GRID ARCHITECTURE, PLANNING AND DESIGN JOURNAL
GRİD MİMARLIK, PLANLAMA VE TASARIM DERGİSİ

Vol. 9, No. 1, 2026, 231-254 / Cilt 9, Sayı 1, 2026, 231-254 / DOI: 10.37246/grid.1604932

Indoor air quality satisfaction assessment of students in architecture studios

Ayşegül TERECİ[1], ORCID: 0000-0001-5989-9565,
Furkan KARAÇOR[2], ORCID: 0000-0002-3165-7481
Hakan BECERİK[3], ORCID: 0009-0006-8436-8487,
Hayriye Betül ÇETİN[4], ORCID: 0009-0009-8304-4386,
Muhammed Hıdır AÇ[5], ORCID: 0009-0005-7564-7233,
Nurcan TUNA[6], ORCID: 0009-0000-1225-8111,
Suna KARAYER[7], ORCID: 0009-0004-1601-6047

Abstract

Architectural students spend most of their architecture education periods in the studios where the structure of design education in architecture is formed. Air quality, which is one of the indoor environmental quality elements of the architectural studios, also affects the performance and well-being of students. In this study, the satisfaction with the air quality of the new studio designed for the Department of Architecture and the classroom previously used as a studio were measured with a survey conducted among 190 students who experienced these spaces, and they were evaluated in terms of air quality. Based on the results of the questionnaire, the differences between the old(not designed as a studio) and the new studio(designed for the Architecture Faculty) were revealed by asking the students about the health symptoms that can be considered as indicators of air quality, significant elements of air quality such as odor, dust, humidity, cleaning periods and ventilation facilities. The findings of the study emphasize the correlation between perceptions of air quality and health concerns related to the built environment and it also demonstrates that users desire control over ventilation systems, regardless of the implementation of upgraded HVAC systems.

Highlights

- Provides information on how indoor air quality is important in educational environment.
- It focuses on assessing indoor air quality in studios to help improve user satisfaction.
- It compares the student satisfaction of indoor air quality in old and new studios.
- Data obtained from the survey were analyzed statistically.

Keywords

Architecture studios; Indoor air quality; Statistical analysis; Survey study; User satisfaction

Article Information

Received:
24.12.2024
Accepted:
31.07.2025
Available Online:
23.04.2026

Article Category

Research Article

Contact

1, 2, 3, 4, 5, 6, 7. Faculty of Fine Arts and Architecture, Necmettin Erbakan University, Konya, Türkiye.

atereci@erbakan.edu.tr
furkankaracor97@gmail.com
hakanbecerik@hotmail.com
hayriyebetul98@gmail.com
muhammedhidirac@gmail.com
nurcanntuna@gmail.com
suna.karayer.sal@gmail.com

Tereci, A., Karaçor, F., Becerik, H., Çetin, H.B., Aç, M.H., Tuna, N., & Karayer, S. (2026). Indoor air quality satisfaction assessment of students in architecture studios. *GRID Architecture Planning and Design Journal,* 9(1), 231-254.

GRID ARCHITECTURE, PLANNING AND DESIGN JOURNAL
GRİD MİMARLIK, PLANLAMA VE TASARIM DERGİSİ

Vol. 9, No. 1, 2026, 231-254 / Cilt 9, Sayı 1, 2026, 231-254 / DOI: 10.37246/grid.1604932

Mimarlık stüdyolarında öğrencilerin iç hava kalitesi memnuniyetinin değerlendirilmesi

Ayşegül TERECİ[1], ORCID: 0000-0001-5989-9565,
Furkan KARAÇOR[2], ORCID: 0000-0002-3165-7481
Hakan BECERİK[3], ORCID: 0009-0006-8436-8487,
Hayriye Betül ÇETİN[4], ORCID: 0009-0009-8304-4386,
Muhammed Hıdır AÇ[5], ORCID: 0009-0005-7564-7233,
Nurcan TUNA[6], ORCID: 0009-0000-1225-8111,
Suna KARAYER[7], ORCID: 0009-0004-1601-6047

Öz

Mimarlık öğrencileri, mimarlık eğitimlerinin büyük bir bölümünü, mimarlıkta tasarım eğitiminin şekillendiği atölyelerde geçirirler. Mimarlık atölyelerinin iç ortam kalitesi unsurlarından biri olan hava kalitesi, öğrencilerin performansını ve refahını da etkilemektedir. Bu çalışmada, Mimarlık Bölümü için tasarlanan yeni atölye ile daha önce atölye olarak kullanılan derslikteki hava kalitesine ilişkin memnuniyet, bu mekanları deneyimleyen 190 öğrenci arasında yapılan bir anketle ölçülmüş ve hava kalitesi açısından değerlendirilmiştir. Anket sonuçlarına dayanarak, öğrencilere hava kalitesinin göstergeleri olarak kabul edilebilecek sağlık belirtileri, koku, toz, nem, temizlik sıklığı ve havalandırma olanakları gibi hava kalitesinin önemli unsurları hakkında sorular sorularak, eski (stüdyo olarak tasarlanmamış) ve yeni stüdyo (Mimarlık Fakültesi için tasarlanmış) arasındaki farklar ortaya çıkarılmıştır. Çalışmanın bulguları, hava kalitesi algıları ile yapılı çevreyle ilgili sağlık endişeleri arasındaki korelasyonu vurgulamakta ve ayrıca, kullanıcıların, yenilenmiş HVAC sistemlerinin uygulanmasından bağımsız olarak havalandırma sistemleri üzerinde kontrol sahibi olmak istediklerini göstermektedir.

Öne Çıkanlar

- İç mekân hava kalitesinin eğitim ortamında ne kadar önemli olduğu hakkında bilgi sağlar.
- Kullanıcı memnuniyetini artırmaya yardımcı olmak için stüdyolardaki iç hava kalitesini değerlendirmeye odaklanır.
- Eski ve yeni stüdyolardaki iç hava kalitesine ilişkin öğrenci memnuniyetini karşılaştırmaktadır.
- Anketten elde edilen veriler istatistiksel olarak analiz edilmiştir.

Anahtar Sözcükler

Mimarlık stüdyoları; İç hava kalitesi; İstatistiksel analiz; Anket çalışması; Kullanıcı memnuniyeti

Makale Bilgileri

Alındı:
24.12.2024

Kabul Edildi:
31.07.2025

Erişilebilir:
23.04.2026

Makale Kategorisi

Araştırma Makalesi

İletişim

1, 2, 3, 4, 5, 6, 7. Güzel Sanatlar ve Mimarlık Fakültesi, Necmettin Erbakan Üniversitesi, Konya, Türkiye.

atereci@erbakan.edu.tr
furkankaracor97@gmail.com
hakanbecerik@hotmail.com
hayriyebetul98@gmail.com
muhammedhidirac@gmail.com
nurcanntuna@gmail.com
suna.karayer.sal@gmail.com

Tereci, A., Karaçor, F., Becerik, H., Çetin, H.B., Aç, M.H., Tuna, N., & Karayer, S. (2026). Mimarlık stüdyolarında öğrencilerin iç hava kalitesi memnuniyetinin değerlendirilmesi. *GRID Mimarlık Planlama ve Tasarım Dergisi,* 9(1), 231-254.

INTRODUCTION

Buildings are designed to meet the diverse needs of their occupants, and while all designs are in compliance with many regulations, if occupants are not satisfied with the buildings, they are considered not successful in achieving the desired performance. Although studies show that the perception of indoor environmental quality depends on differences between users, such as gender, age and metabolic rate, the design of buildings should aim to improve the quality of the indoor environment (Bulut Karaca, 2022a). At this point, the opinions of the users should be considered, and their satisfaction should be measured in the development of future designs also in the management of the facilities.

Perception is a factor that influences understanding and concerns regarding indoor air quality among individuals. It develops an obvious impact on their behaviors and attitudes toward their environments. Air quality perceptions of individuals are often preconditioned by their sensory experiences based on the visibility of pollutants, their sense of smell and physical comfort. This personal approach and awareness of the sources of indoor pollutants lead to particular choices in air quality interventions. Sensory perceptions are particularly important for rapid assessment of indoor air quality. The presence of mold or chemical odors associated with volatile organic compounds (VOCs) can serve as an early indicator of air quality problems, even before the analysis of technical measurements. Sensory responses such as eye or throat irritation and the perception of bad air have been linked to certain pollutants and can help early interventions (Wargocki et al., 2002)

Indoor air quality is one of the key environmental factors influencing occupant comfort and satisfaction. People spend an important part of their lives indoors (often 80-90%), which may account for a substantive part of their exposure to air pollution (Lewis,2022) and it is determined through research that the indoor air quality of the spaces affects human health and performance (Mujan et al., 2019; Shan et al., 2018). Poor indoor air quality also causes Sick Building Syndrome, which means that the occupants of a building feel unwell and uncomfortable, and this appears to be related to the occupancy of the building, even if no specific illness or cause can be identified (Mansor et al.,2024). Indoor air quality is provided by reducing pollutants, thermal satisfaction, obtaining hygienic air, and creating conditions in which individuals can feel the most comfortable and healthy indoors (Orhan & Kaya, 2016). Indoor air quality is not an autonomous factor and is therefore influenced by many factors. Among the factors affecting this quality are outdoor air conditions, ventilation systems, pollutants, human activities, material selection in the building (Filho et al., 2021). When the outdoor air quality is poor, it affects the indoor air according to the rate of utilization of this air with ventilation systems. Ventilation systems are the building component responsible for the replacement of polluted air in buildings with fresh air. However, if they are not designed correctly, they can cause respiratory problems due to the inadequacy of the inhaled air in terms of oxygen, especially due to the inability to get enough fresh air from outside (Querdibitty et al., 2023).

