

# Environmental Psychology Perspectives in Design of Architectural Design Studio at Ahmednagar District Region

Pravin B. Jamdade

M. Arch. (Environmental Architecture), SPPU, Pune/DYPSOA, Charholi Bk., Pune, Maharashtra, India

## ABSTRACT

An Architectural design studio is the most utilised space in architectural education, which functions learning as well as hands-on experience of architectural education subjects. It not only has the enormous potential of creating a playful and lively learning environment but also to energise the students. Its architectural design can be explored from the environmental psychology perspective. This research paper is an attempt to analyse and study the environmental psychology perspectives in architectural design of architectural design studio in the Ahmednagar district region. The effects of environmental stressors like temperature, humidity, ventilation, light, colour and noise on students studying in an architectural design studio are analysed. The methodology used in this paper is the quantitative survey research method. A case study through the structured questionnaire surveys of an architectural design studio in the Ahmednagar district region conducted to study the differences between desired and actual interior environmental conditions of the design studio. Data based on environmental psychology perspectives are analysed, and the outcome of this study is expected to be used as recommendations for new architectural studio design proposals in the Ahmednagar district region.

**Keywords:** Stress, Environmental Stressors, Environmental Psychology, Architectural Design Studio

## I. INTRODUCTION

The relation between the human psyche and the physical environment is examined under an interdisciplinary field named 'environmental psychology.' Environmental psychologists have committed themselves to the study of human behaviour in his daily environment to be able to directly or indirectly investigate the effects of the physical environment on human behaviour. As human behaviour and physical environment are closely related to each other, Architects and designers, need to pay special attention to the psychological needs of the occupants. However, minimal research has been done on the impact of ambient environmental stressors on students studying in an architectural

design studio. It is essential to study the effects of environmental stressors on the students so that stress reduction measures can be worked out accordingly. Also, understanding of the same will be useful while designing future built environments of the same function and same occupancy type. This study aims to highlight the importance of environmental psychology perspective in the design of architectural design studio at the Ahmednagar district region. The impact of environmental stressors such as temperature, humidity, ventilation, light, colour and noise on students studying in an architectural design studio is analysed.

## Architectural Design Studio

The design studio in architectural education is the space where students gain theoretical and practical knowledge (fig.1) and learn to transform this knowledge with their creativity to the representation of a design project. Architecture studio classes include distinctive educational techniques, like 'delivering project critics' at a student's desk, project 'juries,' which are the meetings of the students with more than one teacher around, and the multi-layered open discussion where all students are supposed to participate in the same.



Figure 1 Theoretical learning in Architectural design studio



Figure 2 Studio equipped with drafting tables, pin-up boards, projection facility, etc.

Generally, it is equipped with drafting tables, pin-up boards, projection facilities, and a smartboard, etc. (Fig.2). Students are expected to work in these areas, not only during class hours but also in their free time.

Besides, Stamps (1994) stated that students spent their one third to at least one half the academic time of design within the design studio. Environmental stressors like temperature, humidity, ventilation (air movement), colour, light and noise can affect the performance of students studying in the studio. The objective of this paper is to study the possible impact of these environmental stressors on students studying in an architectural design studio.

### Concept of stress

Stress is an individual's response to a disturbing factor in the environment, and therefore the consequence of such reaction. Environmental psychologists are uncertain if stress is the threat itself or the person's perception and response to such a threat. In other words, stress can be defined as "something which is happening to a person as well as the person's response to what's happening" [1]. Perception of psychological and environmental events and, therefore, the physiological and behavioural responses of the individual are involved when stress occurs. Psychological models of stress focusing influence of psychological factors on stress response have developed independently. The transactional model is the best-known by far [2-3]. As per this model, stress is the product of the interaction between a person and the environment. Stress arises not only from the occurrence of an event but also from people's *cognitive appraisal* of the event plus the *coping* strategies they use to handle the event, both of which also influence stress levels [4].

### Stressor

A stressor is a chemical or biological agent, environmental condition, external stimulus, or an event seen as causing stress to an organism [5]. Psychologically speaking, a stressor can be events or environments that individuals might consider demanding, challenging, and or threatening individual safety. An event that triggers the stress

response may include: environmental stressors (e.g., hyper-thermal temperatures, noise, over-illumination, over-crowding, etc.)

### **Environmental Stress**

Environmental stress can be defined as the physiological and psychological responses to an environmental stimulus (or stressor). Environmental stress is taken into account as a primary response to the physical features of the environment.

### **Environmental Stress Theory**

As per the environmental stress theory developed by Lazarus (1966), stress is a product of an external stimulus and an individual's appraisal of their ability to cope with this stimulus. It helps to elucidate why not all environmental stimuli will cause stress for everyone all of the time; whether stress occurs relies on individual and contextual factors. Two types of appraisal are essential: "primary" occurs when assessing the stressor from personal and situational factors, and "secondary" denotes own interpretation of an individual's psychological strategy or adaptation. Environmental stress theory thus has two key elements: an environmental stressor and a personal interpretation of that stressor.

