



Conceptual framework of acoustic comfort design enablers for a classroom: A systematic review

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ABSTRACT

Effective communication between instructors and students is crucial for facilitating the teaching and learning process. Multiple studies have demonstrated that classroom acoustic conditions impact students' academic achievement and the teachers' overall well-being. The acoustic comfort of a classroom is impacted by multiple aspects that must not be disregarded. Although there have been several studies on classroom acoustics, there is a shortage of thorough reviews that examine the impact of design factors in predicting acoustic quality. The aim of this study is to develop a conceptual framework for classroom acoustic comfort that encompasses the objectives of i) identifying various design enablers that may contribute to optimal acoustic comfort for learning purposes and ii) analysing the influence of each design enabler on significant acoustic parameters for classrooms. An analysis of 74 publications was carried out to examine the effects of various classroom design factors on acoustic performance. The study identifies six design enablers for classroom acoustic comfort: material, volume, layout, amplification system, noise, and occupancy and five acoustic parameters: reverberation time, background noise, signal-to-noise ratio, speech transmission index and speech clarity. A conceptual framework is proposed for designers, researchers, and end-users to consider the enablers' roles in creating an optimal classroom learning environment.

1. Introduction

Teaching and learning activities are principally conducted in a learning space known as a classroom. The classroom plays an important role in ensuring that learners receive knowledge content delivered by the teachers in a precise and distinctive way [1]. According to American Speech-Language-Hearing Association [2], and Rosenberg et al. [3], speaking and listening are the key means of communication in the educational context where approximately 45–75 % of the student's time is spent understanding the speech from the teacher and peers in the classroom. Environmental elements such as lighting, thermal comfort, indoor air quality, and acoustics have a great impact on the efficiency of learning processes in the classroom [4] and acoustics is categorised as one of the enablers that influences a student's learning achievement and the educator's well-being the most [5]. According to Hamida et al. [6], students' acoustical preferences and needs are related to three indicators: occupant-related, dose-related, and building-related.

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