According to ASHRAE (2023), the primary categories of indoor air pollutants have been identified as particulate matter (both biological and non-biological, including allergens and potential pathogens), organic gases (e.g., volatile and semi-volatile organic compounds), and inorganic gases (e.g., carbon monoxide, ozone, and nitrogen oxides). Additional factors that contribute to the quality of the indoor air include water vapor and odors. Volatile organic compounds (VOCs) represent a category of pollutants that have been associated with various sources, including construction materials, furniture, and paint (Guo et al., 2004; Jovanović et al,2014). Formaldehyde, one type of VOCS, is a chemical compound with a notable role in the production of furniture and coating materials. Furthermore, VOCs have been detected in cleaning products (Madureira et al., 2016; Sofuoğlu et al., 2011). In order to ensure that cleaning activities in schools do not adversely affect indoor air quality, cleaning is conducted after students have left the space and the cleaned areas are adequately ventilated. The level of carbon dioxide (CO_2) is widely regarded as an indicator of indoor air quality, a notion that has found application in a variety of settings, including educational institutions. Student density and activity levels are effective on CO_2 levels (Kapalo, 2019). Gaseous pollutants such as carbon monoxide (CO), nitrogen dioxide (NO_2), and ozone (O_3) are not prevalent in schools and are more likely to affect indoor air quality in schools depending on the external environment. The presence of particulate matter, such as carbon dioxide (CO_2), has been identified as an indicator of the quality of air within an indoor environment (Sadrizadeh et al., 2022)

The link between exposure to air pollution and cognitive performance has been found in many studies (Zhang et al., 2018; Clifford et al., 2016). Especially in educational buildings, indoor space quality affects students' learning skills and well-being (Manca et al., 2020; Chithra & Nagendra, 2018). Occupants are identified as the main source of indoor CO_2 through exhalation and a standard classroom can have an occupant density of between 1.8 and 2.4 m^2 per person (Mahyuddin & Essah, 2024). In one of the research, CO_2 measurements were made in selected classrooms of Süleyman Demirel University. Since the faculty buildings where the measurements were made were far away from the main road, it was thought that they were not affected much by traffic and were more affected by the activities in the building. It was concluded that natural ventilation is not sufficient in the air quality of the classrooms, which are intensively used, and there is a high concentration of CO_2 (Yurdakul et al., 2019). In the study conducted in the classrooms and offices of Tunceli University, it was determined that there is no artificial ventilation system in many university buildings in Turkiye and that natural ventilation is insufficient at certain intervals in the measurements made. In this regard, it has been suggested that the number of users should not exceed in the design process, integrable systems should be used according to ASHRAE standards, employees should be trained on indoor environment quality, and separate spaces should be designed for tools such as photocopiers (Sözen & Işık, 2016). In educational buildings, ventilation is mostly done naturally (Faye et al. ,2022), and no system is operated based on air quality measurements. Classrooms are generally ventilated by opening doors and windows between classes.

Conditions such as all students having left the classroom by opening the windows, the windows being fully open, the wind in the outside environment not being in the direction of negative pressure, no obstructions in the outside environment that would slow down the speed of air entering the classroom through the windows, and no reverse airflow in the classroom are effective in ventilating the classrooms by opening the windows (Bulut Karaca, 2022b). In winter months, doors and windows cannot be opened in order not to disturb thermal comfort, which negatively affects indoor air quality. Unless they develop habits that increase their satisfaction levels at this point and as they are constantly exposed to these conditions in space, there is a narrowing in their comfort areas (Frontczak &. Wargocki,2011).

As with other educational institutions, the indoor air quality of architectural studios has a direct impact on the well-being, health, and academic success of students who spend most of their day in these spaces. Given the extended periods spent in these shared workspaces, poor indoor air quality, attributable to insufficient ventilation, the accumulation of indoor pollutants, or unfavorable thermal conditions, has the potential to compromise cognitive function in these environments, which are important for fostering creativity. The consequences of poor indoor air quality can be seen in students with symptoms such as fatigue, headaches and impaired concentration. The level of user satisfaction with the air quality in an architectural studio is influenced by multiple connected factors. These sources or reasons can be broadly categorized into environmental (ventilation, pollutants level, humidity, temperature, odors), physiological (health symptoms, sensitivity), psychological (perceived control, awareness), and contextual (material use, spatial design, occupant density, cleaning, location) dimensions.

According to Tuna Kayılı & Yetiş (2023), pollutants in studio spaces are the materials that users bring to the studio, in addition to indoor factors such as building materials that make up the space. It is particularly noteworthy that the adhesive materials delivered to the studios are considered external pollutants. This study focused on indoor air quality and occupant satisfaction during model-making processes in architecture studios. The measurements were obtained in studios at Karabük University in Turkey and subsequently compared with the ASHRAE standards. The findings indicated that the magnitude of the impact of studio size on the maintenance of indoor air quality was statistically significant. Despite the implementation of continuous natural ventilation during the model-making process, pollutant levels were observed to reach thresholds that have the potential to adversely affect student health. Furthermore, female students exhibited a greater degree of dissatisfaction with indoor air quality in comparison to their male counterparts. Another study related to architectural studios was conducted at the University of Petra in South Amman, Jordan (Al-Jokhadar, 2023). This study examined the relationship between thermal comfort and indoor air quality (IAQ) on the comfort and academic performance of architecture students. The research involved the measurement of carbon dioxide (CO_2), air temperature, and humidity in design studios and classrooms. The study revealed that inadequate indoor air quality influences student comfort and academic performance. This highlights the necessity of adequate ventilation and environmental design in educational settings.

Measurements and questionnaires are sometimes used alone and sometimes in combination to assess indoor air quality. Questionnaire studies are frequently used to prioritize the subjective evaluation of spaces and health problems caused by indoor air quality (Ung-Lanki et al.,2017, Pereira et al., 2014). In addition, in the survey studies, it has been determined that the psycho-social status of these people is also effective in the evaluation (Finell, et al., 2018). Sensory perceptions generally reflect immediate air quality, and it is thought that sensory perceptions expressed as complaints and reports of discomfort may be warnings of health problems (Williams et al., 2024). In this study, it is aimed to determine the factors affecting indoor air quality and the effects of indoor air quality on students according to the results of the satisfaction survey conducted on the Architecture studios they use in the old building not designed for the architecture department and the new building designed for the Faculty of Architecture. In this way, the effect of spaces specially designed for the purpose of use in the architectural design process on user satisfaction will be evaluated. In this way, the impact of spaces designed for architecture on satisfaction with air quality will be measured.

MATERIAL & METHOD

Research method

Data was obtained by conducting a questionnaire study on the indoor air quality satisfaction of 3rd and 4th year architecture students who experienced the studios in both faculties. The questionnaire study was composed of questions about demographic characteristics, ventilation, health problems, humidity, mold problems, comfort and indoor air quality satisfaction. While designing the questionnaire, previous survey studies on indoor air quality satisfaction in educational buildings were utilized (Wu, Lu, & Chou, 2018).

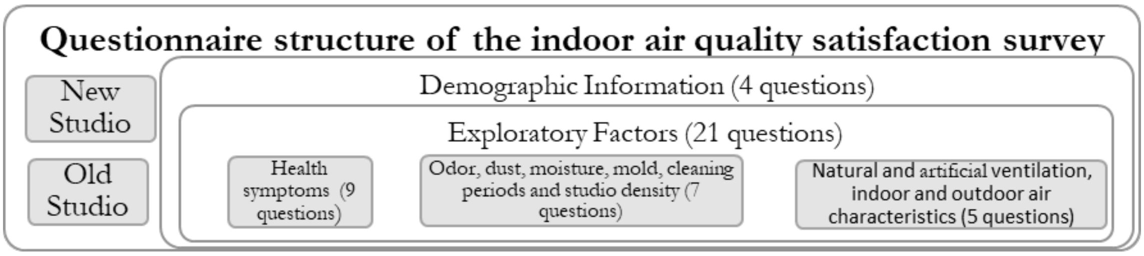

Figure 1. The structure of the questionnaire study

The sample population of 3rd and 4th year architecture students who have experienced both studios in old and new buildings is 320 people in total, and the 'sample size' confidence level required for the reliability of the survey results is calculated as 175 people with a 5% margin of error for 95%. The number of voluntary participations in the survey is 190 people. The structure of the questionnaire study is explained in Figure 1. In addition to personal characteristics (age, gender, city, chronic diseases, smoking) as demographic information of the respondents, 21 questions were asked to be answered on a 5-point Likert scale, measuring the frequency of use of the studios and how long they were used, health complaints during the time spent in the studios and whether the situation changed after leaving the studios, moisture, mold and odor problems in the studios, ventilation of the studios (natural and mechanical), indoor temperature, indoor and outdoor air satisfaction. SPSS 27 (Statistical Package for Social Sciences) package program and AMOS 23 program were used to analyze the data. Following the decision of the Ethics Committee in November, the questionnaires were distributed to the students during the studio courses in December 2023 and the questionnaire responses were collected from the students who wanted to participate in the study.