### **Effects of Ambient Environmental Stressors**

Humans encounter a wide range of environmental stressors in their day to day life. In this paper, six commonly studied environmental stressors like temperature, humidity, ventilation (air movement), light, colour, and noise are considered for the study.

### **Temperature & Ventilation**

Temperature is a significant element in thermal comfort, which has a direct effect on the human being. Changes in natural temperature throughout the season, as well as artificial changes with room heaters and air conditioners, are being experienced by a human being. Temperature can affect the human

mind and body in many different ways. Extreme changes in temperature, whether hot or cold, can put physical demands on the body. It can affect the performance level of students, such as poor performance in a classroom due to high temperature. The hotter the room grows, the less is the attention span, and the higher the cognitive interruptions would be. [6] Also, experimented data from Denmark related to the increased ventilation rates in classrooms with improved school performance [7]. Low ventilation rates may end up in increased exposure to indoor air pollutants, assumed to be the primary reason for adverse effects on occupant health and performance [8–10]. In addition to the inadequate ventilation, some studies have correlated elevated indoor temperatures in schools with the impaired performance of students [7,11]. ASHRAE recommends indoor temperatures in the winter be maintained between 20 and 24°C (68–75°F), whereas summer temperatures should be maintained between 23 and 26°C (73–79°F) [12].

### **Light**

Light is usually researched regarding health, for example, within the study of sleep or seasonal psychological disorder. There is lots of evidence that humans function better in optimum light conditions. *Unlike nocturnal animals, arousal levels of human beings tend to be higher when exposed to daylight. The significance of daylight was shown in the research by Smolders et al. (2013), who found that daylight improved feelings of vitality in human beings [13]. Also, other studies have shown that participants perform better on cognitive tasks in "warm" white lighting compared to "cool" or artificial "daylight" lighting [14-15].*

### **Colour**

It's a facet of environmental stress that's often considered to be under-researched. *However, various studies on colour have been carried out to explore a*

variety of factors, including individual differences and their effect on other stressors. Most of the prevailing work has focused on colour about autonomous arousal. It is in the course of the assumption that warm colours like red and yellow are more "arousing" in terms of psychological and physiological outcomes than cooler colours like green or blue. *Some of the early work was contradictory, with some researchers finding red to be more physiologically arousing and others not [16]. However, Pressey (1921) proposed that the brightness of colour can influence performance, which was an element not accounted for by Gerard (1958) or Wilson (1966). Later research that controlled for brightness seems to support the finding that colours such as red can have an impact on arousal levels (Jacobs and Hustmyer 1974). Recent research has also shown that red (versus blue) induces primarily an avoidance (versus approach) motivation, which red enhances performance on a detail-oriented task [17]. In contrast, blue enhances performance on a creative task. These effects occur outside of an individual's consciousness. Despite being less studied, research has also suggested that it can affect other stressors. For instance, rooms with a darker tone of the same colour were perceived to be more crowded than their lighter-toned counterparts, while red rooms have also been perceived as more closed than Blue ones [18-19]. Light coloured rooms are also considered more open and spacious. This study suggests that colours may affect our perception of the environment. Research has also highlighted the importance of individual differences in our perception of colour, which may explain why some studies find significant results, and others do not [20-22]. Dijkstra et al. (2008) found that the green colour of a hospital room appeared to have a more considerable influence on stress reduction and arousal induction in an orange room for participants with low stimulus screening ability, i.e., those who were less able to ignore irrelevant stimuli. Although these authors used photographs of colourful rooms,*

*Küller et al. (2009) found similar results when entire rooms were repainted for the study; participants in the red room experienced greater arousal than those in the blue room. People with personality traits like introversion and negative mood are found to be more affected by the colour of the room than others.*

### **Noise**

The loud and unpleasant sound which causes disturbance is termed as 'noise.' Some of the primary sources of noise are loud music, traffic, ongoing construction work, electrical generators, people, etc. Noise is typically identified by intensity (e.g., decibel), frequency (e.g., pitch), periodicity (continuous or intermittent), and duration (acute or chronic). The psychological component of sound (i.e., unwanted) and its physical components (i.e., intensity) plays the main role in the perception of the noise. Intense, unpredictable, and uncontrollable noise can create negative feelings like irritation and annoyance [24]. Chronic noise negatively impacts people also at a psychological and behavioural level. It affects performance, and it may alter the ability to allocate attention, interfering in the detection of infrequent signals and damaging memory [25-27]. Noise also affects motivation. Children in noisier classrooms have been reported to have lesser achievement motivation [28].

Dissatisfaction, Physical, and psychological stress within the studio environment affect the students' performance. Therefore, the effect of these four environmental stressors needs to be studied.

