachers through WhatsApps application. The returned questionnaire from SMK Tinggi, SMK Tun Aminah and SMK Semerah was 47, 48 and 44 respectively.

2.3 Questionnaire Development

In this study, the factor of noises in the school environment that were included in the questionnaire were noises within the classroom, neighbour classroom, outside classroom, traffic, electrical appliances, and others (i.e., people at the street, the bells & alarm, construction works from outside the building). Meanwhile, the effects of noise on teachers included in the questions were headache, throat pain, stress, decrease in attention, tired voices, and other health problems [21]-[28]. The questionnaire consists of close-ended questions with 5 Likert scale as shown in Table 1 which adopted by Ivanov et al. [29]. The questionnaire was divided into 4 parts as follows:

- Part A: Demographic of the respondents - Multiple choices
- Part B: Factor of noise in school - Likert scale
- Part C: Effect of noise on teachers - Likert scale
- Part D: Acoustic comfort of the teacher during the teaching and learning process - Likert scale



Fig. 1 - Study locations with the coordinates

Table 1 - 5 Likert scale used in this study adopted by Ivanov et al. [30]

Scale	Feedback
1	Strongly Disagree
2	Disagree
3	Not Sure
4	Agree
5	Strongly Agree

2.4 Expert Review and Pilot Study

Expert reviews are a valuable method for uncovering usability issues, complementary to usability testing. They are often carried out by someone who is experienced in usability and principles of human behavior, and result in a list of usability problems and strengths, together with recommendations to fix those problems [30]. In this study, the validity of the designed questionnaire was evaluated by referring to three experts who have a lot of experience and knowledge in the field studied. Two of them were teachers who have been teaching for more than 5 years and another expert was a lecturer from higher institution who is experienced in questionnaire survey for more than 10 years.

For the pilot study, a total of 30 samples, students in years 2, 3 and 4 from Faculty of Technical and Vocational Education (FPTV), Universiti Tun Hussein Onn Malaysia, were randomly selected. Cronbach's Alpha coefficients using the Statistical Package for Social Science (SPSS) version 25.0 were used to determine the level of consistency of the measurements used and the reliability of the questionnaire instrument. Based on the results obtained from SPSS software, the Cronbach Alpha value for this study is 0.841. Thus, this indicates that the questions posed to the respondents are very good and effective with a high level of consistency.

3. Results and Discussions

The results of the questionnaire survey for Part B, C and D that using 5 Likert scale were analyzed using mean values which the interpretation as shown in Table 2.

Table 2 - Mean score scale and interpretation

Means Score	Interpretation
1.00 to 2.33	Low
2.34 to 3.66	Moderate
3.67 to 5.00	High

3.1 Demographic of respondents

Table 3 shows the background information of 139 teachers from three studied schools. Most of the participating teachers were female. Teachers from SMK Tinggi Batu Pahat mostly were aged more than 40 years old while teachers from SMK Tun Aminah and SMK Semerah mostly aged between 30 to 39 years old. From the survey, almost 80% of

the respondents have been teaching for more than 5 years. In overall, the majority teachers in all 3 schools had more than 10 years of teaching experience.

3.2 Factor of Noises

The noise factors in three studied school environments are shown in Fig. 2. From the results, it can be clearly seen that the sources of noise in SMK Tun Aminah mainly come from outside the classroom which included road traffic, heavy vehicles, vehicle horn, engines, exhaust, and tyres. As expected, this school is located next to the heavy traffic road of Jalan Kluang, hence the noise level from the traffic became the main source of noise pollution to this school. The noise pollution generated by traffic is vital because it may bring many negative impacts to the teachers and students nearby which this issue had become severe concern for adjacent schools in various Asian countries, including Vietnam, India, Malaysia, and China [31].

Table 3 - Background of respondents

	SMK Tinggi Batu Pahat		SMK Tun Aminah		SMK Semerah	
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Sex						
Male	18	38.3	17	35.4	19	43.2
Female	29	61.7	31	64.6	25	56.8
Age						
20 to 29	10	21.3	14	29.2	11	25
30 to 39	12	25.5	20	41.7	15	34.1
40 to 49	16	34	10	20.8	10	22.7
> 50	9	19.1	4	8.3	8	18.2
Teaching experience						
< 5	10	21.3	10	20.8	9	20.5
5 to 10	9	19.1	10	20.8	8	18.2
11 to 15	18	38.3	15	31.3	17	38.6
15 >	10	21.3	13	27.1	10	22.7
Total respondents	47		48		44	