Case Study Areas

The studios selected as the case study are in Konya, Türkiye. Konya is situated within a substantial topographical depression, encircled by mountain ranges to the north and west. The city's topography contributes to the concentration of foggy and hazy air, which is characterized by the presence of polluted air that is unable to disperse or depart from the city during winter months due to the absence of wind and air currents and this phenomenon contributes to an increase in air pollution, particularly on days with low wind speeds during winter (Kunt and Dursun, 2018). However, the selected faculties are in the Akyokuş region in the western part of Konya, which is elevated above the city's overall topography and a low-traffic area. The locations of the studios selected in the study are shown in Figure 2. Among the faculties within the same campus area, Case-1 is the faculty building where the old studios are located. The newly built studio for the Faculty of Architecture is referred to as Case-2. Table 1 presents a comprehensive overview of the properties associated with designated studios.

Figure 2. The location of the cases in the layout plan (redrawn from Konya City Information System (2025))

In the research, the air quality of the studio in the old building and the studio in the new building were evaluated to determine the indoor air quality satisfaction in the studios used by the architecture students. The reason for choosing the studios as the study area is that they are the most used studios in the old and new building by the architecture students. Model making process is not allowed in the designated studios. The models are fabricated by students in specified areas within the faculty, thereby ensuring the absence of any alteration in air quality within the studios, attributable to the use of adhesives. Both studios are cleaned and ventilated in the evening after the students have concluded their activities.

Table 1. Properties of designated studios as case study.

	CASE 1- (Studio 402)	**CASE 2- (Studio Z03)**
Floor	4th Floor	Ground Floor
Floor area	185 m^2	422 m^2
Facade direction	East	Northeast
Lighting system	Natural + Artificial lighting	Natural + Artificial lighting
Floor covering	Ceramic	Linoleum
Wall covering	Plaster + Paint,	Exposed concrete
Ceiling cladding	Acoustic plasterboard suspended ceiling	Exposed concrete
Window area	(3,97 x 2,5) +(4,31 x 2,5) =20,7 m^2	(31x9) =279 m^2
Type of ventilation used	Operable Window (Natural ventilation) + Artificial ventilation	Operable Window (Natural ventilation) + Artificial ventilation
Type of heating used	Natural gas	Natural gas

The old studio (402) shown in Figure 3 is located on the 4th floor of the Faculty of Applied Sciences. The studio, which can accommodate 80 people at the same time, has an area of approximately 185 m^2. The studio is 11,5m wide and 16m long, and its height is 3m up to the suspended ceiling. Located on the east-facing facade of the faculty, the studio has windows opening to the south and north facades. The windows start at a height of 1.2m from the floor and continue up to the suspended ceiling.

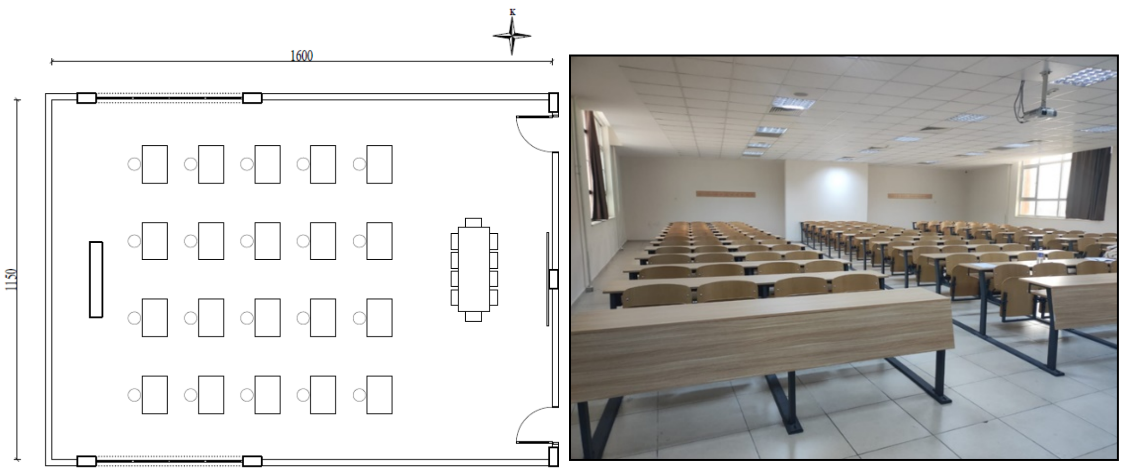

Figure 3. Plan and interior photo of studio 402 (The photo was taken after the table layout was changed).

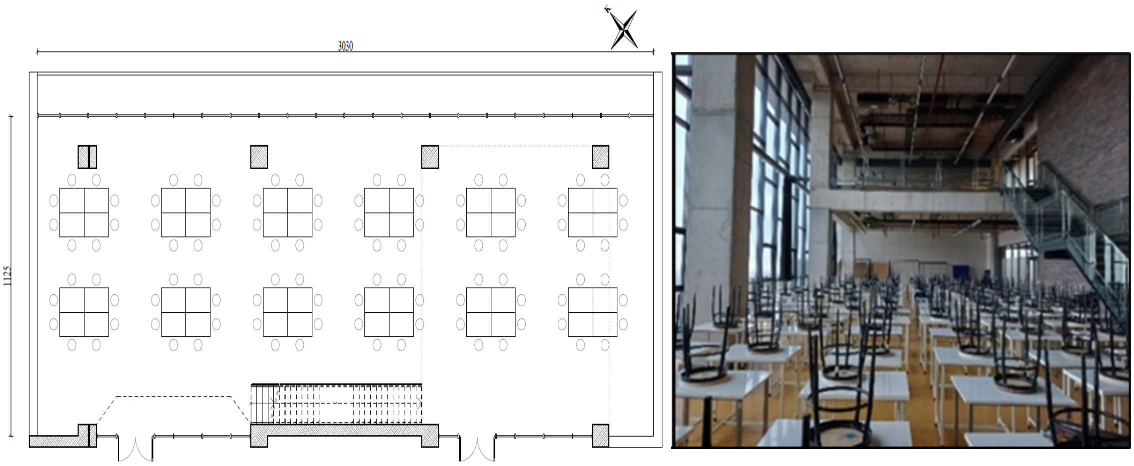

Figure 4. Plan and interior photo of studio Z-033.

Studio Z-033, shown in Figure 4, is located on the ground floor of the Faculty of Fine Arts and Architecture. The studio, which can accommodate 100 people at the same time, has a total area of 422m^2 with a mezzanine of 91m2. The studio is 10m wide and 30m long, with a floor height of 4.5m up to the mezzanine floor and 9m in total. Located on the north-east facing facade of the faculty, the north-east facade of the studio is a curtain wall, and the entire facade is glass. The facade of the studio facing the corridor is designed as completely glass

ARCHITECTURE STUDIO AIR QUALITY ASSESSMENT

In this research, the survey on the satisfaction of the students using the architecture studios was conducted with the voluntary participation of 190 students who had experienced both studios. This sample number was obtained by contacting all students who used the studios and who were willing to participate in the survey. The reliability of the survey questions was calculated by Cronbach's alpha coefficient method in SPSS program. According to this calculation, the alpha coefficient, whose reliability limit is at least 0.70, was '0.835' for the old building studio questions and '0.826' for the new building studio questions. The questions asked about the old building and the new building were factors analyzed separately. Kaiser-Meye-Olkin (KMO) and Bartlett tests were performed to evaluate the suitability of the sample size for factor analysis. As a result of the analysis, KMO Old Building=0,879 and KMO New Building=0,840. The significance value of Bartlett's Test of Sphericity statistics was found as $p<0.001$ for both analyses. The explained variance values for all questions were calculated as 78,768% for the old building and 60,955% for the new building. The results of exploratory factor analyses for both are given in Table 2. It was determined that the KMO values of both analyses were greater than 0.50, the results of the sphericity tests were significant and the explained variance values were more than 50%.

Table 2. KMO, Bartlett's test and validity results.

	Old Building's Studio	New Building's Studio
KMO (Kaiser-Meyer-Olkin)	0,879	0,840
Bartlett's Test of Sphericity (x2 value)	20160,599	15965,352
Bartlett's Test of Sphericity (p value)	<0,001	<0,001
Validity Result (Variance Explained)	78,768%	60,955%

After the relevant assumptions were met, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were conducted to determine the sub-dimensions. The eigenvalues, variance explanation percentages and factor loadings of the items collected under the relevant dimension for the 7 dimensions obtained by Direct Oblimin Rotation method are presented in Table 3.

