



A study on student perceptions of higher education classrooms: Impact of classroom attributes on student satisfaction and performance



Zheng Yang^a, Burcin Becerik-Gerber^{b,*}, Laura Mino^c

^a Sonny Astani Department of Civil & Environmental Engineering, University of Southern California, 3620 S. Vermont Avenue, KAP 217, Los Angeles, CA 90089-2531, United States

^b Sonny Astani Department of Civil & Environmental Engineering, University of Southern California, 3620 S. Vermont Avenue, KAP 224C, Los Angeles, CA 90089-2531, United States

^c Arup Group Limited, 12777 West Jefferson Blvd Suite 100, Los Angeles, CA 90066, United States

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ABSTRACT

Exploring how classroom attributes affect student satisfaction and performance in higher education classrooms continues to be a critical initiative among educators and researchers. Although specific classroom attributes and their impacts on student satisfaction and performance have been investigated independently, a holistic investigation of many of these attributes and their individual and cumulative impacts on student perceptions of their learning environments is missing. This paper takes a statistical approach to assess ambient, spatial, and technological attributes that can be found in higher education classrooms through an online survey conducted in six classrooms in a university. The paper provides insight for future evaluation of higher education learning environments by linking two Likert scales: one rating student satisfaction with classroom attributes and the other rating the impact of these attributes on student performance, and by analyzing the relationships between reported perceptions and student evaluations of different conditions. The results revealed that student perceptions rely heavily on spatial attributes, specifically visibility and furniture, and ambient attributes, specifically air quality and temperature, which are highly impacted by the design, management and maintenance of classrooms. The paper also investigated the impacts of non-classroom factors, including gender, seating location, cumulative GPA, college year and expected course grade, on student perceptions of learning environments. Results showed that perceptions of visibility, acoustics and furniture were more sensitive to non-classroom factors, followed by temperature, air quality, artificial lighting, room layout and software.

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1. Introduction

With the advent of sick building syndrome, numerous concerns have been raised over the impact of classroom attributes on student performance. Psychologists, educators, architects, and engineers have studied ideal learning environments for age groups ranging from preschool to higher education. While these studies all have attempted to characterize the optimal conditions, a consensus has yet to be reached. Adverse *ambient* conditions such as extreme temperatures, inadequate lighting, and poor air quality undoubtedly have negative impacts on student performance, retention, and

attendance, but after minimum requirements are achieved, the essential impacts and relations of these attributes are still unclear [1–4]. The *spatial* design of classrooms, including furniture, visibility, and layout, has also been a frequent topic of investigation [5,6]. While rows of desks facing one direction is the default classroom layout, open floor plans, group seating, and comfortable furniture have been implemented with contradictory results [1,7]. Over the past decade, *technology* has become a central component of many classrooms in the form of audio and visual equipment, participation tools, personal computers, and Internet access. While classroom technology has generally been viewed as a positive addition, in some cases technology has been found to have no impact or even a negative impact on the students' learning experiences [8,9]. Still others contend that the ideal learning environment is context-dependent and thus can never be permanently defined. Studies have found personal factors such as gender and age

* Corresponding author. Tel.: +1 213 740 4383.

E-mail addresses: zhengyan@usc.edu (Z. Yang), becerik@usc.edu (B. Becerik-Gerber), laura.mino@arup.com (L. Mino).

to play a significant role in users' assessments of various spatial and technological attributes [10,11]. Steve et al. have argued that the ideal learning environment is always changing as innovations in technologies, teaching strategies, and design philosophies require continuous measurement and reassessment [1].

This paper presents the findings of a comprehensive and systematic analysis of student perceptions of different classroom attributes, determinants of each attribute perception, and the impacts of non-classroom factors on perception. First, the authors investigate individual and cumulative impacts of ambient, spatial, and technological classroom attributes that exist in higher education classrooms. These three categories of classroom attributes were selected to reflect the range of attributes frequently considered in the assessment of learning environments. A total of ten attributes were included in the investigation. These are temperature, air quality, and lighting, both natural and artificial, acoustics, visibility, classroom layout, furniture, hardware such as projector, computer, clicker, smart board, camera, etc. and software including software installed on classroom computers –instructor and student computers- and the Internet. These attributes also have the potential to be improved by more informed planning and investment in classroom design, management and maintenance. The authors investigate how students perceived these attributes individually as well as how the perceptions of different attributes correlate with each other. Student responses to a two-stage online survey conducted in six classrooms at a university were used to analyze how reported perceptions of various classroom attributes are related to students' evaluations of different conditions. Finally, as perception has been established as personal and contextual, the responses were assessed for their variance according to the non-classroom factors such as gender, college year, expected course grade, cumulative GPA, and students' seating locations. The research presented in this paper aims to answer the following research questions:

