EMPLOYEES COMFORT LEVEL IN EXISTING LIGHTING AT ARFA SOFTWARE TECHNOLOGY PARK (ASTP): A CASE STUDY

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ABSTRACT
Introducing the proper lights in workplaces is significant so as to make an ideal place. The present investigation has conducted on the responses of employees about artificial and natural light, working at Arfa Software Technology Park (ASTP), the one of the building embedded with modern technology in Pakistan. The questionnaire is filled by 400 employees engaged on two selected floors for which researcher seeks permission. The artificial lighting bulbs in general and natural lighting through windows is provided there. The employees consider artificial lighting attractive, efficient, comfortable and bright but they also feel strain on their eyes. They can control light through dimers and that's why they do not require to change light falling on their work desk. They have also considered natural light comfortable but want to control more glare through window blinds. The ample amount of sunlight comes through windows on their work desk which also effect their efficiency of work. The respondent's views can help to eliminate deficiencies in present lighting and also establish a way to develop lighting in such type of buildings.

Keywords employees, response, comfort, interior lighting, technology

INTRODUCTION

Light is essential to locate, guide and mobilize humans to work on around the world. The natural lighting is accompanied with artificial lighting which is the effort to cater darkness. The next step is to find the ways to use both lighting types to look around clearly, easily and without discomfort. The offices required the right lights so that the workplace feels comfortable and workers can retain good behaviour which also help them to raise outputs and reduce failures in the company results [1, 11].

These are requirements and demands which give direction for solutions to improve visibility through lights. The energy conservation can also be achieved by the combination of natural sunlight and artificial lighting which also provides maximum lighting, lighting control system also help in adjusting the right amount of light [2, 7, 12, 13].

For many applications, natural lighting is insufficient, and needs to be combined with artificial lighting systems. people can choose to use the control of light individually which not affect the performance [3, 13].

Light is also being used as a tool to experience the variations in consumers' attitude, behavior and mood, especially in commercial spaces. Bitner (1992) analyzed that good lighting plans tend people to stay longer in the shop as well as increases sales number. It also satisfies consumers' cognitive, emotional and biological mood which also effect on purchase behavior and product preference [4, 7, 8].

Shaver's work on emotions also helped in developing tools for assessing the comfort level of users in different spaces [5].

The combination of color and light also stress on the productivity in office spaces so relationship and performance also impacted by luminance [6,7].

Artificial lighting can be attractive in the way of using right level and color of it. Lighting can gain attention than any other interior element when used rightly. It is not always true that ample light is the emphasizing element but it can be, because the designers of the era may create shadows and contrasts to highlight the space [8].

The use of color rendering index and accurate, task-oriented lighting can retain best mood for longer duration. It can also help in performance enhancement and problem solving [8,9].

Thus, individual mood variations and their mental stamina can be changing because of the lighting. This concludes that principals of good indoor lighting always can be revised according to situation and task but the most important is gender and their emotional and intellectual responses [10, 11].

The lighting parameters can measure the influences of illumination on mood during the stay in interiors, the impacts can be very systematic [12].

The researches also showed that clear sunlight and open windows without blinds also contribute in the conservation of artificial energy consumption up to 50–60% in average during twelve hours [13, 14].

The selected structure, Arfa Software Technology Park (ASTP) is one of the country's leading information and communications technology building. The place is considered first international standard facility for Pakistanis [15].

METHODOLOGY

A survey was conducted to analyze the responses of the employees working on selected floors (11^{th} and 13^{th}) in ASTP, about 200 questionnaires were filled from each floor to know the comfort level of the employees in artificial and natural light, available at their work place. The above-mentioned floors were selected because of the permission granted from authorities of ASTP and also purposefully selected from the top floors because the requirement of the study was to work on both natural lights coming through windows along with general artificial light.

In this study, OBEAs tool with Shaver's categorized emotions were used as a guide line and assessed on 5-point Likert scale [5, 14]. The scale includes the following

sequence: 1. Strongly agree, 2. Agree, 3. Neutral, 4. Disagree, 5. Strongly disagree, which was used in table 3 and 4.

Observational Detail about Arfa Software Technology Park (ASTP)

The observation of the researcher about 11th and 13th floor concluded that both floors were almost same in their distribution of space but due to privacy policy the floor map or pictures were not given here. The both floors consisted on large hall divided into partial cabins for each employee with 16 large windows of almost 5 feet divided equally on walls in rows. Furniture of the building includes wing chairs, wooden office tables, leather sofas on reception and cabinet office tables. Led lights and fluorescent lights were installed in ceiling. This study has compared only two floors' lighting.