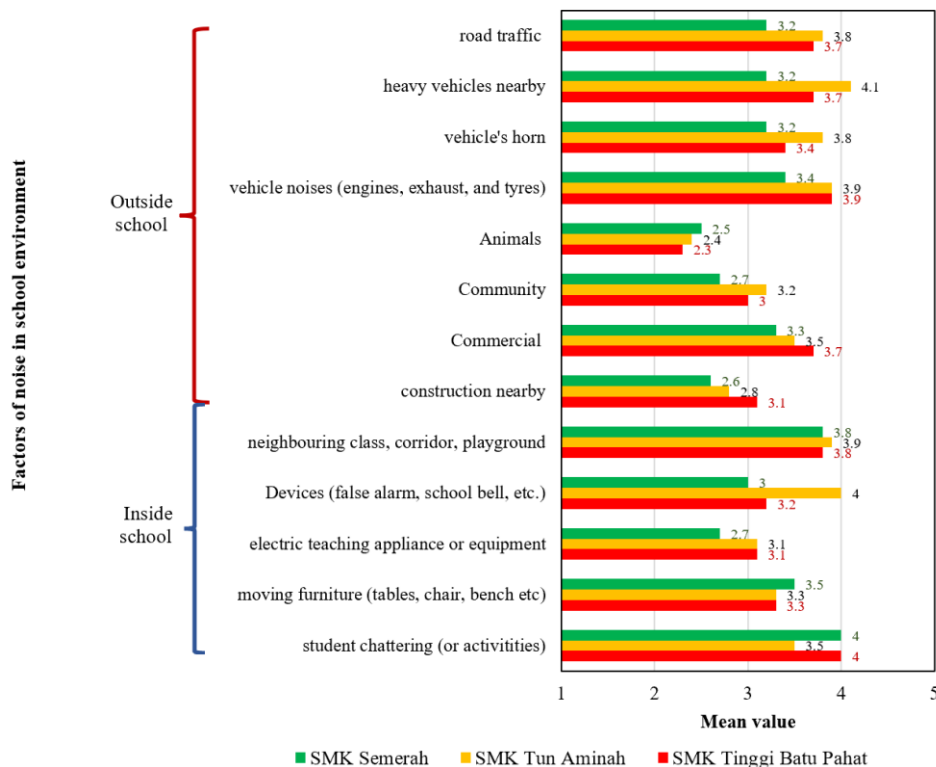


Fig. 2 - Factors of noise in studied school environments

The noise scenario in SMK Semerah was different, where the respondents agreed that the significant noise of the school environment came from inside the school itself (student chattering, neighboring class, corridor, and playground). For the teachers in SMK Tinggi Batu Pahat, they rated that the noises during the teaching and learning session were due to the noise from both outside and inside the school environment. Besides, the teachers in SMK Tinggi Batu Pahat also agreed that noise from nearby commercial areas and student activities in the classroom was the factor of noise in the classroom. This may be due to the fact that this school is located near the road, stadium and recreation park of Taman Rekreasi Tasik Y. Based on the previous study conducted near this recreation park, the noise level in that area recorded was more than 70 dBA [20]. In the present study, external noises from animals, community and construction nearby were not contributed to noise or annoyance to the teachers.

Respondents from all three studied schools agreed that noise from neighboring class, corridor, playground was the factor of noise during teaching session in the classroom with the mean value exceeding 3.60. It can also clearly be seen from the figure that the noise from students chattering themselves was significant noise created inside the school environment for SMK Semerah and SMK Tinggi Batu Pahat. Among the internal noises at school, noise from the electrical appliances such as projectors, computers, air-conditioner, and fans obtained the lowest mean value. This might be because most of the schools are using whiteboards or blackboards during the teaching and learning process. Besides, schools also use natural ventilation and mechanical fans which may not annoy teachers and students in the classrooms. Besides, noise from moving furniture such as tables, chairs, benches and others was not the significant factors of the noise in all studied schools. However, the noise from devices such as false alarms and school bells was contributed to the noise sources in SMK Tun Aminah.

3.3 Effects of Noise on Teachers

Fig. 3 shows the effects of noise in the school environment to the teachers. In general, teachers in SMK Semerah did not experience significant impacts due to the noise in their school environments. The teachers in SMK Tun Aminah experienced almost all the effects of noise that are listed in the questionnaire, except use other tools and are unmotivated. Most of the teachers in this school agreed that they experienced sore throat, stress, headache, fatigue, and lack of concentration when teaching in the classroom which were found the similar noise effects found in teachers from study of Dockerell & Shield [11].

Teachers from SMK Tinggi Batu Pahat and SMK Tun Aminah responded that they have to raise up their voice during teaching session, they have to warn or punish students who made noise, they have to walk around and repeat their speech in order to make sure students can hear their voice clearly. Besides, teachers from SMK Tinggi Batu Pahat also experienced headache, tiredness and cannot concentrate when teaching in the noisy environment. The urban noise nearby school environment probably increase the background noise in the classroom and thus the speech intelligibility will be decreased.

