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The Effect of Noise in Educational Institutions on Learning and Academic Achievement of Elementary Students in Ahvaz, South-West of Iran

*Abdolreza Gilavand[1], Amir Jamshidnezhad [2]

[1]Employed Expert on Faculty Appointments at Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
[2]Assistant Professor, Department of Health Information Technology, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

Abstract

Background
The learning environment dramatically affects the learning outcomes of students. Noise, inappropriate temperature, insufficient light, overcrowded classes, misplaced boards and inappropriate classroom layout all make up factors that could be confounding variables distracting students in class. This study was conducted to examine the effect of noise in educational institutions on the academic achievement of elementary school students in the academic year 2015-2016 in Ahvaz.

Materials and Methods
This study is applied and it is survey in terms of the nature of study. The population of the study included all male elementary school students in Ahvaz, of whom 210 students were selected randomly as the sample of the study. Cluster sampling was done by appropriate allocation. Questionnaires were randomly distributed among students. Data collection tools included Hermance's achievement motivation questionnaire and the researcher-constructed questionnaire (observation checklist to examine the physical parameters of noise in educational institutions) and interviews with students. Validity of questionnaires was confirmed by content and construct validity, and the reliability of study was confirmed by Cronbach's alpha. The data of the study were analyzed using descriptive statistics (frequency, percentage, mean, standard deviation) and inferential statistics (factor analysis, t-test, Kolmogorov - Smirnov test and one-way ANOVA analysis) in SPSS-21.

Results
The results showed that noise in educational institutions has a negative impact on learning and academic achievement of elementary school students in Ahvaz ($P<0.05$).

Conclusion
Educational managers are recommended to reduce or remove the educational environment noises.

***Key Words*:** Academic achievement, Educational institutions, Noise, Students.

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Corresponding Author:

Abdolreza Gilavand , Employed Expert on Faculty Appointments at Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

Email: gilavanda@gmail.com

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1- INTRODUCTION

All experts of education and educational psychology of teaching and learning agree that effective education depends on having a goal, the appropriateness of the physical and social environment of class, motivation of teachers and students for teaching and learning, the students' cognitive, emotional and motor preparation, sound management of class by teachers, their mastery over the subject, and their passion for their work and the students' progress. The teacher try to create a perfect environment for learning to learn prevent the formation of behavior and nuisance factors (1). The learning environment dramatically affects the learning outcomes of students. Noise, inappropriate temperature, insufficient light, overcrowded classes, misplaced boards and inappropriate classroom layout make up factors that could be confounding variables distracting students in class (2).

Noise refers to sounds that hinder an individual's ability to listen to what they want or need to hear (3). Classroom background noise can arise from several possible sources, including external noise (such as traffic noise), internal noise (students running in corridors), and room noise, such as students talking (4). Studies have shown that noise has direct negative effects on student learning, with language and reading development particularly affected (1, 5-8). There are also, problems related to attention, memory and motivation (9). In order to compensate for the noise level in classrooms, teachers often have to speak loudly while teaching. Such a speaking habit is known to be a risk factor that may lead to voice disorders in teachers (10). It is crucial to address the background noise in classrooms so that both students and teachers may learn and work in a healthy environment. In Ahvaz metropolitan, high-density, the lack of empty spaces, poor communication network and, the most importantly, ill-conceived planning, have all led to the development of educational spaces regardless of location, proximity, spread and compatibility principles and criteria. In addition to the failure to comply with the principle of equal and fair access of student population to educational spaces, this problem reduces the students' comfort, efficiency, and health and safety on one hand, and creates numerous problems for students, teachers and citizens on the other. In the latest study assessing the location of training centers in Ahwaz using Boolean logic, it was shown that 63% of junior high schools of Ahvaz were in the wrong location in terms of location criteria. Also, among different educational districts of Ahvaz, Education District 2 and District 3, were respectively the most and the least favorable educational centers in terms of their optimization of their locations (11). In Iran, in the area of comparing the current situation of educational environment with international standards as well as on the impact of physical factors on the educational achievement of students in schools, several studies have been conducted. Some of these studies include Karen et al. (12), Karami et al. (13), Moeinpour et al. (14), Chiang et al. (15), Mills (16), DiSarno et al. (17), Zannin et al. (18-21), Kruger et al. (22), Lewinski et al. (23), Dockrell et al. (24), and Wagemans et al. (25).

Education is the infrastructure of any social, economic, political, and cultural development in any society. Examining the factors affecting the development and progress of modern societies shows that all these countries have qualified education. Also in each educational system, many factors act together to ensure the academic achievement of students. Every part of the system should be prepared in such a way that access to optimal efficiency and targets be achieved, because if one part of the system stops, the performance of other components can be reduced and damaged.