Table 3. Exploratory and confirmatory factor analysis of the 21-item air quality assessment scale and descriptive statistics with reliability coefficients of the sub-dimensions and the whole scale.

	F1 Health symptoms				F2-Natural and Artificial Ventilation, Indoor and Outdoor air characteristics				F3-Odour, dust, moisture, mold, cleaning periods and studio usage intensity				R2	t
Items/ Dimensions	New Buil. EFA	Old Buil. CFA	New Buil. EFA	New Buil. CFA	Old Buil. EFA	Old Buil. CFA	New Buil. EFA	New Buil. CFA	Old Buil. EFA	Old Buil. CFA	New Buil. EFA	New Buil. CFA		
Article 4	-1,00	0,60	-0,91	0,71									0,40	10,78*
Article 2	-0,91	0,69	-0,97	0,60									0,40	10,88*
Article 8	-0,90	0,62	-0,86	0,75									0,57	16,72*
Article 3	-0,90	0,63	-0,97	0,57									0,52	15,02*
Article 5	-0,90	0,65	-0,82	0,77									0,56	16,19*
Article 7	-0,90	0,68	-0,97	0,64									0,22	6,61*
Article 1	-0,86	0,56	-0,97	0,51									0,13	4,55*
Article 6	-0,85	0,66	-0,91	0,61									0,16	5,24*
Article 9	-0,84	0,62	-0,79	0,66									0,54	16,47*
Article 14A					0,91	0,63	0,62	0,83					0,78	29,73*
Article 14B					0,91	0,61	0,96	0,78					0,29	8,40*
Article 16B					0,91	0,91	0,57	0,71					0,74	27,45*
Article 15A					0,91	0,66	0,78	0,60					0,46	13,04*
Article 13A					0,87	0,68	0,67	0,77					0,49	13,82*
Article 13B					0,87	0,67	0,51	0,73					0,46	12,73*
Article 16A					0,73	0,84	0,59	0,66					0,60	18,32*
Article 11									-0,81	0,69	-0,80	0,66	0,18	5,69*
Article 17									0,81	0,76	0,55	0,71	0,15	5,02*
Article 12									-0,81	0,70	-0,69	0,75	0,53	15,29*
Article 10									-0,50	0,65	-0,60	0,66	0,76	27,85*
Article 18									0,50	0,67	0,96	0,61	0,20	5,89*
Eigenvalues	9,42	-	6,88	-	8,20	-	3,42	-	6,76	-	2,57	-		
% Variance Explained (For Sub-Dimensions)	55,49	-	33,01	-	16,79	-	15,91	-	6,49	-	12,03	-		
Mean±Standard Deviation (for Sub-Dimensions)														
Mean±Standard Deviation (For All)	New Building =75,95±11,37; Old Building =63,01±11,72													
Cronbach Alpha (For Sub-Dimensions)	0,784		0,748		0,812		0,762		0,868		0,708			
Cronbach Alpha (For All)	New Building=0,826; Old Building=0,835													

According to the EFA results obtained in Table6, items 1, 2, 3, 4, 5, 6, 7, 8 and 9 loaded on the first factor. This factor was named as 'health symptoms' dimension. In addition, these items are reverse coded. Items 13A, 13B, 14A, 14B, 15A, 16A and 16B loaded on the second factor. This factor was named as 'Natural and Artificial Ventilation, Indoor and Outdoor Air Cleanliness' dimension. There are no reverse coded items. Items 10, 11, 12, 17 and 18 loaded on the third factor. This factor was named as 'Odour, dust, humidity, mould, cleaning periods and studio intensity' dimension. Items 10, 11, and 12 are reverse coded. As seen in Table 3, the eigenvalues of the dimensions were obtained as F1-eigenvalues=9,42, F2-eigenvalues=8,20 and F3-eigenvalues=6,76 for the old building respectively. The variance percentages explained were 55,49%, 16,79% and 6,49%, respectively. For the new building; F1-self-values=6,88, F2-self-values=3,42 and F3-self-values=2,57. The explained variance percentages were 33.01%, 15.91% and 12.03%, respectively. In CFA, a 3-dimensional model was defined for 21 items as in the original scale and exploratory factor analysis. In line with the sub-dimensions of the theoretical model, the following sub-dimensions were formed; F1: 'Health symptoms' (items 1, 2, 3, 4, 5, 6, 7, 8, 9), F2: 'Natural and artificial ventilation, indoor and outdoor air cleanliness' (items 13A, 13B., 14A., 14B., 15., 16A. and 16B. items), F3: 'Odour, dust, humidity, mould, cleaning periods and studio density' (10th, 11th, 12th, 17th and 18th items). This model was analysed by CFA to determine whether it has model data fit or not. The factor loadings of the items belonging to each dimension are given in the CFA columns in Table 3. In the last column of the table, the t values corresponding to the factor loadings of the items obtained as a result of CFA are given and it is observed that the t values of all factor loadings are $p<0.01$ and these values are statistically significant. In addition, Table 3 shows the R2 (percentage of variance explained) of each item according to the CFA result. According to the table, R2 (item reliability) values range between 0.13 and 0.78.

Table 4. Index values for model-data fit of the tested model.

Model	X2	X2/sd	GFI	AGFI	NFI	RFI	IFI	TLI	CFI	RMSEA
Old Building	755,667	2,053	0,945	0,905	0,906	0,903	0,951	0,927	0,948	0,053
New Building	631,77	1,726	0,96	0,923	0,918	0,916	0,917	0,92	0,91	0,045
Compliance Index Criteria Values		<3	>0,90	>0,85	>0,90	>0,90	>0,90	>0,90	>=0,90	<=0,08

As stated in Table 4, GFI, NFI, RFI, IFI, IFI TLI and CFI values were found to be greater than 0.90 and AGFI values were found to be greater than 0.85 as a result of the analysis performed for both buildings. X2/sd values were less than 3 and RMSEA values were less than 0.08. Independent sample test and one-way ANOVA tests were performed in independent (unrelated) groups to test whether the scale distinguishes groups known to be different in terms of the measured feature, since all scale scores showed normal distribution.

The comparison of the scale scores and subscale scores of the participants according to the presence of Chronic Disease is given in Table 5. There is a statistically significant difference between the F2 New Building scores of the participants with (21,38±4,52) and without (25,54±4,48) chronic diseases (t=-3,226; p=0,001). There is a statistically significant difference between the Total New Building scores of the participants with chronic illness (69,38±9,00) and those without (76,89±10,57) (t=-2,492; p=0,014). As seen in Table 5, in 9 questions regarding health problems, users were asked to evaluate the old building and the new building separately. While the first 8 questions asked about health symptoms, the ninth question asked whether this complaint continued. When asked about health symptoms, approximately 37.6% of the responses for the new building were none. The most complained problems were sleepiness, drowsiness, stress and tension. 70.37% of the users who left this building stated that there was no change in their experiences between the building and the external environment. Approximately 29.91% of the answers given to the 8 questions of the old building were none. The most complaints about problems were headaches, stress and tension. 70.45% of the users who left this building stated that there was no change in their experiences between the building and the external environment. When the overall table is examined, the answers of the users "always" and "often" are compared. In this regard, complaints such as cough, shortness of breath, headache, drowsiness and lethargy, attention deficit and decrease in work efficiency, stress and tension, nose and throat allergy, skin flushing, itching, dermatitis, eczema, hives or a similar type of skin allergy. The number of people complaining of health symptoms decreased after moving to the new building. The likelihood of these symptoms disappearing after leaving the building is higher in new building users.

Table 5. Health symptoms questions and percentages of answers (F1).