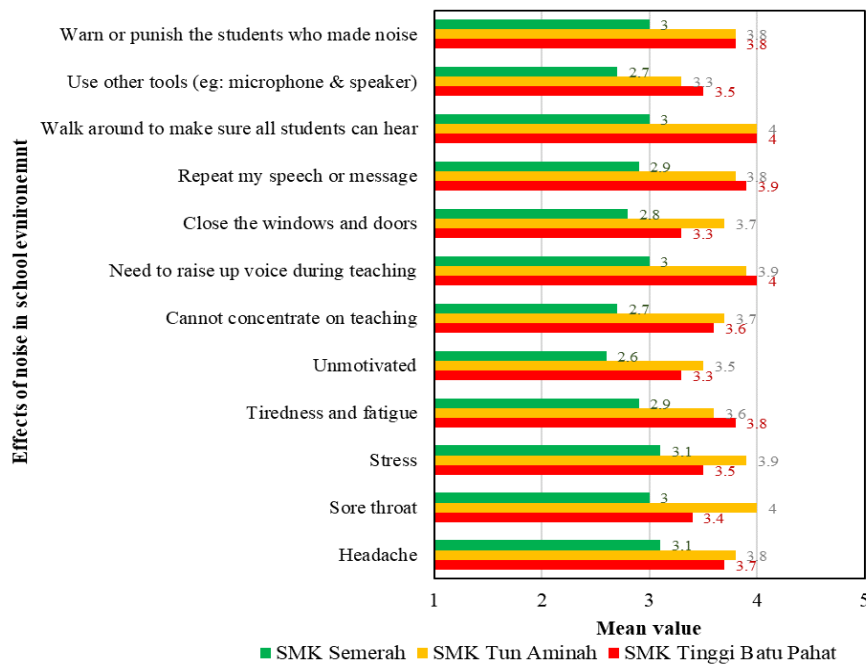


Fig. 3 - Effects of noise in studied school environments

3.4 Acoustic Comfort Evaluation

Fig. 4 shows the acoustic comfort evaluation of the teachers in the studied areas. It is clearly seen from the figure that the teachers in SMK Semerah were satisfied with the current acoustic condition of the school environment. However, the teachers from SMK Tinggi Batu Pahat and SMK Tun Aminah were barely satisfied with the acoustic comfort of the school environment. The teachers from these two schools sometime experienced mental health problems (stress, migraine, depression, and others), physical health problems such as sore throat, need to raise up their voice, felt annoyance few times in a month and felt unmotivated.

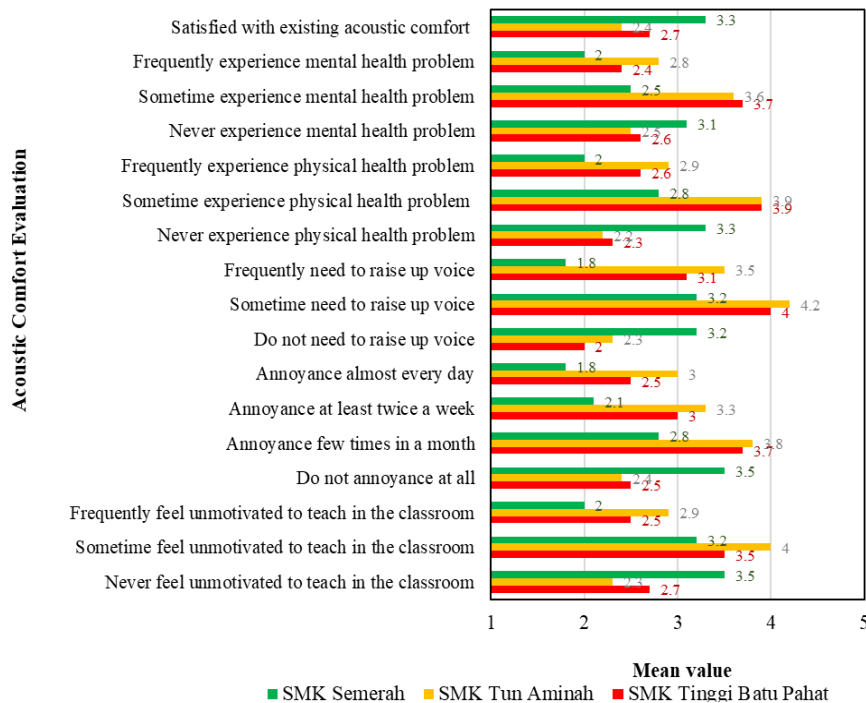


Fig. 4 - Acoustic comfort of teachers in school environments

4. Conclusion

In this study, a questionnaire survey has been carried out to identify the factor and effect of noise in the school environments and to evaluate the acoustic comfort of the teachers during the teaching lesson in the school environment. A total of 139 teachers from 3 public schools in Batu Pahat have been responded to current study. Based on the results of the study, teachers from the SMK Semerah responded that there was no significant noise source and impacts in their school environment during the teaching lesson. However, sources of noise in SMK Tinggi Batu Pahat and SMK Tun Aminah mainly come from outside the classroom. The teachers in SMK Tun Aminah and SMK Tinggi Batu Pahat experienced varies of effects due to this noise pollutions in their schools including sore throat because need to raise up their voice, stress, headache, fatigue, and lack of concentration when teaching in the classroom. From the survey, most of the teachers at SMK Tinggi Batu Pahat and SMK Tun Aminah were slightly not satisfied with the current acoustic condition of the school while the teachers at SMK Semerah were satisfied with the acoustic comfort of their school.

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