DATA ANALYSIS

The employees in ASTP filled the questionnaire, the most of the respondents were between age limit of 25 years to 55 years on both 11th and 13th floor, majority of respondents were qualified with masters and above degree. There were 80% female employees on both floors.

Table 1 Responses of Employees about Lighting in their Work Place at ASTP

11th floor		13th floor	
Feeling	Percentage	Feeling	Percentage
Comfortable	40.0	Comfortable	90.0
Spaciousness	10.0	Spaciousness	0.0
Inviting	10.0	Inviting	10.0
Appealing	30.0	Appealing	0.0
No feeling	10.0	No feeling	0.0
Total	100.0	Total	100.0

Table 1 shows that on 11th and 13th floor 40% and 90% employees feel comfortable, 10% and 0% feel spaciousness, 10% and 10% feel inviting, 30% and 0% feel appealing, 10% and 0% have no feeling about the lighting in their working area, respectively.

It concludes that employees consider lighting in their working area comfortable, inviting and spacious.

Table 2 Preferred Light Color of Employees in their work place at ASTP

11th floor		13th floor	
Colors	Percentage	Colors	Percentage
White	80.0	White	70.0
Yellow	20.0	Yellow	30.0
Blue	0.0	Blue	0.0
Green	0.0	Green	0.0
Colored lights	0.0	Color lights	0.0
Total	100.0	Total	100.0

Table 2 shows that from 11th and 13th floor, white light is preferred by 80% and 70% employees and yellow light is preferred by 20% and 30% employees, respectively.

It concludes that employees preferred white light but a little preference is shown for yellow light. Blue, green and colored lights are not preferred by employees at ASTP.

Table 3 Employees' Responses about Artificial Lighting in their Work Place at ASTP

Sr. no. Artificial lighting attributes	*Floors*	*1*	*2*	*3*	*4*	*5*
1 Feel attractive	*11th*	*20*	*40*	*10*	*20*	*10*
	13th	*25*	*45*	*0*	*25*	*5*
2 Feel efficient	*11th*	*30*	*45*	*10*	*15*	*0*
	13th	*25*	*50*	*10*	*15*	*0*
3 Feel strain on eyes	*11th*	*20*	*45*	*15*	*20*	*0*
	13th	*30*	*30*	*20*	*10*	*10*
4 Can control light	*11th*	*30*	*55*	*10*	*5*	*0*
	13th	*30*	*60*	*10*	*0*	*0*
5 Feel comfortable	*11th*	*25*	*35*	*20*	*10*	*10*
	13th	*30*	*40*	*10*	*10*	*10*
6 Need to change light falling on the work desk	*11th*	*25*	*40*	*15*	*20*	*0*
	13th	*30*	*30*	*10*	*20*	*10*
7 Feel brightness	*11th*	*40*	*30*	*05*	*15*	*10*
	13th	*35*	*40*	*10*	*15*	*10*
8 Effect efficiency of work	*11th*	*40*	*40*	*0*	*15*	*5*
	13th	*30*	*50*	*5*	*10*	*5*

Table 3 shows, employees' responses from 11th and 13th floor about artificial light in their work station which is mentioned serial wise in the following paragraphs, respectively:

1. 20% and 25% strongly agree, 40% and 45% agree, 10% and 0% neutral, 20% and 25% disagree, 10% and 5 % strongly disagree, respectively, about artificial light to feel attractive.
2. 30% and 25% strongly agree, 45% and 50% agree, 10% and 10% neutral, 15% and 15% disagree, 0% and 0 % strongly disagree, respectively, about artificial light to feel attractive.
3. 20% and 30% strongly agree, 45% and 30% agree, 15% and 20% neutral, 20% and 15% disagree, 0% and 10 % strongly disagree, respectively, about artificial light to feel efficient.
4. 30% and 30% strongly agree, 55% and 60% agree, 10% and 10% neutral, 5% and 0% disagree, 0% and 0 % strongly disagree, respectively, about artificial light to feel the strain on eyes.
5. 25% and 30% strongly agree, 35% and 40% agree, 20% and 10% neutral, 10% and 10% disagree, 10% and 10 % strongly disagree, respectively, about artificial light to control light.
6. 25% and 30% strongly agree, 40% and 30% agree, 15% and 10% neutral, 20% and 20% disagree, 0% and 10 % strongly disagree, respectively, about artificial light to need to change, falling on the work desk.

7. 40% and 35% strongly agree, 30% and 40% agree, 5% and 10% neutral, 15% and 15% disagree, 10% and 10% strongly disagree, respectively, about artificial light to feel brightness in it.
8. 40% and 30% strongly agree, 40% and 50% agree, 0% and 5% neutral, 15% and 10% disagree, 5% and 5 % strongly disagree, respectively, about artificial light to effect the efficiency of work.

