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Effect of Acoustic on Students' Performance in Secondary Classroom Environment: A Review

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ABSTRACT: Poor acoustical environments in school, makes reduction of the talking signal, which may impact teachers' voice problems, reduce students' performance and enhance off-task behavior of them. Not only teachers, but also students implied that because of weak acoustic of the class, the interaction and communication have problem in the classroom. The aim of this paper is to understand the effects of acoustic troubles in the classroom on students' working based on their viewpoints and solve their problems. Most of researchers used qualitative and quantitative methods to collect data for their research from the school students. Among all elements students' opinion and their requirements according to the performance and noise are mostly three options. Students put more emphasis on distance and proximity between student-teacher. Other options like white noise, reverberation are the following and last step respectively to make appropriate situation for students' acoustic problems according to students' viewpoint. Consequently, arrange appropriate seating is the major element that can answer the acoustical problems and boost students' performance in the classroom environment.

***Keywords*:** Acoustic, Classroom, Noise, Performance, Student

I. INTRODUCTION

Teaching space are the highest spots in educational-instructional activities. Speech in a classroom is transferred through a grouping of direct and reflected sound from the teacher to students. Direct sound moves to the listener in a straight line, without being reflected from its source. Reflect sound before traveling to listener, arrives at some objects or surfaces in a room [1], [2]. In the classroom, the main sources of energy are reflected sound at distances which eliminated of the teacher and direct sound energy is highest prevalent at distances near to the teacher [3]. Reflected and direct sounds improve classroom communication and make capable students in the classroom to hear the teacher when combined properly in a quiet classroom [4].

Research has shown that new as well as old school has acoustical problems and can seriously influence a child's capability to comprehend [5], [6]. To prepare sound systems and evaluate room acoustics acoustic principles have been clarified and technologies to explain the acoustical troubles in classrooms [7], [4]. From the other point of view, most students would have hard moments to understand hear and the teacher of classroom if being in a classroom was the similar as being out-of-doors since direct sound is comparatively weak [8], [1]. The energy of the speech of human -at close distance is comparatively weak noticeable in microwatts [9].

Classrooms do not need a great deal of sound diffusion and designed mostly for listening to speech [4]. But the absorptive and reflective attributes are significantly essential of the room. The absorption and reflection of sounds can interfere when not controlled correctly in classroom listening. For instance, some of the most regularly used carpet on foam rubber padding and acoustic ceiling tile as absorbent materials in school classrooms. These kinds of materials absorb high-frequency sounds much better than low-frequency sounds. Consonant sounds, which are mainly high frequency, are not returned well when the floor and ceiling are treated with these materials and speaking fluency is destroyed [1], [10].

Same as acoustic, physical environment in the classroom influences students' performance. Students are more probably to have difficulty to be on their duty, since they are not able to listen successfully in school; also cooperation and obedience are hard to support [11]. Specifically, poor class room acoustics are also influenced children with one-sided losses and minimal hearing losses [12], [13]. Students that have learning shortages may be adversely influenced due to the fact that they regularly require syntactic, semantic, phonologic, and pragmatic disarranges that restrict their interaction capabilities in poor classroom acoustics [14], [15]. Consequently, to generate strong district in the classroom and promote students' learning, classroom needs relax manner and attractiveness [16], [17].

II. LITERATURE REVIEW

While constructing new places for schools, there are a number of objects needs into consideration—starting with the location. Building by the side of a highway, an airport or train tracks is noticeably not suggested. But it is not just outside noise must be considered, building schools that optimize speech intelligibility and reduce reverberation make suitable classroom about acoustics.

Acoustical problems in schools prepare the learning difficulties for all group of study such as school of beginners, second- language learners, youngsters with hearing losses and children with learning shortages [7], [18]. because school beginners language, speech, and listening talents have not developed, school beginners have more problems learning in classrooms compare to others

and making it hard for both young students and teachers to speak with each other [19], [20].

Several teachers are able to project their voices with strong voices without tiring for long amount of time. Others teachers have comparatively weak voices and when imposed to raise their voice level, they become stressed. Teachers are also more exhausted when teachers transfer their voices to compensate for high noise levels at the end of the day of school [7]. Noise levels of classroom sometimes are too high that teacher can conquer with verbal attempt and the result is damage of a teacher's vocal mechanism [21]. Noise of the classroom has been exposed to influence teachers' function [22], [23]. For instance, one scientist [23] gained data regarding the effects of noise in the classroom from more than 1.200 teachers.

Some researchers have concentrated on the impacts of noise, distance, and reverberation. Moreover, there is more concentration to listen the troubles of unusual students, students which are disengagement, the voice of teacher, and teacher tiredness [24], [7]. The perfect conveyance of information about acoustic is essential for best academic success in a classroom. The teacher's voice level, background noise and distance from the teacher to the child are acoustical variables that can compromise perceptual abilities.

Background noise levels relate to all typical noise sources offer in a learning space (excepting students' sound within that educational space and teachers' sound) and also it would be narrow to confirm sufficient speech interaction. Background noise inside the classroom related to any unwanted aural that students' needs, or wants, to comprehend and hear but this noise disturb them [25].

Inside the class the noise sources contain interior noise (noise that makes of inside the building, but outside of the classroom, such as classrooms next to lecture rooms, canteens, and/or busy corridors), exterior noise (noise which is produced from outdoor of the building, such as local construction, traffic of airplane, playground and vehicle transportation) and noise of room (noise that is produced inside the class) [26], [27]. To conceal the teacher's talking the capability of classroom noise depends on amount of acoustical factors [28], [29]. Background noise is capable of compromise educational performance, spelling skills and reading, attentiveness, attention, and behavior in children [30], [31].

