Effects to teaching environment of noise level in school classrooms

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This study determines noise level in school classrooms during school hours and identifies the effects of noise to teaching environment in classrooms using a Sound Level Meter (SLM) and a questionnaire survey on 44 teachers and 150 students. Data analyses, using t-test, one sample t-test and one-way ANOVA (Tukey’s HSD Post Hoc test), indicates that noise level in school classroom during school hours exceeded WHO guideline value. This noise affects teachers and students in terms of teaching and learning process and human health.

Keywords: Classroom noise, Decibels (dB), Sound level meter, Teaching environment

Introduction

Noise annoyance includes feelings of irritation, discomfort, distress, frustration, or offence when noise interferes with someone’s thoughts, feelings or ongoing activity¹. Road traffic noise² causes stress among students in school. Lundquist et al³ and Boman & Enmarker⁴ stated that pupils rated noisy activity (chatting) is one of the most annoying types of noise in school environment. In term of human health, intense noise or prolong stay in a noisy environment can also lead to a permanent reduction of hearing sensitivity, due to damage to sensory organs of inner ear, which may result in permanent hearing loss.

Effects of Noise

Noise is an unwanted sound⁵, which is a form of energy, transmitted through air and is measured in decibels (dB). Following 4 different aspects⁶ can make noise unacceptable in working environment: i) Noise can cause hearing loss; ii) Noise can affect performance and productivity; iii) Noise can be annoying; and iv) Noise can interfere with spoken communication. Similar to this, Schönflug⁷ highlighted effect of noise, which exists in school environment. School settings of indoor sound levels for different school activities show that moderate sound levels between 50-70 dB(A) Leq³ (equivalent sound level). Tesarz & Kjellberg⁸ observed that teachers perceived irrelevant speech and its interference with their work as the most serious noise problem. Boman & Enmarker⁴ highlighted that perception of annoyance was associated with stress symptoms for younger pupils in school environment. Schick et al⁹ analyzed acoustics of 16 classrooms and found that teachers (25%) felt annoyed by noise and children faced attention disorders.

According to World Health Organization (WHO) guideline value for schools, critical effects of noise in classrooms are on speech interference, disturbance of information extraction (comprehension and reading acquisition), message communication and annoyance. In order to be able to hear and understand spoken messages in classrooms, background sound pressure level should not exceed 35 dB L_Aeq (maximum permissible sound level) during teaching sessions. Average daily exposure¹⁰ for a child at school is 72 dB(A) L_Aeq. In Malaysia, L_Aeq near the school area during daytime is 50 dBA.

This study determines noise level in school classrooms during school hours, and identifies the effects of noise to teaching environment in classrooms.

Methodology

Noise monitoring in classrooms was carried out using Sound Level Meter (SLM) and a questionnaire on
teachers (44) and students (150) at Jelai (F) Gemas National Secondary School, Negeri Sembilan, Malaysia. Five classrooms in Block B & C of school were chosen randomly and noise level was measured using SLM (Fig. 1). Data was collected from 7.30 am until 1.30 pm (3 measurements, each of 20 min) for 1 month. Questionnaire was adopted from Stacie Reck-Ward and Amanda Murray questionnaire from Faculty of education, University of Alberta and Sturgeon Heights School. By comparing means of responses, respondent’s perceptions on the effect of noise on learning activities were obtained.

Using t-test, one sample t-test and one-way ANOVA (Tukey’s HSD Post Hoc Test), data was analyzed on teachers and students, both male and female of different age groups.

Results and Discussion

Noise Level Measurement using Sound Level Meter (SLM)

Noise measurement in Block B and Block C were taken as maximum sound level (L_{max}), minimum sound level (L_{min}) and equivalent sound level (Leq) (Table 1). The t-test shows that there are no significant differences on noise level between Block B and Block C. Mean noise level in Block B and Block C was: L_{max}, 88.14-95.18 dBA; and L_{min}, 43.44-54.62 dBA. Higher-level noise in Block B can be related because Block B is located near road sides with high volume flow of transport. One sample t-test (Table 2) indicated that mean noise level in each block exceeded WHO guideline value (35 dBA), suggesting that school under study is not in a conducive environment for teaching and learning purpose. This result is similar with the report of Department of Environment (DOE), Malaysia.