1. How do students perceive ambient, spatial, and technological classroom attributes, and what are the interdependencies among perceptions of different attributes?
2. What are the relationships between reported perceptions and corresponding descriptive conditions, and how should a perception concerning a specific attribute be interpreted?
3. How do student perceptions of classroom attributes vary with non-classroom (personal and contextual) factors such as gender, college year, seating location, expected course grade and cumulative GPA?

2. Classroom attributes influencing student perceptions of learning environments

Classrooms should be configured to provide the best learning environments possible to promote student learning [12]. Trickett and Moos [13], and Walberg and Anderson [14] conducted one of the first studies about learning environments in late 60's and early 70's. Since then, several studies have built on their work and extended it to different educational settings [15–18], and a large number of instruments have been developed to assess students' perceptions of various aspects of learning environments [19–21]. In general, students' perceptions can be divided into three categories: perception of the psychosocial environment such as belongingness and connection with classmates [22–27]; perception of the psychological environment such as motivation, self-efficacy and achievement [27–31]; and perception of the physical environment such as classroom size, lighting and technology [32–37]. This classification scheme is consistent with the one

originated from Moos' work (i.e., relationship dimensions, personal development dimensions, maintenance and system change dimensions) [38].

Each of the above perception types could add to the global understanding of the impact of learning environments on student satisfaction and performance [36]. This paper focuses on the physical learning environments – one of the most salient features of a classroom setting [39,40]. Well-organized classroom environments can facilitate student learning and increase students' evaluations of the instructor and the course [33,41,42]. Moreover, physical learning environments can be improved through classroom design, maintenance and management [36]. While several studies have analyzed the impact of physical learning environments on student satisfaction and performance in K-12 education settings, there are relatively few attempts that study physical learning environments and their impact on student satisfaction and performance in higher education [33], and the findings from primary and secondary education classrooms may not be applicable in higher education settings [36,43].

Physical learning environments should be evaluated by studying both the physical attributes and the students' perceptions of those attributes. Based on the literature, physical attributes could be classified into three categories. The first category is the ambient environment, including attributes such as temperature, acoustics, lighting, daylight and air quality [44]. The second category consists of attributes related to the spatial environment, such as classroom layout [45], classroom furniture [5], visibility and accessibility of sightline [46]. The third category encompasses technology-related attributes including appropriateness of functions of high-tech hardware, ease of software use [47], and speed of net transfers.

These three types of physical attributes are correlated [36,48] and closely related to the learning outcomes and student behavior [32,49], which in turn determine student satisfaction and performance. For example, some of the prior work has focused on learning environment attributes that influence student satisfaction [50–53]. Aldridge and Rowley found that high-quality education environments, better learning opportunities and positive perceptions strongly improved the student performance [54]. Hill and Epps suggested that attributes with satisfactory conditions, such as lighting, temperature, and space management, increased student satisfaction with learning environments [33]. There is no perfect classroom environment to satisfy all types of academic activities [35], sometimes not much can be done to change a specific attribute [36], and how much a physical environment matters depends on a student's perceptions [55]. Accordingly, student perceptions should be treated as important determinants by efforts that focus on improving learning environments in higher education settings [56].

2.1. Ambient, spatial and technological attributes

The ambient attributes studied in this paper are temperature, air quality, acoustics and lighting. Surveys and quantitative tests found temperature to be the most influential ambient attribute in determining student perceptions of classrooms [57,58]. Various studies have shown that students easily accept slightly cool thermal conditions [59] but prefer slightly warm environments [60], and temperatures above 74F influence student performance in math and reading [61]. Air quality is closely tied to temperature and ventilation as it defines the concentration of indoor pollutants, especially that of CO₂ [62,63]. Poor air quality has been correlated with low efficiency, high absence rate, unsatisfactory performance and failure [64,65]. Regarding classroom acoustics, student perceptions are affected by internal environmental sounds such as

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