The noise levels incline to influence focus and consideration more critically in children with high anxiety levels or lower IQs [32]. Background noise levels were significantly connected to read scores in elementary school-age children in classrooms [33]. Reductions in classroom noise had a considerable result on rising attentiveness, focus and sharing behavior among children [34].

Reflected sound waves or Echoes are postponed and adequately strong to be separate from the original sound source. They are probable to happen where the behind wall has a tough surface such as classrooms. Echoes impact the level, intelligibility and quality of the sound although they are not generally heard as separate phenomena [1], [35]. Classroom echoes are frequently more of a problem than classroom reverberation despite the fact that much highlighting has been located on reverberation [8], [36]. The most significant acoustical crisis within classrooms is extreme white noise even though classroom echoes, modes, and reverberation can influence speech intelligibility in a room, which covers the teacher's talking.

The last factor that affects speech awareness is the gap between teacher and student in the classroom. Actual distance from the student to the teacher, Holliman and Anderson named it proximity and calculated in centimeters [37]. The direct sound field controls in the listening environment when proximity relatively adjacent to the child. Compare to students in any other row, the first two rows students' performance was better [37].

The space between students and teacher can powerfully impact speaking comprehension. Since the significant distance of the room is reached, speech perception scores reduce [38], [39]. A current study of the influence of student-teacher proximity on speech recognition marks was managed with students between 5 to 7 years of age by Crandell [18]. Student's scores were associated to the proximity between student and teacher [40]. Students' positions when it is close to the rear of the class were related with weaker academic performance [41].

III. INDICATORS

Scientists know that students merit the best ideal environment for studying, particularly in a classroom someplace they are able to hear clearly the teacher's speech (closeness). Students also have to answer to the question and focus entirely on their learning. Experiments of classrooms in secondary school level exposed that extreme background noise, which contests the speaking of teachers and decreasing reverberation and background noise inside the classrooms would be maximum valuable to the students with weak acoustics that can create the educational plan unreachable for the students.

The three acoustical independent variables affect students' performance in Fig. 1. Therefore, it is significant to obviously explain and describe the main viewpoints of efficient characteristics in the framework of following performance of students' area based on their requirements.

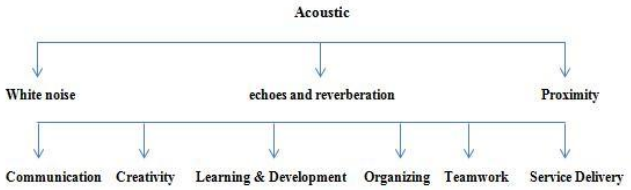

Fig. 1. Influences of acoustic features on students' performance

IV. METHODOLOGY AND FINDING

Most of researchers employed mix method to gather information of students within the classroom. They used questionnaire to obtain pure information which directly take of students' requirements and their points of view. By investigating of students about acoustic crisis in the classroom and compare with other researchers' experiments according the acoustical problems, we could get suitable knowledge to solve students' problems.

Qualitative and quantitative approaches allow understanding students' interaction, learning and physical attribute on students' performance. For example, most of researchers prepared questionnaire as a quantitative method to determine the connection of students' performance and

noise effects, especially measured the students' beliefs about acoustic problem in the classroom. Extract students' viewpoints may be determined by suppositions depend on previous knowledge or by accessibility within the classroom.

For the qualitative part, most of authors were emphasized on observation as a qualitative method to reach deep opinion of students and get the real beliefs. Generally, students were asked to indicate which elements of noise affected more on their performance in the classroom and were observed to measure which items affects more compare to others. By this way, most of analyses showed that physical elements of classroom especially echoes and noise were noticeable enough to disturb the learning of students and quality of their performance even slight hearing disorder.

everal researchers also employed interview to identify information from students and recognizes complete opinion of students based on their performance. Majority of interviews part used an open-ended style and based on the questionnaire data partial of that used as a semi-structure. According to the data gained of interviews with several of students and study of the related literature several items were arranged so cautiously to collect students' opinion of their studying and to contain performance.

The amount of elements needed by the investigation based on eigenvalue principles is three. Features are called based on the significances of the points into consideration. First of all is called "White noise" and the other one is entitled "reverberation and echoes" and the last-objected is identified as "proximity".

By comparing of researchers and analyzing of their finding, double suggestions could be proposed; firstly, decreasing distance between a speaker and listener improved the capability of listening perception in the significant distance of the classroom. Next, the significant distance in typical classrooms, for highest speaking perception is merely at distances that are comparatively adjacent to the teacher. Younger students are in danger for noise intervention is the greatest populations of students and they have higher perceptual troubles compare to adults.

V. CONCLUSION AND SUGGESTIONS

Classroom acoustics problems are an extensive educational topic that needs extra research. All students and teachers are affected by poor classroom acoustics. Some crucial acoustical variables (noise, reverberation, and distance) in this research are offer in a classroom environment which measured on the students' performance. The majority of students emphasized their requests powerfully and considered the acoustical situations in interaction environments, especially focus on proximity as a major element inside the classroom. Proximity between students and teachers has the greatest effect on performance of students.

Next feature which students considered about that was white noise in class area which influenced their performance extremely. Decreasing background noise inside the classrooms would be highly useful to the performance of students. In order to recover the acoustical environment problems in the classroom, the following recommendations may be employed based on architectural perspectives:

The greatest critical key around acoustic troubles based on requirements of students is modifying the seat arrangement to organize the finest and useful proximity for students and improve their performance. Soft architecture or flexible components inside the classroom are sections which can be simply change position by teachers in a classroom place. Similar features contain chairs and tables. Replacing the seat composition is the easiest and cheapest solution for any designer and teacher to achieve students' requirements within the classroom. Consequently, discover the finest arrangement improves teacher-student communication certainly.

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