It concludes that employees of A feel artificial light attractive, efficient, comfortable and bright but they also feel the strain on their eyes while staying in artificial light so they control light through dimers and that's why they do not need to change light (source) falling on the work desk. Employees feel brightness in the light which also affect the efficiency of their work.

Table 4 Employees' Responses about Natural Lighting in their workplace at ASTP

Sr. no. Natural lighting attributes	Floors	1	2	3	4	5
1 Feel comfortable	*11th*	*20*	*40*	*10*	*20*	*10*
	13th	*25*	*40*	*5*	*5*	*25*
2 Want to control light	*11th*	*25*	*45*	*0*	*25*	*5*
	13th	*30*	*48*	*12*	*10*	*0*
3 Feel glare most of the time	*11th*	*30*	*45*	*10*	*15*	*0*
	13th	*40*	*40*	*10*	*10*	*0*
4 Can control light	*11th*	*25*	*50*	*10*	*15*	*0*
	13th	*30*	*30*	*10*	*20*	*10*
5 Ample amount of natural light	*11th*	*30*	*45*	*15*	*10*	*0*
	13th	*45*	*40*	*15*	*0*	*0*
6 Need to change light falling on work desk	*11th*	*30*	*30*	*20*	*10*	*10*
	13th	*20*	*20*	*20*	*30*	*10*
7 Sufficient number of windows	*11th*	*30*	*55*	*10*	*5*	*0*
	13th	*40*	*30*	*10*	*10*	*10*
8 Effect efficiency of work	*11th*	*30*	*60*	*10*	*0*	*0*
	13th	*20*	*20*	*20*	*30*	*10*

Table 4 shows, employees' responses from 11th and 13th floor about natural light coming into their work station which is mentioned serial wise in the following paragraphs, respectively:

1. 20% and 25% strongly agree, 40% and 40% agree, 10% and 5% neutral, 20% and 5% disagree, 10% and 25 % strongly disagree, respectively, about natural light to be comfortable.
2. 25% and 30% strongly agree, 45% and 48% agree, 0% and 12% neutral, 25% and 10% disagree, 5% and 0 % strongly disagree, respectively, about artificial light to feel attractive.
3. 30% and 40% strongly agree, 45% and 40% agree, 10% and 10% neutral, 15% and 10% disagree but nobody strongly disagrees, respectively, who want to control natural light.
4. 25% and 30% strongly agree, 55% and 30% agree, 10% and 10% neutral, 15% and 20% disagree but nobody disagrees, respectively, from getting an ample amount of natural light. 0% and 10 % strongly disagree, respectively, says that they can control the light coming from windows.
5. 30% and 45% strongly agree, 45% and 40% agree, 15% and 15% neutral, 10% and 0% disagree but nobody strongly disagreed, respectively, disagree but nobody disagrees, respectively, from getting ample amount of natural light.
6. 30% and 20% strongly agree, 30% and 20% agree, 20% and 20% neutral, 10% and 30% disagree, 10% and 10 % strongly disagree, respectively, about the need to change light falling on the work desk.
7. 30% and 40% strongly agree, 55% and 30% agree, 10% and 10% neutral, 5% and 10% disagree, 0% and 10% strongly disagree, respectively, about having a sufficient number of windows.
8. 30% and 20% strongly agree, 60% and 20% agree, 10% and 20% neutral, 0% and 30% disagree, 0% and 10% strongly disagree, respectively, about the effect on the efficiency of work.

It concludes that employees of ASTP feel natural light comfortable but want to control light because they feel glare for most of the time even, they can control the light coming from windows. They also want to change light falling on their work desk because of the ample amount of natural light coming in from the windows which are present in sufficient numbers and also affect their efficiency of work.

SUMMARY AND CONCLUSION

The general lighting type was provided on two selected floors in Arfa Software Technology Park with both artificial lighting bulbs and natural lighting through windows. The 80% of the employees were females, between age ranges from 25 to 55 years, most of them were having a master's degree. The employees' responses about lighting condition showed that they consider it attractive, efficient, comfortable and bright but they also feel the strain on their eyes while staying in artificial light so they control light through dimers and that's why they do not need to change light (source) falling on the work desk. They also considered natural light comfortable, but want to control light because they felt glare for most of the time even they have access to control light through window blinds. They also want to change light falling on their work desk because of an ample amount of natural light coming in through the windows which are sufficient in number so it also effect their work efficiency. The respondent's views can help to eliminate deficiencies in lighting and also establish a way to develop lighting in such types of buildings.

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