(F1)	Always	Often	Neutral	Rarely	Never
(M1) Do you have a cough problem while you are in the studio?					
M1-New Building	2 (%1,06)	10 (%5,32)	36 (%19,15)	49 (%26,06)	91 (%48,4)
M1-Old Building	5 (%2,7)	25 (%13,51)	48 (%25,95)	44 (%23,78)	63 (%34,05)
(M2) Do you have shortness of breath while you are in the studio?					
M2-New Building	0 (%0)	8 (%4,26)	29 (%15,43)	38 (%20,21)	113 (%60,11)
M2-Old Building	2 (%1,08)	20 (%10,75)	48 (%25,81)	25 (%13,44)	91 (%48,92)
(M3) Do you suffer from headaches while you are in the studio?					
M3-New Building	13 (%6,91)	37 (%19,68)	46 (%24,47)	50 (%26,6)	42 (%22,34)
M3-Old Building	11 (%5,95)	54 (%29,19)	58 (%31,35)	32 (%17,3)	30 (%16,22)
(M4) Do you experience sleepiness and lethargy while you are in the studio?					
M4-New Building	22 (%11,76)	56 (%29,95)	47 (%25,13)	41 (%21,93)	21 (%11,23)
M4-Old Building	34 (%18,38)	71 (%38,38)	46 (%24,86)	24 (%12,97)	10 (%5,41)
(M5) Do you experience attention deficit disorder and decreased work efficiency while you are in the studio?					
M5-New Building	7 (%3,76)	26 (%13,98)	51 (%27,42)	76 (%40,86)	26 (%13,98)
M5-Old Building	13 (%7,07)	56 (%30,43)	68 (%36,96)	33 (%17,93)	14 (%7,61)
(M6) Do you experience stress or tension while you are in the studio?					
M6-New Building	23 (%12,3)	38 (%20,32)	51 (%27,27)	45 (%24,06)	30 (%16,04)
M6-Old Building	34 (%18,58)	62 (%33,88)	44 (%24,04)	28 (%15,3)	15 (%8,2)
(M7) Do you have nose and throat allergies while you are in the studio?					
M7-New Building	8 (%4,26)	14 (%7,45)	34 (%18,09)	44 (%23,4)	88 (%46,81)
M7-Old Building	10 (%5,43)	23 (%12,5)	40 (%21,74)	37 (%20,11)	74 (%40,22)
(M8) Do you experience skin rashes, itching, dermatitis or any similar skin allergies while you are in the studio?					
M8-New Building	1 (%0,53)	5 (%2,67)	14 (%7,49)	15 (%8,02)	152 (%81,28)
M8-Old Building	3 (%1,64)	5 (%2,73)	17 (%9,29)	14 (%7,65)	144 (%78,69)
(M9) If you are experiencing the health problems listed above, these symptoms will occur when you leave the studio:					
	Disappear Completely	Better	Worse	No change	-
M9-New Building	5 (%3,7)	20 (%14,81)	15 (%11,11)	95 (%70,37)	-
M9-Old Building	8 (%6,06)	12 (%9,09)	19 (%14,39)	93 (%70,45)	-

Table 6. Odor, dust, moisture, mold, cleaning periods and studio density questions and percentages of answers (F3).

(F3)	Always	Often	Neutral	Rarely	Never
(M10) Is there an odor problem in the studio?					
M10-New Building	5 (%2,65)	14 (%7,41)	28 (%14,81)	69 (%36,51)	73 (%38,62)
M10-Old Building	12 (%6,38)	48 (%25,53)	44 (%23,4)	49 (%26,06)	35 (%18,62)
(M11) Is there a dust problem in the studio?					
M11-New Building	4 (%2,13)	26 (%13,83)	34 (%18,09)	58 (%30,85)	66 (%35,11)
M11-Old Building	17 (%9,19)	48 (%25,95)	42 (%22,7)	33 (%17,84)	45 (%24,32)
(M12) Is there any visible moisture or Mold problems in the studio?					
M12-New Building	0 (%0)	4 (%2,14)	23 (%12,3)	19 (%10,16)	141 (%75,4)
M12-Old Building	5 (%2,7)	13 (%7,03)	44 (%23,78)	29 (%15,68)	94 (%50,81)
	Very Good	Good	Neutral	Bad	Very Bad
(M17) Are you satisfied with the student density in the studio according to its size?					
M17-New Building	34 (%17,89)	31 (%16,32)	45 (%23,68)	55 (%28,95)	25 (%13,16)
M17-Old Building	67 (%36,02)	68 (%36,56)	31 (%16,67)	15 (%8,06)	5 (%2,69)
(M18) Are you satisfied with the cleaning periods in the studios?					
M18-New Building	17 (%8,99)	23 (%12,17)	59 (%31,22)	67 (%35,45)	23 (%12,17)
M18-Old Building	43 (%22,87)	53 (%28,19)	55 (%29,26)	30 (%15,96)	7 (%3,72)

Following the questions about health problems, the percentage distributions of which are given in Table 6, three questions about odor, dust and humidity problems were asked, followed by two questions about the intensity of use and cleaning periods. The users who had no complaints about odor, humidity and dust problems in the new building constituted 49,71% of the total. In the old building, the number of users who had no complaints in this regard was 31.25%. The most complained problem was odor and dust problem. When the overall table is analyzed, the responses of the users always and quite often are compared. In this direction, it was determined that the number of those who complained about odor, dust, visible dampness and mold problems was quite high in the old building users. Regarding the satisfaction with student density according to the size of the studio, in the new building, the option of 'very little' was mentioned the most with a rate of 28,95%. In the old building, on the other hand, 36,56% of the respondents answered 'often' in this satisfaction question. In the question about cleaning periods, 34,45% of the users of the new building answered, 'rarely'. In the old building, the most common answer to this question was neutral with a rate of 29,26%. When the very good and good answers of the users are compared, the number of users who found the student density and cleaning periods good according to the size of the studio increased when they moved to the new building.

As seen in Table 7, users were asked to evaluate the quality of the air with 4 questions. The natural ventilation of the new building was evaluated as bad in summer with a rate of 42,11%, while it was evaluated as bad and neutral in winter with a rate of 32,11%. The natural ventilation of the old building was evaluated as neutral in the summer with a rate of 30,85%, while it was evaluated as neutral in the winter with a rate of 31,91%. The artificial ventilation of the new building was evaluated as bad in summer with a rate of 40,53%, while it was evaluated as bad in winter with a rate of 34,39%. The artificial ventilation of the old building was evaluated as neutral in the summer with a rate of 37,57% and as neutral in the winter with a rate of 35,98%. The cleanliness of the indoor air of the studio was evaluated as bad by 43,68% in summer and 37,37% in winter in the new building. In the old building, 43.92% in summer and 39.36% in winter were neutral. In the new building, 42,11% in summer and 39,15% in winter, the cleanliness of the outdoor air of the studio was evaluated as bad. In the old building, 44.15% in summer and 42.33% in winter were neutral.

Table 7. Natural and artificial ventilation, indoor and outdoor air characteristics in studios (F2).

(F2)	Very Good	Good	Neutral	Bad	Very Bad
(M13) Are you happy with natural ventilation (window opening) in the studio?					
M13 New Building - Summer	11 (%5,79)	9 (%4,74)	51 (%26,84)	80 (%42,11)	39 (%20,53)
M13 New Building - Winter	18 (%9,47)	22 (%11,58)	61 (%32,11)	61 (%32,11)	28 (%14,74)
M13 Old Building - Summer	27 (%14,36)	41 (%21,81)	58 (%30,85)	45 (%23,94)	17 (%9,04)
M13 Old Building - Winter	43 (%22,87)	45 (%23,94)	60 (%31,91)	31 (%16,49)	9 (%4,79)
(M14) Are you satisfied with the artificial ventilation (air conditioning) in the studio?					
M14 New Building - Summer	4 (%2,11)	9 (%4,74)	56 (%29,47)	77 (%40,53)	44 (%23,16)
M14 New Building - Winter	9 (%4,76)	19 (%10,05)	54 (%28,57)	65 (%34,39)	42 (%22,22)
M14 Old Building - Summer	32 (%16,93)	51 (%26,98)	71 (%37,57)	28 (%14,81)	7 (%3,7)
M14 Old Building - Winter	38 (%20,11)	52 (%27,51)	68 (%35,98)	22 (%11,64)	9 (%4,76)
(M15) Is the indoor air in the studio clean?					
M15 New Building - Summer	8 (%4,21)	12 (%6,32)	58 (%30,53)	83 (%43,68)	29 (%15,26)
M15 New Building - Winter	8 (%4,21)	16 (%8,42)	68 (%35,79)	71 (%37,37)	27 (%14,21)
M15 Old Building - Summer	21 (%11,11)	55 (%29,1)	83 (%43,92)	25 (%13,23)	5 (%2,65)
M15 Old Building - Winter	26 (%13,83)	64 (%34,04)	74 (%39,36)	20 (%10,64)	4 (%2,13)
(M16) Is the outdoor air in the studio clean?					
M16 New Building - Summer	5 (%2,63)	15 (%7,89)	53 (%27,89)	80 (%42,11)	37 (%19,47)
M16 New Building - Winter	5 (%2,65)	17 (%8,99)	57 (%30,16)	74 (%39,15)	36 (%19,05)
M16 Old Building - Summer	13 (%6,91)	35 (%18,62)	83 (%44,15)	47 (%25)	10 (%5,32)
M16 Old Building - Winter	17 (%8,99)	39 (%20,63)	80 (%42,33)	41 (%21,69)	12 (%6,35)

When the overall table is analyzed, very good and good responses of the users are compared. In this direction, the users evaluated the old building as better in terms of natural and artificial ventilation in summer and winter seasons. The users also considered the old building as better in terms of indoor and outdoor air cleanliness in the studio. The comparison of scale scores and subscale scores according to the presence of hereditary chronic disease is given in Table 8.

Table 8. Comparison of scale scores according to the presence of hereditary chronic disease.