By considering and analyzing inputs such as physical variables, planning can be made more consciously. In addition to physical factors, there are other variables that affect learning and academic achievement, and by doing research in this regard, we can detect their effects. When education systems do not have the necessary information in such basic fields, correct performance cannot be expected in various fields of education. On the other hand, in applied areas, understanding environmental factors affecting the educational process and considering them in planning increases mental health of students and reduces their stress, resulting in enhanced educational performance. The aim of this study was to examine the effect of noise in educational institutions on the academic achievement of elementary school students in academic year 2015-2016 in Ahvaz, Iran.

2-MATERIALS AND METHODS

2-1. Study design and population

At a cross-sectional study (2015-2016), the population of the study included all male elementary school students in Ahvaz, (South-west of Iran), of whom 210 students were selected randomly as the sample of the study. Questionnaires were randomly distributed among students. Data collection tools included: Hermance's achievement motivation questionnaire and the researcher-constructed questionnaire (observation check-list to examine the physical parameters of noise in educational institutions) and interviews with students. Validity of questionnaires was confirmed by content and construct validity, and the research reliability was confirmed by Cronbach's alpha. Cronbach's alpha co-efficient and retest method were established for reliability of questionnaire with the rate of 84% and 74%, respectively (21).

The data of the study were analyzed using descriptive statistics (frequency, percentage, mean, standard deviation) and inferential statistics (factor analysis, t-test, Kolmogorov - Smirnov test and one-way ANOVA analysis) in SPSS-21. In this research, the sample data were selected from the different educational areas including educational area no. 1: 50 students, no. 2: 41 students, no.3: 59 students and no. 4: 60 students.

2-2. Ethical Considerations

The ethical considerations necessary to satisfy the respondents were observed and they were ensured that their views will be kept confidential.

2-4. Measuring tools

2-4-1. Construction questionnaire

Observation checklist to examine physical variables of coloring the learning environment: due to there is no standard questionnaire related to subject of study, after interviews with a number of teachers and experts, to equip and modernize schools and collect their views and taking into account the scientific principles, a questionnaire was developed. Then, by conducting pre-test (among 30 students), reliability and validity of questionnaire was calculated. Their validity was confirmed by content and construct validity was confirmed by a number of experts and their reliability was calculated and confirmed by Cronbach's alpha (87%).

2-3-2. Academic Achievement Motivation Questionnaire of Hermance (21)

It is one of the most common paper and pencil questionnaire to assess the need for achievement. Hermance (1977) constructed this questionnaire based on experimental and theoretical knowledge about the need for achievement and studying the related literature related. The initial questionnaire included 29 questions developed based on ten characteristics that distinguish people who have high

achievement motivation with those who have low achievement motivation. To prepare materials of questionnaires, Hermance considered ten characteristics of people as based in selecting questions:

- High level of desire;
- Strong motivation for upward mobility;
- Long resistance facing with assignments or moderate difficulty level;
- Willingness to reattempt in doing assignments;
- Dynamic perception of time, the feeling that things happen quickly;
- Foresight;
- Paying attention to merit criterion in selecting friends, colleagues and model;
- Recognition through good performance at work;
- Doing job well;
- Low risk behavior.

Hermance found these ten characteristics was acquired on the base of previous research and he selected them as guide for selecting the questions. After trial implementation and analyzing the questions and calculating the correlation of individual questions with total test, 29 questions were selected as final questionnaire of achievement motivation. It should be noted that after analyzing the questions, no significant question about the tenth characteristics was included in the final questionnaire. Therefore, the final questionnaire was constructed only on the basis of nine characteristics. The questions of questionnaire were stated as incomplete sentences and multiple options were given for each of the. To equalize the value of questions, four options were written for all 29 questions. The options were given score in terms of intensity of motivation of achievement from high to low or low to high. Scoring the questionnaire was conducted based on nine characteristics that questions were developed based on them. Some of the questions were written positively, while other groups of them were written negatively. T0 each question of this questionnaire (Observation checklist to examine physical variables of coloring the learning environment), the minimum score (0) and maximum score (2) were assigned, in the other hand:

(0): If the school has not met the standard principles at all in the studied component (non-standard);
(1): If the school has met the standard principles relatively in the studied component (semi-standard);
(2): If the school has met the standard principles fully in the studied component (standard).

Given the number of questions in observation checklist (5), the minimum score obtained by each school (completely non-standard), and the maximum obtained score by in terms of studied components, researcher marks each item in terms of meeting the standards according to three standard option of standard, semi-standard and non-standard. According to the observation checklist, standard schools were those schools which required the min score based on confirmation of modernization, development and equipping of schools organization.