## **II. THE SETTING OF THE STUDY**

The Studio2 & Studio 4 at Pravara Rural College of Architecture, Loni, were the setting for this study (fig.4). Studios were an example of design studios (5 in numbers) in terms of space characteristics. The reason behind the selection of Studio 2 and Studio 4 is the

### III. METHOD

significant design process taking place in it. These studios have open-plan layout and physical features that allow occupants to be by himself/ herself in the studio (fig.3).

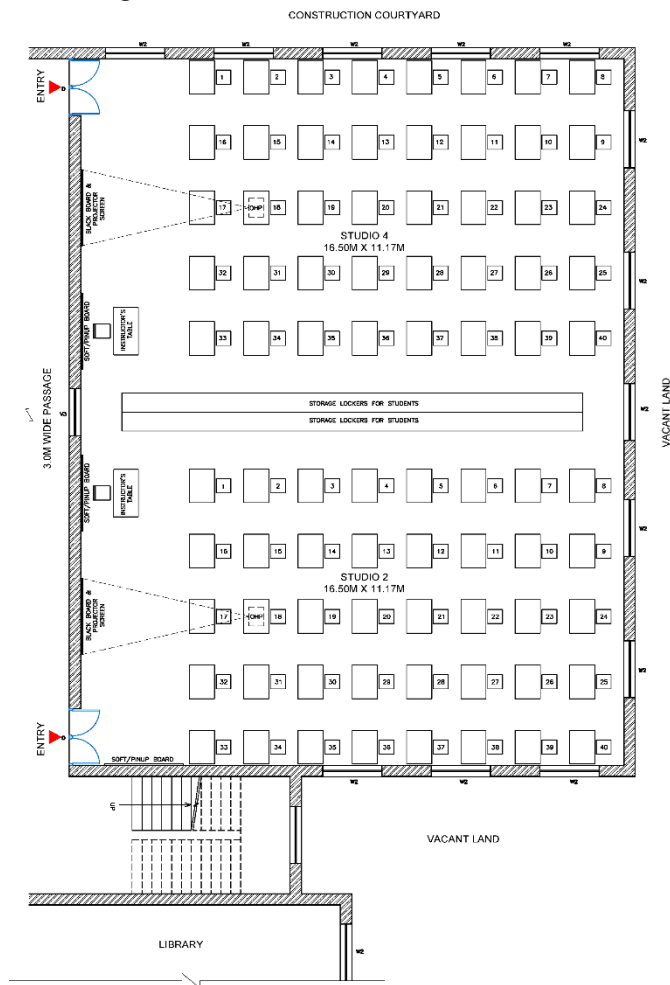


Figure 3 Floor plan of Studio 2 & Studio 4



Figure 4 View from Studio 2

The study was conducted using a structured questionnaire composed of two different sections. Initially, some personal information of participants, such as name, age, and sex, was collected. The first section of the survey had few multiple-choice questions regarding activity they are performing and also regarding their clothing. The second part of the questionnaire consisted of a 7-point scale that measured the sensation of existing interior environmental conditions and the level of expectations for the same. The overall comfort level and the impact of environmental stressors like temperature, humidity, air movement, light, colour, and the noise on the productivity of students were analysed in Q.19 & Q.20, respectively. Q.21 was related to the acceptance of interior environmental conditions. Q.22 was related to the ranking of environmental factors in descending order, i.e. from most affecting to the least affecting the scale of 1 to 5. Q.23 and 24 were related to awareness of the field ‘environmental psychology’. The questionnaire was distributed among the students studying in studio2 and studio 4 to assess the existing interior environmental conditions and their expectation levels for the same. Also, the impact of environmental stressors on their productivity is studied through the questionnaire.

#### *Participants*

There was a total of 62 student participants, of whom 20 (32.3%) were male, and 42 (67.7%) were female. The age range was between 19 to 24, and the mean age of the participants was 21.33 years. Sixty-one (98.4%) participants were wearing a full sleeve shirt with jeans, and one student (1.6%) was wearing a short-sleeve shirt with jeans. (fig.5)

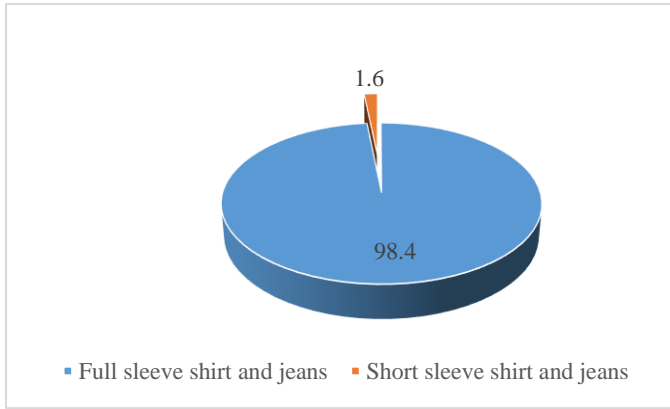


Figure 5 Clothing Type (%)

While the survey was being conducted students wear performing various activities like reading (9.7%), writing (8.1%), thinking (6.5%), Moving around (1.6%), Drafting while standing (29%) and drafting while sitting (45.2%) (Fig.6).