	Hereditary Chronic Disease			
	Exist Ort.±S.S.	Does not Exist Ort.±S.S.	t	p
F1 New Building	30,54±4,72	32,62±5,53	-1,318	0,189
F1 Old Building	28,15±5,68	29,47±5,89	-0,781	0,436
F2 New Building	21,38±4,52	25,54±4,48	**-3,226**	**0,001**
F2 Old Building	18,00±5,31	19,37±5,01	-0,946	0,345
F3 New Building	17,46±2,67	18,73±3,27	-1,366	0,174
F3 Old Building	14,46±3,71	15,00±3,79	-0,495	0,621
Total New Building	69,38±9,00	76,89±10,57	**-2,492**	**0,014**
Total Old Building	60,62±11,62	63,59±11,18	-0,922	0,358

Table 9. Comparison of scale scores according to smoking history.

	Smoking Story					
	Never	Very rarely	Everyday	Quit	F	p
	Ort.±S.S.	Ort.±S.S.	Ort.±S.S.	Ort.±S.S.		
F1 New Building	32,82±5,11	31,38±5,52	32,21±6,31	33,33±4,16	0,528	0,664
F1 Old Building	29,37±5,87	29,79±5,31	29,06±6,33	32,00±1,00	0,286	0,835
F2 New Building	25,59±4,55	25,25±4,45	24,60±4,72	24,67±6,51	0,561	0,641
F2 Old Building	19,83±4,99	20,08±4,70	17,79±5,15	18,33±2,08	2,247	0,084
F3 New Building	18,89±3,35	17,50±2,54	18,72±3,24	17,67±3,79	1,308	0,273
F3 Old Building	15,26±3,91	15,50±2,95	14,37±3,65	10,00±3,46	2,695	0,044pad=0,014 pbd=0,012
Total New Building	77,31±10,39	74,13±9,01	75,53±11,62	75,67±14,19	0,749	0,524
Total Old Building	64,46±10,37	65,38±9,25	60,38±13,37	60,33±3,21	1,932	0,126

The comparison of scale scores and subscale scores according to smoking history of the participants is given in Table 9. There is a statistically significant difference between F3 New Building scores according to smoking history (F=2,695; p=0,044). Post Hoc analysis was performed to determine the groups causing the significant difference. LSD method was used as Post Hoc analysis. As a result of the analysis, the differences between those who never smoke (15,26±3,91) and those who smoke and quit (10,00±3,46) and between those who smoke rarely (15,50±2,95) and those who smoke and quit (10,00±3,46) caused the differences (pad=0,014; pbd=0,012).

To evaluate the internal consistency of the Air Quality Assessment Scale, Cronbach Alpha reliability coefficients for the total scale and its sub-dimensions were calculated and presented in Table 10. The reliability coefficients of the Air Quality Assessment Scale for the old building were α=0.784 for the 'F1' dimension, α=0.812 for the 'F2' dimension, α=0.868 for the 'F3' dimension and α=0.835 for the whole scale, respectively. For the new building, α=0.748 for 'F1' dimension, α=0.762 for 'F2' dimension, α=0.708 for 'F3' dimension and α=0.826 for the whole scale, respectively. α between 0.8-0.9 is considered Good and α between 0.7-0.8 is considered Acceptable (George & Mallery, 2003).

Table 10. Cronbach alpha reliability coefficients of the air quality assessment scale and its sub-dimensions.

Total Scale/Subscales	α
F1 Old Building	0,784
F2 Old Building	0,812
F3 Old Building	0,868
Total Old Building	0,835
F1 New Building	0,748
F2 New Building	0,762
F3 New Building	0,708
Total New Building	0,826

Table 11 shows the corrected items-total score correlation coefficients (item-remainder correlation coefficient) for the items of the Air Quality Assessment Scale and the scale alphas after item removal. Accordingly, items 1, 3, 4, 5, 7, 8, 10, 11, 12, 14A, 15, 16A, 16B, 17, and 18, 17., and 18., the corrected item-total score correlation coefficients of the items were above '.40', the corrected item-total score correlation coefficients of the items 2. new building, 6. old building, 9. old building, 13A. old building, 13B. old building and 14B. were between '.25 and .40', but when these three items were removed from the scale, the alpha coefficient did not change the reliability of the test dramatically and even decreased in some cases. It was observed that the contribution of each item to the reliability of the test was positive and similar.

Table 11. Item analysis results of the air quality assessment scale.

Air Quality Assessment Scale	Items	Average of the Scale when the Item is Removed	Variance of the Scale When Item Is Removed	Corrected Item-Test Correlations	Cronbach Alpha after Substance Removal Alpha
Alfa = 0, 826 Number of items = 21 X = 63,01±11,72/75,95±11,37 N = 190835/0,	M1 Old /New Building	59,0421/72,2842	141,543/118,268	0,470/0,438	0,831/0,817
	M2 Old /New Building	58,7737/72,6421	138,536/120,707	0,588/0,286	0,826/0,824
	M3 Old /New Building	59,6684/72,1737	139,736/119,742	0,549/0,425	0,827/0,818
	M4 Old /New Building	60,2526/72,3789	143,248/118,967	0,468/0,372	0,831/0,820
	M5 Old /New Building	59,8789/72,3579	141,991/117,808	0,527/0,502	0,829/0,815
	M6 Old /New Building	60,1632/72,2737	144,021/120,189	0,391/0,385	0,834/0,819
	M7 Old /New Building	59,0211/72,3421	140,254/119,369	0,463/0,401	0,831/0,818
	M8 Old /New Building	58,2526/71,8421	143,174/116,07	0,436/0,524	0,832/0,813
	M9 Old /New Building	60,2474/71,6368	151,616/116,815	0,063/0,532	0,856/0,813
	M10 Old /New Building	59,4579/72,6105	141,921/112,25	0,473/0,574	0,831/0,809
	M11 Old /New Building	59,5368/73,0895	138,43/115,151	0,520/0,470	0,828/0,815
	M12 Old /New Building	58,7316/72,5526	139,203/114,661	0,547/0,552	0,827/0,811
	M13A Old /New Building	59,7895/72,8895	146,104/115,369	0,340/0,435	0,837/0,817
	M13B Old /New Building	60,1368/71,9842	145,706/114,492	0,368/0,507	0,835/0,813
	M14A Old /New Building	60,0737/71,3579	146,312/119,205	0,392/0,432	0,834/0,817
	M14B Old /New Building	60,1526/73,4789	146,151/128,939	0,383/0,369	0,835/0,852
	M15 Old /New Building	60,0158/71,9632	147,031/119,157	0,416/0,481	0,834/0,819
	M16A Old /New Building	59,6737/72,1632	147,84/116,963	0,454/0,426	0,836/0,817
	M16B Old /New Building	59,7316/71,4368	147,615/122,12	0,449/0,289	0,836/0,823
	M17 Old /New Building	60,6684/72,9211	147,154/118,486	0,453/0,319	0,836/0,823
	M18 Old /New Building	60,2053/72,6737	146,809/118,433	0,439/0,385	0,836/0,819

Table 12 shows the corrected item-total score correlation coefficients (item-retained correlation coefficient) and scale alphas after item removal for the items of the Air Quality Assessment Scale F1 subscale. Accordingly, it was observed that the corrected item-total score correlation coefficients of the 1st, 2nd, 3rd, 4th, 5th, 5th, 6th, 7th, and 8th items were above '.40', the corrected item-total score correlation coefficients of the 9th item were between '.25 and .40', but when these three items were removed from the scale, the alpha coefficient did not change the reliability of the test dramatically and even decreased in some cases. It was observed that the contribution of each item to the reliability of the test was positive and similar.

Table 12. Air quality assessment scale F1 subscale item analysis results.

Air Quality Assessment Scale	Items	Average of the Scale when the Item is Removed	Variance of the Scale When Item is Removed	Corrected Item-Test Correlations	Cronbach Alpha after Substance Removal Alpha
Alfa = 0,784/0,748 Number of items = 9 X = 29,38±5,87/32,47±5,5 N = 190	M1 Old /New Building	25,1316/28,0211	41,215/33,015	0,531/0,553	0,755/0,707
	M2 Old /New Building	24,8632/27,8158	40,182/33,389	0,616/0,569	0,743/0,707
	M3 Old /New Building	25,7579/28,7895	41,2/31,828	0,550/0,524	0,752/0,708
	M4 Old /New Building	26,3421/29,2684	42,618/32,346	0,506/0,497	0,759/0,713
	M5 Old /New Building	25,9684/28,7316	41,65/32,98	0,591/0,516	0,749/0,711
	M6 Old /New Building	26,2526/29,0684	42,444/31,916	0,457/0,496	0,765/0,712
	M7 Old /New Building	25,1105/28,1632	39,506/32,455	0,577/0,501	0,747/0,712
	M8 Old /New Building	24,3421/27,5368	41,655/34,737	0,530/0,462	0,755/0,722
	M9 Old /New Building	26,3368/29,6579	46,288/37,486	0,389/0,318	0,786/0,768

Table 13 shows the corrected item-total score correlation coefficients (item-retained correlation coefficient) and scale alphas after item removal for the items of the Air Quality Assessment Scale F2 subscale. It was observed that the corrected item-total score correlation coefficients of M11. items were above '.40', the corrected item-total score correlation coefficients of M10. new building, M12. new building, M17. both buildings, M18. Both buildings' items were between '.25 and .40', but when these three items were removed from the scale, the alpha coefficient did not change the reliability of the test dramatically and even decreased in some cases. It was observed that the contribution of each item to the reliability of the test was positive and similar.