2-4. Data analyses

Data of study were analyzed using descriptive statistics (frequency, percentage, mean, standard deviation) and inferential statistics (factor analysis, t-test, Kolmogorov - Smirnov test and one-way ANOVA analysis) at SPSS- 21 software. In this section, the descriptive statistics related to observation, a checklist to examine the impact of physical variables of noise on learning and achievement questionnaire of students was provided. Then, statistical hypotheses were examined in the data analysis section. To examine the normal distribution of data,

Kolmogorov-Smirnov test was used. Then, to examine the hypothesis of study, structural equation and Pearson correlation coefficient were used, while single-sample t-test, independent two-sample t-test and ANOVA were used to examine the sub-hypotheses of study.

3-RESULTS

For investigating students' amount of learning and academic achievement (including 29 questions of 4 options), the Hermans' standard questionnaire was used as a research tool and for studying physical variables of noise in educational spaces (including 5-question of the standard, semi-standard and non-standard of 3-option) a researcher-made questionnaire; given the age of the respondents, the method of interview was used in completing questionnaires. By completing questionnaires and interview, some parents or teachers of students were also present. Based on (Table.1) in which the demographic characteristics of the students have been specifically mentioned, from between 210 elementary students samples under study, 11(5.2%) students were from elementary second grade, 38 (18.09%) students from third grade, 63 (30%) students from fifth grade and 73 (34.7%) students from sixth grade. Also in terms of age characteristics of the students under question, 15 (7.14%) students were 7-year old, 21 (10%) students 8-year old, 38(18.09%) students 9-year old, 63(30%) students 10-year old, and 73 (34.7%) students 11-year old. For investigating the normality of the distribution of data related to the noise of educational spaces, amount of learning and academic achievement, in (Table.2) the Kolmogorov-Smirnov test (by accepting the null hypothesis at the error level of 5%) has been used. Results showed that the noise in educational institutions was equal to 1.16±0.135, learning 0.34±1.04 and academic achievement 0.42±1.09. In (Table.3), regarding 9 questions related to the check-list of variables of noise in educational institutions with three options standard, medium and non-standard, the amount of point and score of students has been stated. The first question was about the rubber hot-shoes. In this case, 35(14.8%) students have selected the standard option, 64(27%) students the medium option and 80 (33.8%) students non-standard option. The mean and standard deviation (SD) of this question have been 1.06±2.71. The second question asked whether the double-glazed windows and doors are used; 28 (11.8%) individuals have selected the option standard, 50(21.1%) individuals the option medium and 96 (40.5%) individuals the option non-standard. The mean and standard deviation of this question have been also 1.05±2.87. The third question asked whether the student sound in the exercise yard does create noise pollution in class; 20(8.4%) individuals have selected the option standard, 37(15.6%) individuals the option medium and 109(46%) individuals the option non-standard. The mean and standard deviation of this question have been also 0.99±3.04. The fourth question asked was about the distance between sound producing sources and the school; 36(15.2%) individuals have selected the option standard, 54(22.8%) individuals the option medium and 96 (40.5%) individuals the option non-standard. The mean and standard deviation of this question have been also 1.03±2.71. The fifth question asked about the place of the school (near to main street, highway); 21 (8.9%) individuals have selected the option standard, 35(14.8%) individuals the option medium and 106 (44.7%) individuals the option non-standard. The mean and standard deviation of this question have been also 1.01±3.05. The sixth question asked whether the school is in the vicinity of schools; 29(12.2%) individuals have selected the option standard, 67(28.3%) individuals the option medium and 81 (34.2%) individuals the option non-standard. The mean and

standard deviation of this question have been also 1.08±2.78. The seventh question asked whether the class doors are adjacent or opposite each other; 30 (12.7%) individuals have selected the option standard, 41 (17.3%) individuals the option medium and 96(40.5%) individuals the option non-standard. The mean and standard deviation of this question have been also 1.09±2.94. The eighth question asked whether the adjacent classes use a common ventilation duct; 23 (9.7%) individuals have selected the option standard, 58(24.5%) individuals the option medium and 102(43%) individuals the option non-standard. The mean and standard deviation of this question have been also 1.00±2.84. The ninth question asked whether the sound of fluorescent lights and air conditioning produce disturbing noise; 29(12.2%) individuals have selected the option standard, 67(28.3%) individuals the option medium and 81 (34.2%) individuals the option non-standard. The mean and standard deviation of this question have been also 1.08±2.78.