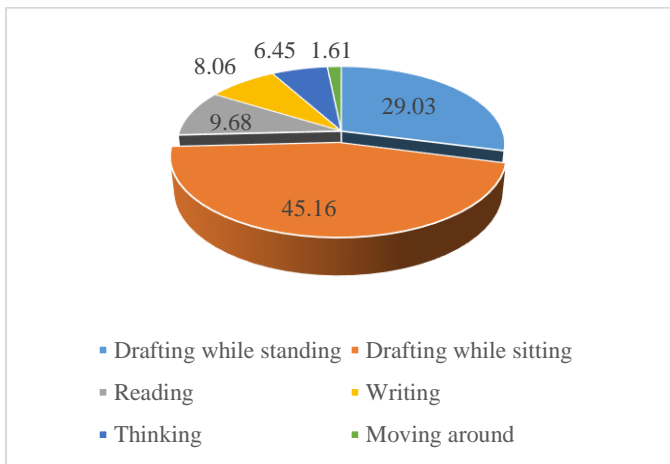


Figure 6 Participants performing particular activity (%)

#### IV. RESULTS

##### Temperature

The analysis of temperature sensation responses and temperature expectations responses is given in fig.7 and fig. 8, respectively. As seen in fig. 7, the majority of the respondents (96.77%) senses the temperature to be 'Warm' ('hot' to 'slightly warm'), while not a single respondent felt that the air was 'cool' ('slightly cool' to 'cold'). It indicates that the temperature of the studio was above the respondent's expectation level.

Only 3.23% felt 'neutral.' As seen in fig.8, 96.77% of participants expect the temperature level to be 'Cool' (slightly cooler to much cooler), while no respondent expects the temperature to be 'warm.' A small percentage of respondents, 3.23%, preferred 'no change' in temperature levels.

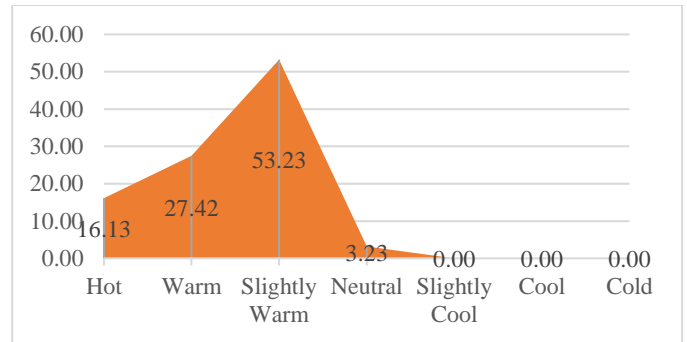


Figure 7. Temperature sensation responses result in percentage

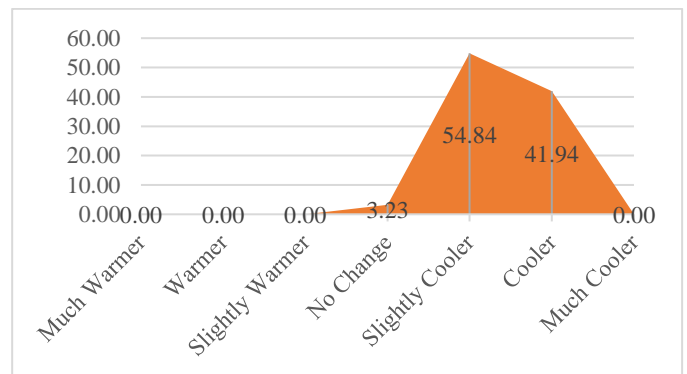


Figure 8 Temperature expectation responses results (%)

##### Humidity

The analysis of humidity sensation responses and humidity expectation responses are given in fig. 9 and 10, respectively. As seen in fig.9, the majority of respondents (72.58%) felt that the air in the studio was 'dry' ('much too dry' to 'slightly dry'), while a small percentage of respondents (9.68%) felt that air was 'humid.' Only 17.74% of respondents felt that the air in the studio was 'just right.' As seen in fig. 10, the majority of the respondents (62.52%) expects the air to be humid ("Slightly humid to 'much too humid') while a very small percentage of respondents (11.29%)

expects the air in the studio to be 'dry.' Around one fourth (24.1%) of respondents do not expect any change in humidity level.