Table 13. Air quality assessment scale F2 subscale item analysis results.

Air Quality Assessment Scale	Items	Average of the Scale when the Item is Removed	Variance of the Scale When Item is Removed	Corrected Item-Test Correlations	Cronbach Alpha after Substance Removal Alpha
Alfa= 0,812/0,762 Number of items = 5 X = 19,24±5,01/ 25,22±4,61	M10 Old /New Building	11,5526/14,6158	11,233/7,889	0,434/**0,392**	0,610/0,433
	M11 Old /New Building	11,6316/14,8158	9,588/6,723	0,562/0,438	0,543/0,324
	M12 Old /New Building	10,8263/14,0895	10,599/8,717	0,495/**0,280**	0,581/0,486
	M17 Old /New Building	12,7632/15,5737	12,711/8,055	**0,333/0,341**	0,653/0,542
	M18 Old /New Building	12,3/15,3263	12,783/7,501	**0,285/0,322**	0,672/0,411

Table 14 shows the corrected item-total score correlation coefficients (item-retained correlation coefficient) and scale alphas after item removal for the items of Air Quality Assessment Scale F3 subscale. Accordingly, it was observed that the corrected item-total score correlation coefficients of items M13A, M14A, M14B, 15 and 16A, 16B were above '.40', the corrected item-total score correlation coefficients of the new building item M13B were between '.25 and .40', but when these three items were removed from the scale, the alpha coefficient did not change the reliability of the test dramatically and even decreased in some cases. It was observed that the contribution of each item to the reliability of the test was positive and similar.

Table 14. Air quality assessment scale F3 subscale item analysis results.

Air Quality Assessment Scale	Items	Average of the Scale when the Item is Removed	Variance of the Scale When Item is Removed	Corrected Item-Test Correlations	Cronbach Alpha after Substance Removal Alpha
Alfa = 0,868/0,708 Number of items = 7 X = 14,93±3,77/18,61±3,29	M13A Old /New Building	16,2579/21,5474	19,833/16,133	0,518/0,485	0,794/0,732
	M13B Old /New Building	16,6053/21,9053	20,156/16,869	0,507/**0,326**	0,795/0,769
	M14A Old /New Building	16,5421/21,4368	19,424/16,268	0,677/0,552	0,764/0,719
	M14B Old /New Building	16,6211/21,6421	19,644/15,638	0,622/0,497	0,774/0,729
	M15 Old /New Building	16,4842/21,6211	21,203/16,099	0,547/0,547	0,788/0,719
	M16A Old /New Building	16,1421/21,5368	21,519/16,282	0,466/0,521	0,800/0,725
	M16B Old /New Building	16,2/21,6053	20,88/16,388	0,519/0,470	0,792/0,735

CONCLUSION

In this study, a statistical evaluation was conducted to assess the experiences of students with both new and old studios. The evaluation covered a range of parameters, including the physical environment, indoor air quality and health symptoms. The findings indicated that users exhibited a predominantly positive experience in the new studio and submitted a reduced number of health-related complaints concerning environmental conditions in comparison to the old studio.

A notable reduction in symptoms such as headaches, stress, drowsiness, sleepiness, and tension were observed among users following their transition to the new studio. This decline indicates the effect of indoor environmental quality and comfort on user health. Furthermore, users expressed intensified levels of satisfaction with the new studio, particularly with regard to the dimensions of the studios, the density of students, and the frequency of cleaning. Additionally, a substantial enhancement in parameters such as odor, dust, and humidity were observed, favoring the new one.

However, user evaluations of ventilation systems demonstrated the opposite trend. In the evaluation of the conditions in both the old and new studio, users indicated that the former was more favorable in terms of natural and artificial ventilation. This phenomenon can be attributed primarily to the absence of enough natural ventilation systems in the new studio and the inability of users to directly regulate the artificial ventilation systems.

The findings of the study indicate that in the process of designing and operating buildings, it is imperative to consider not only physical dimensions and architectural aesthetics, but also users' perceptions of environmental control and spatial interaction levels. It is imperative to furnish users with flexibility and intervention opportunities, particularly in parameters such as indoor air quality and ventilation systems, to ensure optimal physical health and psychological well-being. In subsequent designs, the incorporation of systems in which users can directly influence environmental conditions should become a principal criterion for sustainable and user-oriented building performance.

Consequently, this research offers a framework for the evaluation of contemporary building design methodologies and the development of next-generation structures that prioritize user comfort and health. A systematic evaluation of user feedback in design processes has the potential to contribute to the creation of more functional, accessible, and healthy living-learning spaces.

The quality of the time people spend in indoor spaces is directly related to the planning, design and quality of the indoor environment. It is important to ensure that the design responds to the needs of the users and the quality of the indoor environment. Satisfaction analysis, which shapes user-centered design, should be comprehensive in terms of feedback on designs, and whenever possible, users should be reached, and their wishes and expectations pay regards. In addition, user satisfaction is as important as air quality measurements, and user evaluations should be considered when improving air quality. In the survey study, users were asked about thermal and visual comfort factors that affect the quality of the space, and separate ratings were developed. In later stages of the study, these data will be supported by measurements and a combined assessment of the factors affecting the overall quality of the space will be made.

Conflict of Interest Statement | Çıkar Çatışması Beyanı

Araştırmanın yürütülmesi ve/veya makalenin hazırlanması hususunda herhangi bir çıkar çatışması bulunmamaktadır.

There is no conflict of interest for conducting the research and/or for the preparation of the article.

Financial Statement | Finansman Beyanı

Bu araştırmanın yürütülmesi ve/veya makalenin hazırlanması için herhangi bir mali destek alınmamıştır

No financial support has been received for conducting the research and/or for the preparation of the article.

Ethical Statement | Etik Beyanı

Araştırma etik standartlara uygun olarak yapılmıştır.

All procedures followed were in accordance with the ethical standards.

Copyright Statement for Intellectual and Artistic Works | Fikir ve Sanat Eserleri Hakkında Telif Hakkı Beyanı

Makalede kullanılan fikir ve sanat eserleri (şekil, fotoğraf, grafik vb.) için telif hakları düzenlemelerine uyulmuştur.

In the article, copyright regulations have been complied with for intellectual and artistic works (figures, photographs, graphics, etc.).

Author Contribution Statement | Yazar Katkı Beyanı

AUTHOR 1: (a) Idea, Study Design, (b) Methodology, (c) Literature Review, (e) Material, Resource Supply, (f) Data Collection, Processing, (g) Analyses, Interpretation, (h) Writing Text, (ı) Critical Review

AUTHOR 2, 3, 4, 5, 6, and 7: (f) Data Collection, Processing, (h) Writing Text

REFERENCES

Al-Jokhadar, A., Alnusairat, S., Abuhashem, Y., & Soudi, Y. (2023). The Impact of Indoor Environmental Quality (IEQ) in Design Studios on the Comfort and Academic Performance of Architecture Students. *Buildings*, *13*(11), 2883. https://doi.org/10.3390/buildings13112883

ASHRAE (2023). ASHRAE position document on indoor air quality. American Society of Heating, Refrigerating and Air-Conditioning Engineers. Available at https://www.ashrae.org/file%20library/about/position%20documents/pd_indoor-air-quality-2023-06-28.pdf. Accessed April 26, 2024.

Bulut Karaca, Ü. (2022 a). A Study on Indoor Environmental Quality. *Kent Akademisi*, 15(4), 1724-1741.

Bulut Karaca, Ü. (2022 b). A Study on Improving Indoor Air Quality in Primary School Classrooms. *Avrupa Bilim ve Teknoloji Dergisi* (33), 60-67.

Chithra, V., & Nagendra, S. (2018). A review of scientific evidence on indoor air of school building: pollutants, sources, health effects and management. *Asian Journal of Atmospheric Environment*, 12 (2), 87-108.

Clifford A., Lang, L., Chen, R., Anstey, K., & Seaton, A. (2016). Exposure to air pollution and cognitive functioning across the life course–a systematic literature review. *Enviromental Research*, 147, 383–398.

Faye McNeill V., Corsi R., Alex Huffman J., King C., Klein R., Lamore M., Maeng D.Y., Miller S.L., Lee Ng N., Olsiewski P., Godri Pollitt K.J., Segalman R., Sessions A., Squires T., Westgate S., (2022), Room-level ventilation in schools and universities, *Atmospheric Environment: X*, 13 100152, https://doi.org/10.1016/j. aeaoa.2022.100152.

Filho, N. A., Urrutia-Pereira, M., d'Amato, G., Cecchi, L., Ansotegui, I. J., C.Galán, . . . Rouadi, P. (2021). Air pollution and indoor settings. *World Allergy Organization Journal,* 14(1), 100499.

