

## The Effect of Transportation Noise on Retrieval of Information from Short Term Memory

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**Abstract:** Transportation noise is a prominent cause of interrupting the attention of students. Exposure to transportation noise can impair students' ability to retrieve the information from short term memory. Therefore, study aimed at to find out the effect of exposure to transportation noise on short term memory of students. Noise resulted from road traffic is measured by Sound Level Meter (SLM) and created three different conditions according to dB units. A sample of 120 school students aged 13 to 16 years participated in a field experiment study. The short term memory of participated students is measured through recall of trigram experiment based on Brown Peterson and Peterson technique. It was hypothesized that different outcomes of capacities of short term memory will be yielded into three conditions of transportation noise. Analysis of variance and Bonferroni's post hoc multiple comparison using revealed supportive results for research hypothesis. The capacity of STM was varied with three conditions of noise. Findings indicate that a constant transportation noise severely impairs the capacity of short term memory of school students. Schools located in high level of transportation noise zone are not beneficial educational environments.

**Keywords:** Transportation Noise, Retrieval of Information and Short Term Memory

### I. INTRODUCTION

The roads are blood vessels of modern life and transportation is consistently going on it. An immense number of heavily laden Lorries, motor cars, two wheelers and travel buses are constantly travel through our cities which have been created shrill sound. Though it has been brought a lot of advantages but it cannot avoid its disadvantages. Noise from transportation is prominently increasing in day to day life. There is increasing attention to the effects of noise on cognitive functioning such as recall and recognition, visual attention, short term memory, problem solving and reasoning. The effect of noise on pupil performance is researched and established by worldwide scientist. However, the effect of noise on the ability to retrieve the information from short term memory has researched by less number of scholars. Noise includes any sound, often loud, harsh or confused in nature; noise is also considered a disturbance or, "nonharmonious and discordant sound" that may interfere with one's daily activities or peace of mind (Rose, A., 2011). The importance of short-term memory in acquisition of information on the one hand and its sensitivity to noise-induced disruption on the other hand lead to design the study to investigate the influence of continuous exposure to noise on retrieval of information process. Transportation and other type of noise exposure directly and indirectly cause a number of functions such as cognitive, emotional and physical. Students are more vulnerable to the effects of all kinds of noise. They have less cognitive capacity to understand the syllabus and store it into long term memory in noisy conditions (Stansfeld, S.A. Haines and Brown, 2000; Stansfeld et. al., 2005). The students may not be susceptible to noise effects on cognitive performance (Boman, Enmarker and Hygge, 2005; Johnson, C., 2000; Talarico, M. et. al., 2007). Moreover, students exposed to noise at school experiencing some loss of information compared with students not exposed to noise (Haines et. al., 2001a & 2001b). Studies of school students denoted that students

exposed to noise suffer consistent damaging effects on cognitive performance. These include an inability to focus, process of information, visual attention and poorer memory retention were also common findings in many studies (Miedema, H. 2001; Schulz, T.J. 1978). From a RANCH study conducted in UK, Netherland and Spain it is cited that road traffic noise and recognition memory, episodic memory has a negative linear relationship (Stansfield et. al., 2005). The loss of information from short term memory is a result of diversion of attention. The RANCH study suggests that noise may directly affect attention of students (Cohen et. al., 1973; Evanse and Lepore, 1993). Retrieval of information from memory depends on how we pay our attention towards stimuli to store it which could be distorted by noise. Noise can have a great effect on the degree to which information is processed, retained, and recalled (Cohen, S., et. al. 1986). When attention to information is divided, encoding became weaker and later attempts to retrieve are likely to impair. Hence, investigator set up the field experiment to investigate the relationship between exposure to transportation noise and cognitive functions. The present study postulated that exposure to these types of noise would be influenced to the process of retrieval of information from short term memory of school students.

### II. METHOD

#### 2.1 Sample and procedure

The sample for this study was drawn from various schools of Sangli district. Altogether 120 students, 60 males and 60 females, participated in the study. They were in the 8th to 10th class of secondary school and their age was between 13 to 15 years. The schools have been selected on the basis of level of exposure of transportation noise and classified into three conditions of road traffic noise exposure viz. below 25dB, 30 to 75 dB and above 80dB and afterwards randomly selected

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three schools within an every cell so as to examine the effects of transportation noise within these conditions on retrieval of information from short term memory. The data were collected by conducting recall of trigram experiment based on Brown Peterson and Peterson technique. In each school, 10 students were randomly called for an experiment. Subjects were presented trigrams –meaningless three consonant syllabus (e.g. AVM) for a 100 MS and asked to retrieve it after counting backwards in threes from a random numbers with intervals of 3, 6, 9, 12, 15 and 18 seconds. According to measure the noise intensities in classrooms during the experimentation the Sound Level Meter was hold at ear height level and transportation noise intensity is recorded.

## 2.2 Measures

### 2.2.1 Sound Level Meter (SLM)

According to measure the noise level in schools, the Sound Level Meter was used to record the intensity of noise while experimentation. Sound pressure level is assessed in dB (A) units as independent variable.

### 2.2.2 Short Term Memory Experiment

Ample researches on memory are based on experiments conducted in laboratory conditions. Instead of it, in present research the field experiment method has been employed. To measure the short term memory, an experiment based on Brown Peterson and Peterson's experimental design has conducted in which subject have to recall the trigrams after intervals of 3, 6, 9, 12, 15 and 18 seconds. During the interval to prevent rehearsal subjects were asked to count backwards in threes from three digit random numbers.