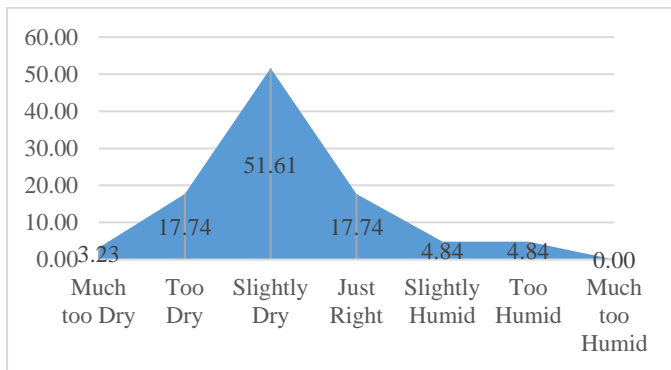


Figure 9 Humidity sensation responses results (%)

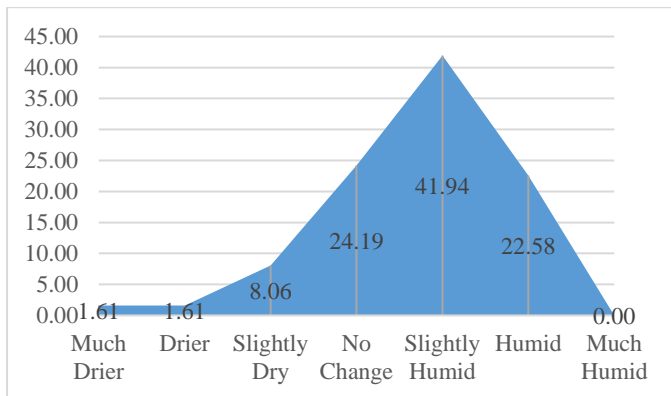


Figure 10 Humidity expectation responses results (%)

### Air Movement

The analysis of air movement sensation responses and air movement expectation responses are given in fig. 11 and 12, respectively. As seen in fig.11, the majority of respondents (88.71%) felt that the air movement in the studio was 'Low' ('very low' to 'slightly low'), while a small percentage of respondents (93.23%) felt that air movement was 'High.' Only 8.06 % of respondents felt that the air movement in the studio was 'just right.' As seen in fig. 12, the majority of the respondents (91.94%) expects the air movement to be 'Higher' ('slightly higher to 'much too higher') while a very small percentage of respondents (4.84%) expects the air in the studio to be 'lower.' A small percentage of respondents (3.23%) do not expect any change in air movement.



Figure 11 Air movement sensation responses results (%)

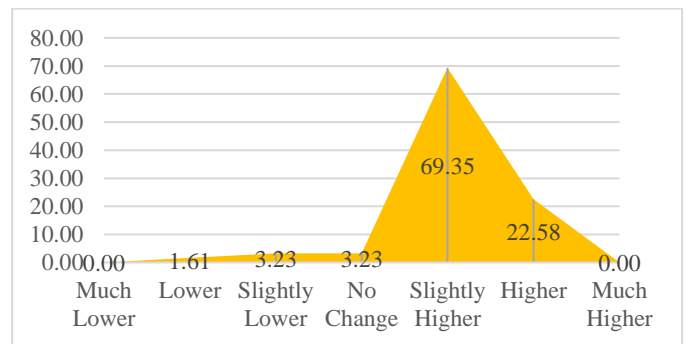


Figure 12 Air movement expectation responses results (%)

### Natural Light

The analysis of natural light sensation responses and natural light expectation responses are given in fig. 13 and 14, respectively. As seen in fig.13, the majority of respondents (72.58 %) felt that the natural light level in the studio was 'Dim' ('very dim' to 'slightly dim'), while a small percentage of respondents (9.68%) felt that natural light level was 'Bright.' Only 17.74 % of respondents felt that the natural light level in the studio was 'neither bright nor dim.' As seen in fig. 14, the majority of the respondents (82.26%) expect the natural light to be 'Brighter' ('slightly brighter to 'much brighter'). No respondent (0%) expects the natural light to be 'Dimmer.' A small percentage of respondents (17.74%) does not expect any change in indoor natural light level.

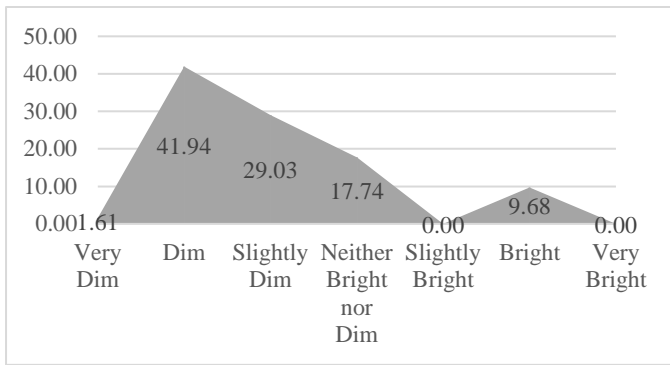


Figure 13 Natural light sensation responses results (%)