Effects of Noise to Teaching Environment Using Questionnaire

Teachers

As per result of teachers’ questionnaire, reliability value (0.825) is acceptable for this study purpose. The t-test showed that teachers were disturbed by noise level (Fig. 2).
Teachers Health

The t-test showed that male and female teachers were both affected by noise level with the mean value of 2.2 and 2.1 respectively. But in term of “stress or headache”, female teachers scored (2.0) more compared to male teachers (1.5), indicating that female teachers health is more affected compared to male teachers. Psychological stress contributes to voice problems among teachers. Numerous stress factors that have been linked to teachers work include disrespectful behavior of pupils and noise in classrooms caused by misbehaving pupils.

Table 2 — One sample t-test with test value 35 dBA

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>Mean difference</th>
<th>95% Confidence interval of difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Block B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L_\text{eq} &amp; 7.30 am</td>
<td>30.749</td>
<td>34.48000</td>
<td>31.3667</td>
</tr>
<tr>
<td>L_\text{eq} &amp; 10.30 am</td>
<td>41.719</td>
<td>38.72000</td>
<td>36.1431</td>
</tr>
<tr>
<td>L_\text{eq} &amp; 12.30 pm</td>
<td>15.691</td>
<td>37.00000</td>
<td>30.4532</td>
</tr>
<tr>
<td>Block C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L_\text{eq} &amp; 7.30 am</td>
<td>13.127</td>
<td>38.74000</td>
<td>30.5461</td>
</tr>
<tr>
<td>L_\text{eq} &amp; 10.30 am</td>
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<td>39.68000</td>
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</tr>
<tr>
<td>L_\text{eq} &amp; 12.30 pm</td>
<td>15.457</td>
<td>37.60000</td>
<td>30.8463</td>
</tr>
</tbody>
</table>

Several studies show that teachers report that their voice problems have a negative effect on their performance at work.

Noise and Teacher’s Mood

The t-test showed that both male and female teachers’ internal motivation to have a pleasant teaching process was affected when the noise level increased. Factors such as pupils’ disrespectful behavior and noisy classes also contribute to stress reactions among teachers. As this disrupts teaching, student misbehavior has been found to be a significant variable for predicting and causing...
teaching stress\textsuperscript{16,18} and a cause for burnout among teachers\textsuperscript{17}. Compared to male teachers, female teachers’ score of t-test was higher, and hence female teachers had more difficulty in concentrating in noise level environment. Jones & Davies\textsuperscript{22} found that females rated annoyance higher than males did, but they found no gender differences in hearing status and noise sensitivity.

iii) Noise Effect on Teaching Process

In t-test on noise effect on teaching process, female teachers’ score was higher than male teachers, indicating that female teachers have to raise their voice during noisy environment, and this indirectly affect flow of teaching and learning process. Teachers have to speak loud because of background noise and poor acoustic conditions in the classrooms.

v) Teachers Attitude Toward Classroom Noise

A higher significant value for female teachers compared with male teachers showed that female teachers were more likely to react during noisy classroom compared to male teachers. This result can also be related to higher score of female teachers in “raised your voice or shouted to be heard in classroom”, “become more angry and sensitive” and “speak less and give more assignment to students” in the questionnaire. This indicated that female teachers need a more pleasant environment for teaching purposes.

Score value for the age group of 20-30 y, 31-40 y and 41-50 y are 2.20, 2.18 and 2.02 respectively. One-way ANOVA (Tukey’s HSD Post Hoc test) showed that teachers in age group of 20-30 y were highest group affected by classroom noise (Fig. 3), may be because such teachers have less experience in teaching. Among main question items that have identified with high score by this group age were “noise has harmful effects on physical, emotional or mental health, noise makes you irritable, makes you anxious, makes you sad and noise interfering on conversation in classroom”. Second highest group of age (31-40 y) stated that “they feel stress, mental or emotional health disturbed after teaching a noisy classroom” as their main item which affected them the most. This group normally involved senior teachers; therefore, they expect the teaching environment to be in a conducive mode.

