

**Investigation of Sound-absorbing Material  
Configuration of a Smart Classroom Utilizing  
Computer Modeling**

*by*

**Sabeer H. Mir and Adel A. Abdou**

*Reprinted from*

JOURNAL OF  
**BUILDING ACOUSTICS**

Volume 12 • Number 3 • 2005

**MULTI-SCIENCE PUBLISHING CO. LTD.**  
5 Wates Way, Brentwood, Essex CM15 9TB, United Kingdom

## Investigation of Sound-absorbing Material Configuration of a Smart Classroom Utilizing Computer Modeling

Sabeer H. Mir and Adel A. Abdou

*King Fahd University of Petroleum and Minerals (KFUPM)*

*Architectural Engineering Department*

*sabeer@kfupm.edu.sa*

(Received 5 November 2004 and accepted in revised form 13 April 2005)

### ABSTRACT

Advancements in information and instruction technology have led to the evolution of a new type of classroom referred to as “*smart classrooms*”. These have enhanced audio-visual equipment, computers and seating layouts designed to facilitate interactive learning. Placement of different sound-absorbing finishes in an efficient manner improves the listening conditions within the classroom and reduces the amplification of internally generated noise such as that from computers and instructional equipment. This study investigates the best overall configuration of sound-absorbing material placement and characteristics of surface treatment in an attempt to enhance the listening conditions in smart classrooms. A typical layout of a smart classroom was modeled and simulated using room acoustics computer modeling. Acoustics indicators such as Reverberation Time (RT), Sound Clarity ( $C_{50}$ ) and Speech Transmission Index (STI) were used for comparing alternative cases in optimising sound-absorbing material characteristics and placement. Additionally, measurements were conducted in similar classrooms to assess the magnitude and characteristics of generated noise. To determine the impact of the resulting background noise simulations were carried out. The resulting configuration of sound-absorbing material for a typical smart classroom can also be utilized by architects and educational institutions to enhance the acoustics of existing conventional classrooms in the process of being converted or upgraded.

### 1. INTRODUCTION

Identification of the right visual and thermal as well as acoustical environment for enhanced levels of comprehension has been the principal aim of many studies. Vocal communication being the fundamental medium for information exchange, classroom acoustics plays a major role in the effective exchange of knowledge in classrooms. Inappropriate acoustical design for a space intended for learning, such as a classroom, exacerbates the difficulty of communication between teacher and students. This makes it necessary to have an appropriate acoustical ambience within the classroom. The