In (Table.4) the good fitness test of Chi-square and the observed and expected frequency have been shown from perspective of the students under question. Results showed that the amount of Chi-square test was equal to 20.35 and degree of freedom 2 with a significance level 0.001 is of error level is less than the error level of 0.05; so we accept the difference between the observed frequency and expected frequency and consider the test significant. Since the Chi-square test is influenced by the highest frequency (at least with 111 individuals), then we conclude with confidence of 95% that from the perspective of elementary school male students of Ahvaz, noise in educational institutions has had a moderate effect on their learning and academic achievement. Also in this research there was not observed any relationship between the demographic variables under investigation such as age, education level, education district of education place etc. and the amount of learning and academic achievement(P>0.05).

Table 1: Demographic information of students

Variables	Number and percentage of Students
Educational grade	
2	11(5)
3	25(12)
4	38(18)
5	63(30)
6	73(35)
Total	210(100)
Age	
7	15(7)
8	21(10)
9	38(18)
10	63(30)
11	73(35)
Total	210(100)
Educational area	
1	50(24)
2	41(20)
3	59(27)
4	60(29)
Total	210(100)

Table 2 Examination of normal distribution of data

Factors	Number of questions	Eigen value	Percentage of variance	Cumulative variance percentage
Noise in educational institutions	9	1.89	3.79	51.14

Table 3: Frequency and percentage of respondents regarding to the noise on learning and academic achievement

Questions	Response			Mean± SD	P-value
	Standard N (%)	Moderate N (%)	Non-standard N (%)		
Rubber hot-shoes suitable for all tables and benches are installed.	35(14.8)	64(27)	80(33.8)	2.71(1.06)	0.640
Double-glazed windows and doors are used.	28(11.8)	50(21.1)	96(40.5)	2.87(1.05)	0.614
Student sound in the exercise yard does not create noise pollution in class	20(8.4)	37(15.6)	109(46.0)	3.04(0.99)	0.609
There is a distance between sound producing sources and the school	36(15.2)	54(22.8)	96(40.5)	2.71(1.03)	0.601
The school is not in the vicinity of highways or main streets	21(8.9)	35(14.8)	106(44.7)	3.05(1.01)	0.587
The school is not in the vicinity of schools	29(12.2)	67(28.3)	81(34.2)	2.78(1.08)	0.560
Class doors are not adjacent or opposite each other	30(12.7)	41(17.3)	96(40.5)	2.94(1.09)	0.530
Adjacent classes do not use common ventilation duct	23(9.7)	58(24.5)	102(43.0)	1.00	0.520
Sound of fluorescent lights and air conditioning do not produce disturbing noise	29(12.2)	67(28.3)	81(34.2)	2.78(1.08)	0.560

Table4: Chi-square goodness of fit test and observed and expected frequency

Variables		Observed frequency	Expected frequency	Remaining	P-value
Students' perspective	Standard	69	79	-10.0	0.001
	Moderate	98	79	32.0	
	Non-standard	37	79	22.0	
	Total	210			

4- DISCUSSION

The results showed that noise in educational institutions has a negative impact on learning and academic achievement of elementary school students in Ahvaz. Therefore, we can say that the results of this study are in line with those of studies conducted by Karen et al. (12), Karami et al. (13), Moeinpour et al. (14), Chiang et al. (15), Mills (16), DiSarno et al. (17), Zannin et al. (18-21), Kruger et al.

(22), Lewinski et al. (23), Dockrell et al. (24) and Wagemans et al. (25). Noise is well known to have an impact on human performance. Chiang and Lai (15) investigated and identified some of the negative effects of working in a noisy room, with a focus on young children. They claim that noise influences not only learning outcomes, but also the health of the occupants. In the case of young children, they have not yet developed enough executive skill in activities involving communication channels, like speech comprehension, use of language, and written and oral skills (16). Therefore, interference profoundly interrupts the process of acquiring those essential capacities in children, and noise is far from the only possible kind of interference. Noise undermines reading, writing and comprehension skills, as well as overall academic performance, as noise makes it hard to focus on the task being performed (21). Chiang and Lai (15) reviewed previous findings on noise's harmful effect on mental and physical well-being as part of their study. From a plethora of demonstrable effects, the following negative outcomes were reported specifically in the context of a noisy room: getting tired easily, leading to lower efficiency; increased heart rate; dyspepsia; poor appetite; insomnia; headache; tinnitus; and facial pallor Zannin and Zwirtes (2009) carried out a study comparing schools built in 1977–2005 according to three different recommended standard designs for school buildings. Reverberation time, sound insulation coefficients and ambient noise were co-related to international standards. Their research confirms what previous studies have found. Many classrooms are simply not comfortable places to acquire knowledge or to be mentally focused at all time, due to noise interference. Zannin and Zwirtes (18) showed that even following standard best practices for design, the results are sub-optimal for a learning environment. Most importantly, the authors highlight that the relative position of school- yards and recreation spaces is often ill conceived with respect of the rest of the school.

