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The effects of traffic noise on English learning of Chinese university students

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ABSTRACT

The acoustic environment quality is an important factor that influences the quality of the school education. English-immersed teaching mode is becoming an important direction of education reform in China. The effects of classroom acoustic quality on students' learning under English-immersed teaching mode have attracted great attention in these years. Traffic noise is one of the common noise sources in university campus, which has a great impact on students' learning efficiency. The effects of traffic noise on students' learning efficiency and subjective perception in non-native language environment may be different from the traditional native-speaking environment. This is because listening comprehension in English environment is a complicated psychological and physiological process for the students who use English as a second language. However, researches on the impacts of traffic noise on Chinese students in English language environment are still very limited. In this paper, the influences of traffic noise levels on listening efficiency of university students in English-immersed model have been investigated. Experimental tests are carried out in a typical classroom in Huaqiao University, China, to investigate the English listening efficiency of Native Chinese students without hearing problem in acoustical conditions varying different traffic noise levels. The results of this research could provide a reference for the design and renovation of Chinese university classrooms, especially for English-immersed model classes.

Keywords: Traffic noise; Noise level; Classroom acoustics; English Listening; Second language

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1. INTRODUCTION

The acoustic environment quality of classroom is a major factor that influences a variety of learning activities[1, 2]. The detrimental effects of noise on students' performance (such as comprehension, memory and attention) in the classroom have been widely investigated recently[3, 4]. Patrik et al.[5] have reported that students' prose memory is significantly interferenced by aircraft noise and meaningful background speech noise through experimental tests. Prodi et al.[6, 7] explored the effects of three kinds of typical noise (activity, tapping and traffic noise) on students' listening efficiency, mainly obtained by intelligibility scores, response time and their ratios, with the results impling that different types of noise have significantly different impact on students' performance.

Most researches show that traffic noise is the predominant external noise source on campus[8, 9]. Astolfi et al.[10] pointed out that traffic noise was the most interference noise, as its speech intelligibility score was lower than all the other type of noise (babble, fan-coil, and impact noise). Madouly et al.[11] established a classroom acoustics assessment model based on the analytical hierarchy process(AHP), which implied that traffic noise from external noise sources is the main criteria that affects learning quality. Meanwhile, with the acceleration of urbanization process, the prevention and control of traffic noise on campus are getting more and more prominent.

Under the tide of globalization, multilingual and multicultural communication in public have shown a strong and growing trend, and the polulation of non-naitve speakers in the university has risen sharply throughout the word[12]. Many studies have shown repeatedly that students have new requirements for the quality of classroom acoustic environment when they study in non-native language environment[13, 14]. Galbrun et al.[15] conducted experiments in four room acoustic conditions (STI = 0.2, 0.4, 0.6, 0.8) to compare speech intelligibility scores among English, Polish, Arabic and Mandarian. Which revealed that the perceived speech intelligibility of different languages under the same STI environment (except STI = 0.8) differed between each other, and the speech intelligibility score of English was the highest under all conditions. Qin et al.[16] found that the optimal English speech level for the speech intelligibility of Chinese students was 71 dB(A) when reverberation time(RT) and signal to noise ratio(SNR) kept constant. Mendel et al.[17] and Dorothy et al.[18] demonstrated that non-native listeners required more favorable SNRs in speech recognition than native speakers. In addition, Alice et al.[19] Comprehensively assessed the different performance between the native and non-native participants with varying conditions. The results show that although the two groups have similar intelligibility scores, the non-native participants' reaction time is significantly higher than the native.

Several studies in the existing literature have demonstrated that acceptable listening conditions for speech recognition are insufficient for students to mental process, memorize the spoken message[20]. However, there is a lack of research on the influence of noise levels on students' learning performance in non-native language environment. Hurtig et al.[21] tested 72 swedish speaking children's recall of words in English and Swedish under two SNRs, which found that children performed worse in the non-native language environment than native environment. Ellen et al. [22] surveyed the English speech comprehension of 56 native listeners and 58 non-native listeners by changing noise levels. The results show native speakers' speech comprehension performance decreases significantly when noise level exceeds 50 dB(A), compare to a lower noise level of 40 dB(A) for non-native speakers.

Overall, further careful studies specifically for non-native speakers are still needed. This paper is aimed to survey the influence of traffic noise levels on Chinese students' subjective performance in non-native environment through experimental tests.

2. EXPERIMENTAL DESIGN

2.1 Classroom

Experimental tests were carried out in a typical classroom in Huaqiao University with a reverberation time of 1.12s. The listening comprehension tests were selected from College English test Band 4(CET-4). English listening materials are played back by a loudspeaker. The sound source was positioned in the front of the classroom at 1.5m above the floor where representing the position of the teacher, as shown in Fig 1.

Traffic noise was recorded in advance and played back by loudspeakers locating on the left side of the classroom at equal distances to simulate the linear source of traffic noise. The mean traffic noise level at the listening positions was set to be 40 dB(A), 50 dB(A) and 60 dB(A) respectively.

2.2 Participants

A total of 21 students from Huaqiao University, china, with English as a second language took part in the experiment. All participants reported normal hearing. One participant was excluded for personal problems, leaving 14 women and 6 men for the statistical analysis. The participants were distributed in the middle of the classroom (see Fig 2). The participants completed the English listening test under 3 acoustic conditions in a random order and filled a subjective questionnaire at the end of each condition. A 10-min break was given after each acoustic condition over. The questionnaire was carried to assess disturbance degree of traffic noise, which taken the form of 7-point Likert scale.

Fig.1 Layout of the sound source

Fig.2 Seat distribution of participants

3. RESULTS

Fig.3 shows the participants' mean disturbance ratings with traffic noise level range from 40 dB(A) to 60 dB(A) are 1.50, 3.60, and 6.05, respectively. The disturbance degree increases with the rise of traffic noise level, as shown in Fig 3.

Friedman test is utilized to reveal that there are statistically significant differences in students' subjective perception among 3 conditions (P-value<0.01), as shown in Table 1.

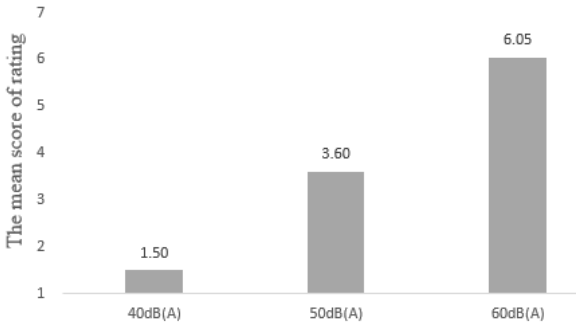

Fig 3. The mean score of disturbance rating（through 1=not disturbing to 7=very disturbing）

Table 1. Friedman tests of disturbance between different conditions of traffic noise levels

Mean rank			Chi-square	Df	P-value
40dB(A)	50dB(A)	60dB(A)			
1.08	2.00	2.93	36.026	2	0.000

4. CONCLUSIONS

This paper is aimed to study the effects of different traffic noise levels on Chinese university students' listening efficiency in a non-native environment. It confirms that traffic noise has a significant disturbance on students, and this negative impact becomes stronger with the increase of traffic noise levels.

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