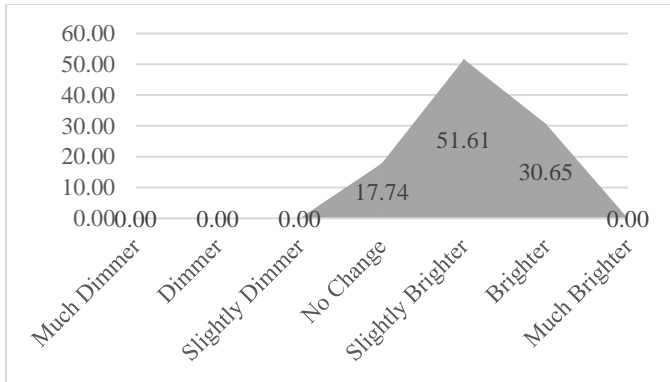


Figure 14 Natural light expectation responses results (%)

### Colour

The analysis of colour’s impact on productivity given in fig. 15. As seen in fig.15, the majority of respondents (64.52 %) stated that the actual colour of the studio (Neutral colour scheme) does not affect their productivity level. Around one-third of respondents (29.03%) stated that the existing colour scheme is decreasing their productivity level. In comparison, 17.74 % of respondents stated that the existing colour scheme of the studio effects in an increase in their productivity level. As per this analysis, we can state that the neutral colour scheme neither results in increased performance nor decreased performance.

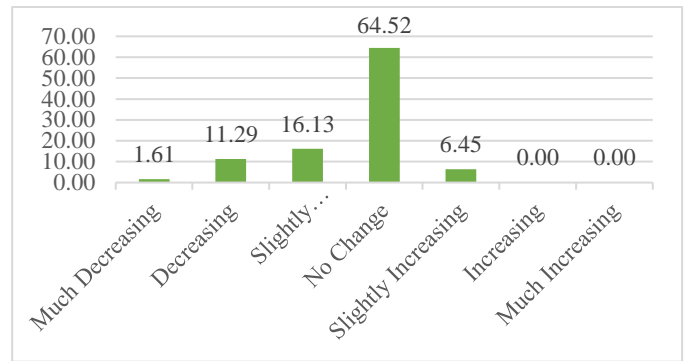


Figure 15 Impact of colour on productivity responses results (%)

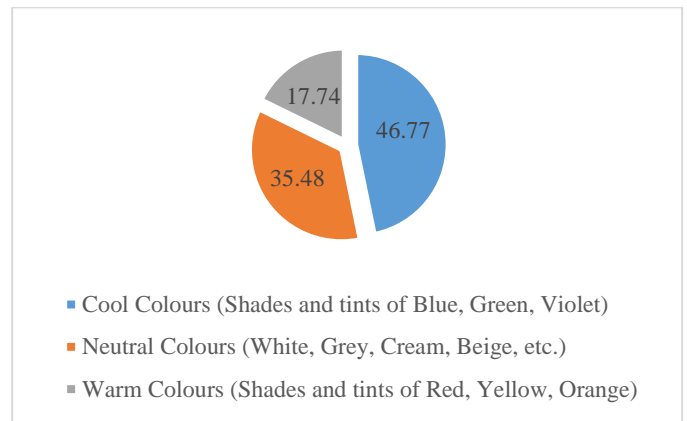


Figure 16 Colour preference for studio responses results (%)

The analysis of colour preference for studio responses is given in fig. 17. As seen in fig.16, the majority of respondents (46.77 %) stated that to increase their productivity, they would prefer a cool colour scheme for their studio. In comparison, 35.48 % of respondents stated that they would prefer a neutral colour scheme for the studio. Only 17.74 % stated that they would prefer a warm colour scheme for the studio.

### Noise

The analysis of sound level sensation responses and sound level expectation responses are given in fig. 17 and 18, respectively. As seen in fig.17, the majority of respondents (77.42 %) felt that the sound level in the studio was ‘unacceptable’ (‘absolutely unacceptable’ to ‘slightly unacceptable’). In comparison, a small percentage of respondents (8.06%) felt that the sound



level in the studio was 'Acceptable.' Only 14.52 % of respondents felt that the sound level in the studio was 'just perfect.' As seen in fig. 18, the majority of the respondents (67.74%) expects the sound level to be 'lower' ('slightly lower to 'much lower'), while 17.74% respondents expect sound level to be 'higher' ('Much higher' to 'slightly higher'). Only 14.52% of respondents do not expect any change in sound levels.