Less affected group of age (41-50 y) stated that “facing hearing problem” and “voice related illness increased as the size of the class has increased”. The reason for this problem can be related to the age factor and human body stability as the age increase. Old teachers (41-50 y) compared to young teachers (21-30 y) demonstrate a higher impaired ability to interpret difficult and spoken messages with low linguistic redundancy. The Tukey’s HSD Post Hoc Test also highlighted that the noise effects on teachers decreases as the age increases, may be due to maturity and experience of teachers.

Students

The t-test on students’ showed that female students were more affected than male students (Fig. 4). Students’ from lower forms (13-15 y) are more affected (Fig. 5) in all aspects compared to students from upper forms (16-17 y). The age group 13-15 y is significantly different from age group 16-17 y. Studies verified that poor classroom acoustics might also have a negative effect on disciplinary issues, as it might have an impact on the pupils’ concentration and thus raise noise levels\textsuperscript{23}. 

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Fig_3.png}
\caption{Fig. 3 — Teachers mean perception score according to age group}
\end{figure}
i) Student’s Health and Classroom Noise

Based on t-test, female students have a higher significant value in aspects “they could hear their teachers’ voice clearly during normal teaching and learning process and during group activities”. This can be related to the findings by Bland. The study stated that female hears better than male, and female are twice as sensitive to noise as male. Male students’ score significantly higher in aspects, “emotionally and mentally disturbed” and “they stated that their classroom is very noisy”. The t-test indicates higher significant values for young students’ (13-15 y), who cannot cope up with external disturbance during learning process.

ii) Noise and Student’s Mood

Female students stated that they felt irritable and depressed due to noise level in classroom. The t-test also highlighted that young group (13-15 y) have a higher significant mean score value in the item of “feel irritable, depressed and sad” due to noise level.

iii) Student’s Noise Annoyance

The t-test on female students noise annoyance has highlighted that there are higher significant mean score value in the item of “noisy sport activity in the school field” with mean value of 1.64. Female students stated that sports activities in their school field were very noisy and affect teaching and learning environment in classroom. Young group (13-15 y) has shown higher significant value in the item of “next door classroom are very noisy and overall noise level in the school” respectively, as confirmed by Boman & Enmarker.

iv) Noise Effect on Teaching Process

The t-test result highlighted that the female student’s have to sit near to their teacher so that they can hear
properly. They also have the opinion that noise affects their teachers’ lesson delivery in the classroom. Young group (13-15 y) has stated that noise always disrupt their concentration on learning process, and also lesson delivery in classroom. This can be related to students, who are still new to secondary school environment compared to senior group (16-17 y), who have experienced noise in school classroom.

v) Teachers Attitude Toward Classroom Noise

The t-test shows that most of female students have the opinion that, their teachers are reacting badly toward classroom noise. Students stated that their teachers have to raise their voice or shout in order to be heard by them, and also ask next-door classroom students to be quite during lesson. According to earlier studies, teachers perceived irrelevant speech and its interference with their work as the most serious noise problem. Hence, based on study findings on teachers and students noise questionnaire, healthy teaching environments are disturbed because of noise level produced in school classrooms.

Conclusions

Noise level in school classrooms during school hours exceeded WHO guideline value. Both male and female teachers are disturbed by noise level. Female students are more affected than male students. Noise effects on teachers increases as age increases. Very noisy classrooms would create difficulty for children to hear and understand their lessons. To improve school teaching environment, higher school authority should take into consideration in term of school design in order to reduce undesirable background noise. Sound barriers have to be build to avoid excessive road traffic noise along the road adjacent to school classrooms.

References