Finell, E., Tolvanen, A., Pekkanen, J., Minkkinen, J., Ståhl, T., & Rimpelä, A. (2018). Psychosocial Problems, Indoor Air-Related Symptoms, and Perceived Indoor Air Quality among Students in Schools without Indoor Air Problems: A Longitudinal Study. *International Journal of Environmental Research and Public Health*,15, 1497.

Frontczak M., Wargocki P., (2011), Literature survey on how different factors influence human comfort in indoor environments, *Building and Environment,* 46, 922–937, https://doi.org/10.1016/j.buildenv.2010.10.021

Guo, H. , Lee, S.C., Chan, L.Y., Li.W.M., (2004). Risk assessment of exposure to volatile organic compounds in different indoor environments. *Environmental Research*, 94, 57–66. https://doi:10.1016/S0013-9351(03)00035-5

Jovanović, M., Vučićević, B., Turanjanin, V., Živković, M., Spasojević, V. (2014).Investigation of indoor and outdoor air quality of the classrooms at a school in Serbia. *Energy,* 77, 42-48. http://dx.doi.org/10.1016/j.energy.2014.03.080

Kapalo, P., Mečiarová, Ľ., Vilčeková, S., Krídlová Burdová, E., Domnita, F., Bacotiu, C., Péterfi, K.E., (2019). Investigation of CO2 production depending on physical activity of students. *International Journal of Environmental Health Research,* 29,31-44. https://doi.org/10.1080/09603123.2018.1506570

Konya City Information System, (2025). https://kentrehberi.konya.bel.tr/. Access date: 26.04.2025.

Kunt, F., & Dursun, Ş. (2018). Impacts of Some Meteorological Factors on Air Pollution of Konya City Centre. *Ulusal Çevre Bilimleri Araştırma Dergisi,* 1(1), 54-61.

Lewis, A. C., Allan, J., Carslaw, D., Carruthers, D., Fuller, G., Harrison, R. M., Heal, M., Nemitz, E., Reeves, C. E., Carslaw, N., Dengel, A., Dimitroulopoulou, S., Gupta, R., Fisher, M., Fowler, D., Loh, M., Moller, S., Maggs, R., Murrells, T., ... Willis, P. (2022). *Indoor Air Quality*. Defra. https://doi.org/10.5281/zenodo.6523605

Madureira, J., Paciência, I., Pereira, C., Teixeira, J.P., de Fernandes, E.O., (2016),. Indoor air quality in Portuguese schools: levels and sources of pollutants, *Indoor Air,* 26, 526-537.

Mahyuddin, N. and Essah, E. A. (2024), Spatial distribution of CO2 impact on the indoor air quality of classrooms within a university. *Journal of Building Engineering*, 89. 109246.

Manca, S., Cerina, V., Tobia, V., Sacchi, S., & Fornara, F. (2020). The effect of school design on users' responses: a systematic review. *Sustainability*, 12 (8), 3453.

Mansor, A.A., Abdullah, S., Ahmad, A.N., Ahmed,, A.N., Zulkifli, M.F.R, Jusoh, S.M., Ismail, M. (2024). Indoor air quality and sick building syndrome symptoms in administrative office at public university. *Dialogues Health*, 4:100178. https://doi: 10.1016/j.dialog.2024.100178

Mujan, I., Anđelković, A. S., Munćan, V., Kljajić, M., & Ružić, D. (2019). Influence of indoor environmental quality on human health and productivity - A review. *Journal of Cleaner Production*, 646-657.

Orhan, İ. H., & Kaya, L. G. (2016). A Review of LEED Certificated Green Buildings and Indoor Environmental Quality. *Mehmet Akif Ersoy Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 7, 18-28.

Pereira, L., Raimondo, D., Corgnati, S., & da Silva, M. (2014). Assessment of indoor air quality and thermal comfort in Portuguese secondary classrooms: Methodology and results. *Building and Environment,* 81, 69-80.

Querdibitty D., Campbell C., J., Wetherill, M. S., & Salvatore, A. L. (2023). Geographic and social economic disparities in the risk of exposure to ambient air respiratory toxicants at Oklahoma licensed early care and education facilities. *Enviromental Research*, 114975.

Sadrizadeh, S., Yao, R., Yuan, F., Awbi H., Bahnfleth W., Bi, Y., Cao, G., Croitoru, C., Dear, de R., Haghighat,F., Kumar, P., Malayeri, M., Nasiri, F., Ruud, M., Sadeghian, P., Wargocki, P., Xiong, J., Yu, W., Li, B. (2022). Indoor air quality and health in schools: A critical review for developing the roadmap for the future school environment.*Journal of Building Engineering*, 57. https://doi.org/10.1016/j.jobe.2022.104908

Shan, X., Melina, A., & Yang, E. (2018). Impact of indoor environmental quality on students' wellbeing and performance in educational building through life cycle costing perspective. *Journal of Cleaner Production*, 204, 298-309.

Sofuoglu, S.C., Aslan, G., Inal, F., Sofuoglu, A., (2011). An assessment of indoor air concentrations and health risks of volatile organic compounds in three primary schools. *International Journal of Hygiene & Environmental Health*, 214, 36-46. https://doi:10.1016/j.ijheh.2010.08.008

Sözen, A., & Işık, E. (2016). Indoor Air Quality Measurements and Analyses in Offices and Classrooms: The Example of Tunceli University. *Mühendis ve Makina*, 57(677), 53-64.

Tuna Kayılı, M., & Yetiş, C. (2023). Determination of the indoor air quality and occupancy satisfaction in architecture studios during model making process. *GRID - Architecture Planning and Design Journal*, 6(1), 30-55. https://doi.org/10.37246/grid.1031184

Ung-Lanki, S., Lampi, J., & Pekkanen, J. (2017). Analyzing symptom data in indoor air questionnaires for primary schools. *Indoor Air*, 27, 900–908.

Wargocki, P., Wyon, D. P., Sundell, J., Clausen, G., & Fanger, P. O. (2002). *The effects of outdoor air supply rate in an office on perceived air quality, Sick Building Syndrome (SBS) symptoms and productivity*. Indoor Air, 10(4), 222–236. https://doi.org/10.1034/j.1600-0668.2000.010004222

Wu, Y., Lu, Y., & Chou, D. (2018). Indoor air quality investigation of university library based on field measurement and questinare survey. *International Journal of Low Carbon Technologies*, 148-160.

Williams, A., Schulte, K. & Varaden, D. (2024). 'Incense is the one that keeps the air fresh': indoor air quality perceptions and attitudes towards health risk. *BMC Public Health* 24, 3178 https://doi.org/10.1186/s12889-024-20635-1.

Yurdakul, S., Ayyıldız, N., Çelik, V. E., & İçöz, E. (2019). Investigation of The Indoor Environment Quality of The Selected Classrooms of The Suleyman Demirel University. *Mühendislik Bilimleri ve Tasarım Dergisi,* 7(4) , 811-818.

Zhang, X., Chen, X., & Zhang, X. (2018). The impact of exposure to air pollution on cognitive performance. *The Proceedings of the National Academy of Sciences* (PNAS), 9193–9197.

BIOGRAPHIES OF THE AUTHORS

Ayşegül TERECİ (Assoc. Prof. Dr.)

Ayşegül TERECİ graduated from Gazi University, Faculty of Engineering and Architecture, Department of Architecture in 2003. She completed her master's degree in ITU Building Technology and Physical Environmental Control Department in 2006. She worked as a researcher at the Stuttgart University of Applied Sciences in Germany. She received her Ph.D. degree from the METU Building Sciences program in 2012. Between 2013-2023, she worked as an Assistant professor at KTO Karatay University. She is working as an Associate Professor in the Department of Architecture at the Faculty of Fine Arts and Architecture at Necmettin Erbakan University.

Furkan KARAÇOR

He graduated from Anadolu University, Faculty of Architecture and Design, Department of Architecture in 2022. Since 2023, he has been continuing his Master of Architecture education at Necmettin Erbakan University.

Hakan BECERİK

In 2021, he graduated from Necmettin Erbakan University, Faculty of Engineering and Architecture, Department of Architecture. He has been continuing his master's degree in architecture at Necmettin Erbakan University Institute of Science and Technology since 2023.

Hayriye Betül ÇETİN

In 2021, he graduated from Necmettin Erbakan University, Faculty of Engineering-Architecture, Department of Architecture. Since 2023, she has been continuing her master's degree in Necmettin Erbakan University Institute of Science and Technology, Department of Architecture.

Muhammed Hıdır AÇ

He graduated from Necmettin Erbakan University Faculty of Fine Arts and Architecture, Department of Architecture in 2022. Since 2023, he has been continuing his master's degree studies in the field of Architecture at Necmettin Erbakan University Institute of Science and Technology.

Nurcan TUNA SARITAĞ

She graduated from Konya Technical University, Faculty of Architecture and Design, Department of Architecture in 2022. Since 2023, she has been continuing her Master study in the Architecture Department at Necmettin Erbakan University.

Suna KARAYER

In 2022, she graduated from Necmettin Erbakan University Faculty of Engineering and Architecture, Department of Architecture. She has been continuing her master's degree in architecture at Necmettin Erbakan University since 2023.