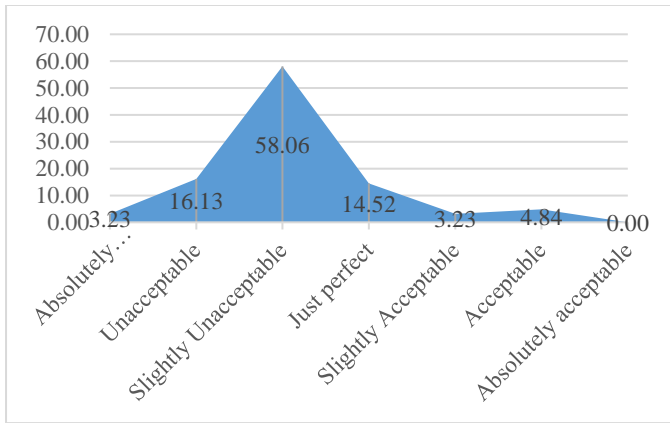


Figure 17 Sound sensation responses results (%)

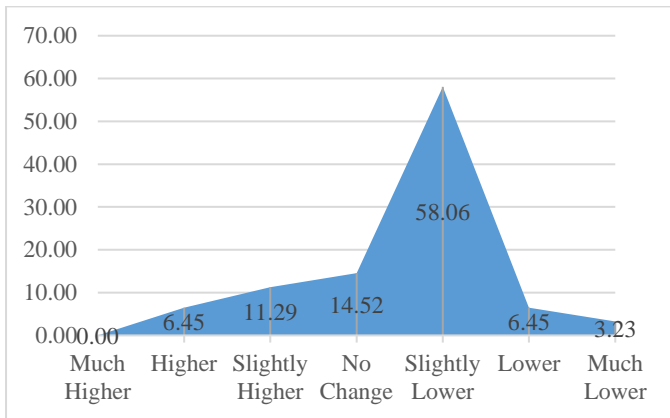


Figure 18 Sound expectation responses results (%)

**Overall comfort**

The analysis of the overall comfort levels of respondents is given in fig. 19. As seen in fig. 20, the majority of respondents (75.81%) felt 'uncomfortable' ('very uncomfortable' to 'fairly uncomfortable'), while 8.06% of respondents felt 'comfortable' ('fairly comfortable' to 'very uncomfortable'). Only 16.13% of respondents felt neutral (neither comfortable nor uncomfortable).

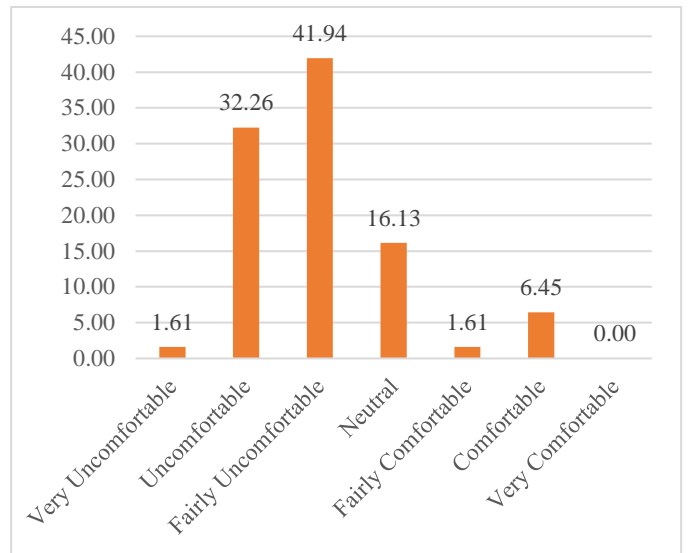


Figure 19 Overall comfort level responses results (%)

**Effect of environmental conditions on productivity**

The analysis of environmental conditions' effect on productivity is given in fig. 20. As seen in fig.20, the majority of respondents (77.42 %) stated that their productivity in the existing environmental condition was 'Lower than normal' ('much lower than normal' to 'slightly lower than normal'). In comparison, 3.23% of respondents stated that their productivity level was 'Higher than normal' ('slightly higher than normal' to 'much higher than normal'). Only 19.35% of respondents stated that their productivity levels were 'normal.'

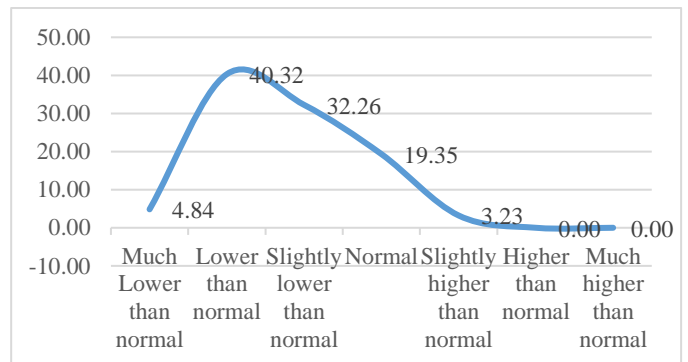


Figure 20 Effect of environmental conditions on productivity responses results (%)

**Acceptance of interior environmental conditions**

The analysis of acceptance of interior environmental conditions is given in fig. 21. As seen in fig.21, the majority of respondents (79.03 %) does not accept the

existing environmental conditions of the studio, while 20.97% of respondents accept the existing interior environmental conditions of the studio.