In addition, the architectural design and material choices allow for voice and noise to be carried between two adjoined classrooms and hallways. Noise level is another important issue when looking at how acoustics affects academic performance. No internationally recognized norms on maximum noise levels for classrooms exist, but, for example, Brazil's regulatory body has mandated a maximum of 40 dBA (19). However, one well- controlled study of classroom noise levels revealed values over 40 dBA for each of five tested classrooms with open and closed windows (19). In the same study, the authors found that both students and teachers pointed out that noise in the classroom was a major source of disturbance for them. Interviews with 62 teachers and 462 students included questions pertaining to how they evaluated various acoustic aspects of their classrooms. These interviews indicated that bothersome noise came mostly from other classrooms. Presumably, teachers and students in adjoining classrooms spoke too loudly. The study reported that every objectively measured acoustic characteristic of the classrooms (background noise, reverberation time, sound insulation) fell short of Brazil's standards. In yet another study, researchers showed clearly that classrooms were not a productive and comfortable place to acquire knowledge, because of poor acoustics (22). Zannin et al. (21) and Zannin et al. (20) recently found this pattern of negative effects again. Lewinsky et al. considered the negative impact of noise on student learning in 2015. They concluded that preference for a learning environment that cues a telic motivation state in the students (23).

5-1. Recommendations

Finally, 4 recommendations were provided as follows:

1. Due to relationship between components of noise of educational spaces and increased behavioral disorder among students, it is recommended that educational managers of country pay attention to psychological advices on colors and sounds.

2. It is recommended that particular attention should be paid to educational space of schools in terms of designing and building. The physical environment spaces should be designed and built so that they can be compatible with inherent tendency and nature of students. In addition, solutions should be found for educational spaces requiring major repairs.

3. As standards and criteria determine the desired level, and since the desired level of one region might be different from other region, it is recommended that a committee to be established to assess the internal situation of schools in Ahvaz so that it can determine the desired standards and criteria and schools to assessed accordingly.

4. It is required that higher attention to be paid on ergonomic relationship with behavioral disorders in students since the beginning of pre-school education and conduct the assessment plan to detect children who have particular needs and attempt to organize children with behavioral disorder (27).

5- CONCLUSION

Professional promotion of teacchers and students is one of the most important factors examined in evaluating specific characteristics of the performance of any educational institution and its realization creates better results in outcomes of the system (28). In recent years, curricula and textbooks have been thoroughly considered, but this principle, the physical characteristics of educational environment and its impact on students' performance and mood have not been investigated significantly. Theoretically, paying attention to environmental factors of the educational environments and foresight on supplying facilities and needs of educational spaces not only help managers and planners in adopting right and realistic decisions, but also are a necessity of any kind of educational planning. Studies have shown that noise pollution is the main cause of discomfort among teachers and students which appears in the form of discomfort, irritability, lack of concentration, drowsiness, fatigue, depression and headache. In addition, in the long term it can cause cardiovascular, respiratory and gastrointestinal problems. Other studies have shown that noise pollution can cause poor concentration in school, interfering with the conversation, drop off students in the courses and even reducing their grades, especially in math. Some studies have focused on hearing loss and mental disorders among students in relation to noise pollution. Previous studies indicate that more than 60% of acoustic conditions in schools are inappropriate and students are exposed to noises that are greater than the recommended levels, which is caused by the low-quality of the new building materials used in structures having poor insulation, especially those used in class doors and windows, foreign sources of noise and inappropriate material of interior surfaces with regard to the acoustic resonance and its reflection. Because controlling the aggravating factors affecting noise pollution in schools has multiple solutions including an acoustic modification of the internal surfaces of structures, proper insulation, controlling sounds from mechanical sources and somatic noise sources, identifying and implementing solutions should be in a way not interfering with normal activity and the comfort people requires detailed and purposeful studies. Analyses and

calculations have shown that the best way to control noise is based on the modified acoustic structures for schools. Studies have shown that most educational spaces in our new schools, especially in remote and disadvantaged areas are not compatible with psychotic features of children and adolescents. Therefore, it is necessary to exert modifications in this regard. Physical variables, even if they have no impact on students' academic achievement, should be taken into consideration for maintaining health care and mental health and safety.

6- CONFLICT OF INTEREST: None.

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