## III. RESULTS

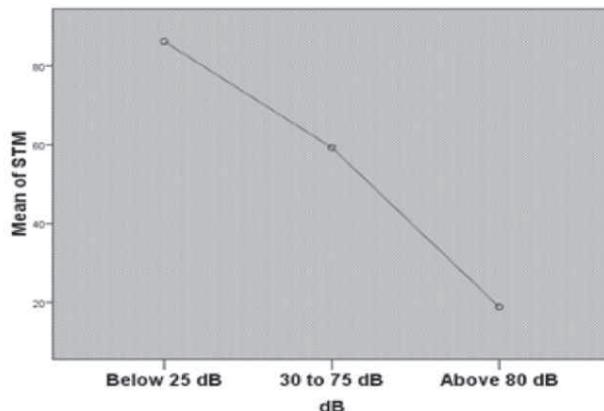
To test the effect of transportation noise on retrieval of information from short term memory one-way ANOVA and Bonferroni's post hoc multiple comparison is performed. **Table 1** show that F value is significant ( $F_{2,117} = 117.09$ ,  $p < .00$ ) and explains the variation in an amount of retrieval of information for school students in three different conditions. The Bonferroni's post hoc section in **Table 1** show that students studying in schools located at busy transportation zone (above 80 dB) have very less mean score of STM than students studying at silent zone (below 25 dB). The mean difference for this pair is significant (67.27,  $p < .00$ ). The significant mean difference of STM also yielded between students studying in school at 30 to 75 dB and below 25 dB zones (26.90,  $P < .00$ ). Moreover, students studying in schools located at 30 to 75 dB zones are varied from schools located at above 80 dB zones about an amount of retrieval of information from STM. These findings are consistent with research conducted by (Klatte, M.; Meis, M. & Lachmann, T., 2010). In a study of 262 third and fourth grade students (142 from noise schools and 120 from quiet schools) living in Los Angeles a negative relationship was found between the noise and cognitive functioning (Cohen, S. et al., 1980).

**Table 1:** Summary of one-way ANOVA and Bonferroni's post hoc multiple comparison of retrieval of information from short term memory.

Sources of Variance	Sum of Squares	df	Mean Squares	F	Significance
Between Groups	91729.017	2	45864.508	117.096	.000
Within Groups	45826.975	117	391.684		
Total	137555.992	119			
<b>Post Hoc Section (Bonferroni)</b>					
	N	Mean	Mean Difference		Significance
Above 80 dB	40	18.88	(1)-(2) 40.37		0.00
30 to 75 dB	40	59.25	(2)-(3) 26.90		0.00
Below 25 dB	40	86.15	(3)-(1) 67.27		0.00
Total	120				

Mean scores in an amount of retrieval of information from short-term memory with respect to three conditions of noise are depicted in Fig 1. Compared with the STM in the above 80 dB noise condition, higher percentage of STM were obtained under the 30 to 75 dB noise and particularly under the below 25 dB noise condition. Significant difference between three noise conditions (below 25 dB, 30 to 75 dB, above 80 dB) could see in figure 1. In the condition of highest frequency noise students got lowest percentage of STM while in the situation of low frequency noise obtained highest. Findings confirmed that the students' ability of retrieval of information from short term memory is disturbed due to excessive level of noise.

**Figure 1. Percentage of STM in Three Conditions of Noise**



**Figure 1:** Percentage of STM in three conditions of noise.

## IV. DISCUSSION

A range of studies on the relationship between noise and the cognitive performance of students have been undertaken. This field experiment study found cause and effect relationship between noise and loss of information from short term memory. In today's era new technology brought different types of vehicles to save our valuable time but on the contrary it carried remarkable disadvantages. Several studies have tested the relative importance of noise free environment for our well-being. This study adds evidence to the importance of noise free environment for schools students. Researcher found evidence that intense noise disturb

the ability to retrieve the information from short term storage. Students cannot hear clearly what the teacher is saying or concentrate continuously on the lectures due to the high level of noise. Noise often results in a restriction in one's breadth of attention (**Broadbent, 1971; Hockey, 1970**). The adverse effects of road traffic noise on student's memory are found in study of (**Ma Hui and Gong Shengnan, 2013; Stansfeld, S. et. al., 2005; Hygge, S., Evans, G. & Bullinger, M., 2002**). Evidences in ample studies for an effect of noise not only on short term memory but on long term memory also found. The finding of RANCH study, suggest that high exposure was associated with deficits in long term memory (**Clark Charlotte, 2009; Matheson, M. et. al., 2010**). Noise exposure is consistently correlated with reading deficits and may interfere with speech perception and long-term memory in primary-school children (**Evans & Lepore, 1993**). This result differs from a previous where the effect of noise with its different levels on memory did not assess. In the low frequency noise students might be normally performed but as it increases students cognitive abilities strongly get affected. Thus, the present result refers to the importance of noise free environment in school settings.

## V. CONCLUSION

Through the conducted field experiment on short term memory under different noise conditions the evidence for the importance of noise free environment for school students is provided. Current findings indicating the negative effects of transportation noise on retrieval process. Student's capacity of short term memory is decreased with the increasing of noise level under the conditions of transportation noise. It is seen that students' short term memory not influenced under the condition of 25 dB. However, under the above 30 dB transportation noise condition especially above 80 dB it is severely affected. Therefore, it is concluded that transportation noise play a negative role in the process of short term memory. Hence, Schools located in high level of transportation noise zone are not beneficial educational environments.

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