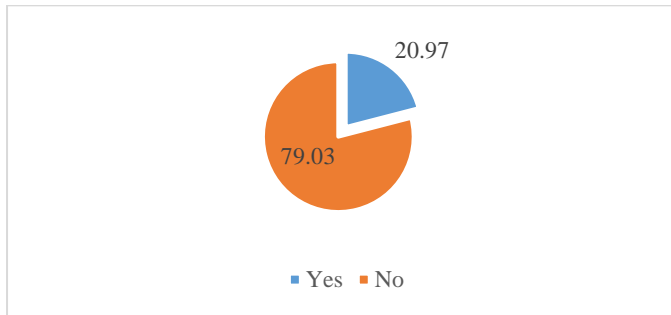


Figure 21 Acceptance of interior environmental conditions responses result (%)

*Ranking analysis of environmental factors*

The ranking analysis of environmental factors affecting performance is given in fig. 22. Respondents responses to temperature as ‘most affecting environmental factor.’ According to the average rank (Table no.1), the factors can be identified from the ‘most affecting’ to the ‘least affecting’ the performance, as follows: Temperature, Air movement, Noise, Light and Colour (fig.22)

	Ra nk 1	Ra nk 2	Ra nk 3	Ra nk 4	Ra nk 5	Tot al	Over all Rank
<b>Temp.</b>	49	6	2	3	2	283	<b>1</b>
<b>Air Movement</b>	4	26	26	4	2	212	<b>2</b>
<b>Light</b>	1	12	9	36	4	156	<b>4</b>
<b>Colour</b>	2	2	1	3	54	81	<b>5</b>
<b>Noise</b>	6	16	24	16	0	198	<b>3</b>

Table No.1 Ranking responses results for Environmental factors affecting performance

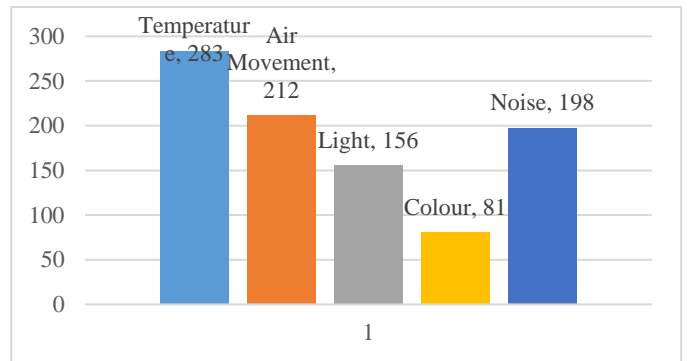


Figure 22 Ranking of environmental factors affecting performance

*Awareness of environmental psychology*

Responses results regarding the need for paying attention to the psychological needs of occupants are given in table no.2. As seen in table no.2, the majority of respondents (95.2 %) felt that architects and designers should pay special attention to the psychological needs of the occupants while designing.

	Responses	Percentage
<b>Yes</b>	<b>59</b>	<b>95.2</b>
<b>No</b>	<b>03</b>	<b>04.8</b>
<b>Total</b>	<b>62</b>	<b>100.00</b>

Table 2. ‘need for paying attention to the psychological needs of occupants’ responses results

58.1% of respondents were aware of the field ‘environmental psychology’, while 41.9% of respondents were not aware of the field.

**V. LIMITATIONS AND SUGGESTIONS**

As a limitation of this study, some students might have over-reported or underreported their environmental stress related to mentioned environmental stressors. It is also possible that individuals who indicated no stress had different expectations than those who experienced stress. Finally, to continue the research further, it is recommended to study the mentioned environmental stressors in an experimental method.

## VI. CONCLUSION

In this study, interior ambient environmental stressors like temperature, humidity, ventilation (air movement), light, colour and noise were extracted from various sources and researches in the field of environmental psychology. A questionnaire-based on these environmental stressors were designed to assess the existing interior environmental conditions and expectation for the same. It also helps to analyse the impact on environmental stressors and also the differences between desired and actual interior environmental conditions of the design studio. And additionally, it also helped in ranking environmental factors in descending order, i.e. from the most affecting factor to the least affecting factor.

Results indicate that the differences in existing and expected environmental conditions are resulting in lower productivity levels of respondents. Also, as per the ranking analysis, Temperature, air movement and sound levels had a major impact on the performance of respondents where light and the colour had a negligible impact on the performance of the respondents. Understanding theories of environmental psychology could play an important role in the design of architectural design studios. These results can provide recommendations to architects, landscape designers, interior designers, planners and policymakers who are interested in creating a healthier learning environment for architecture students.

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