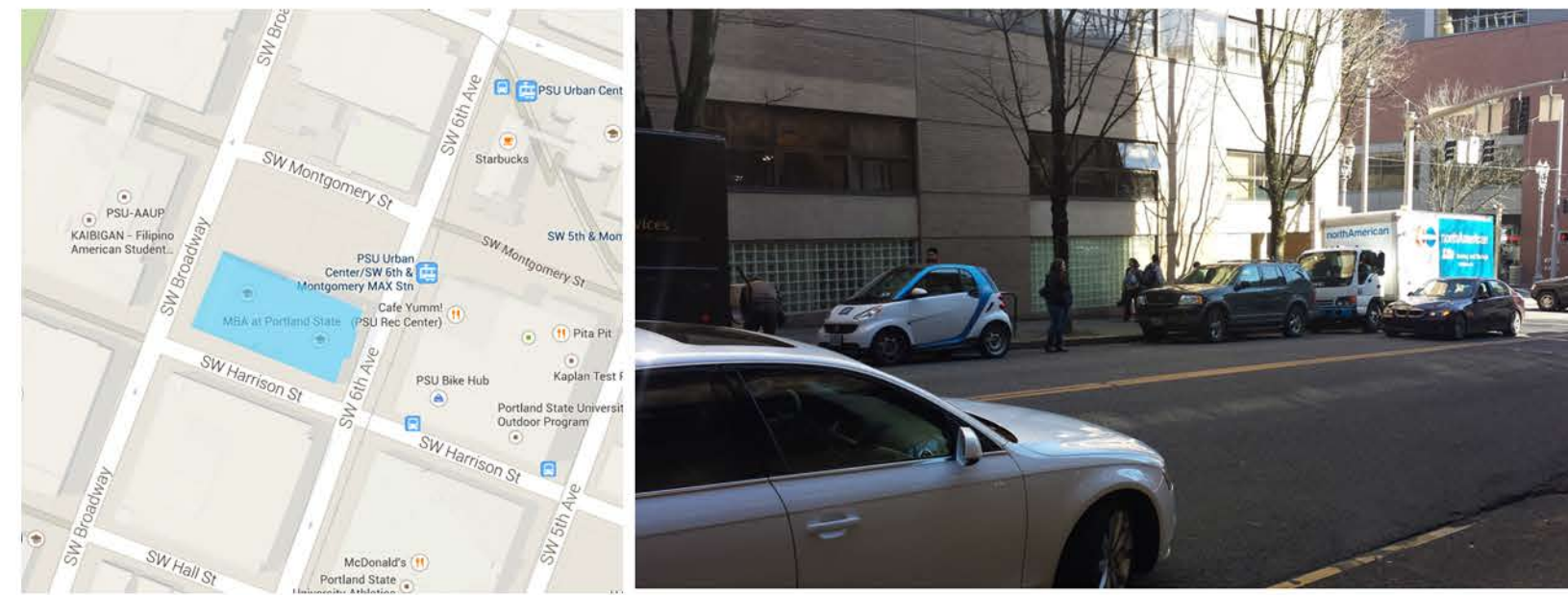


# PSU Business School Renovation + Personal Comfort

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## Introduction

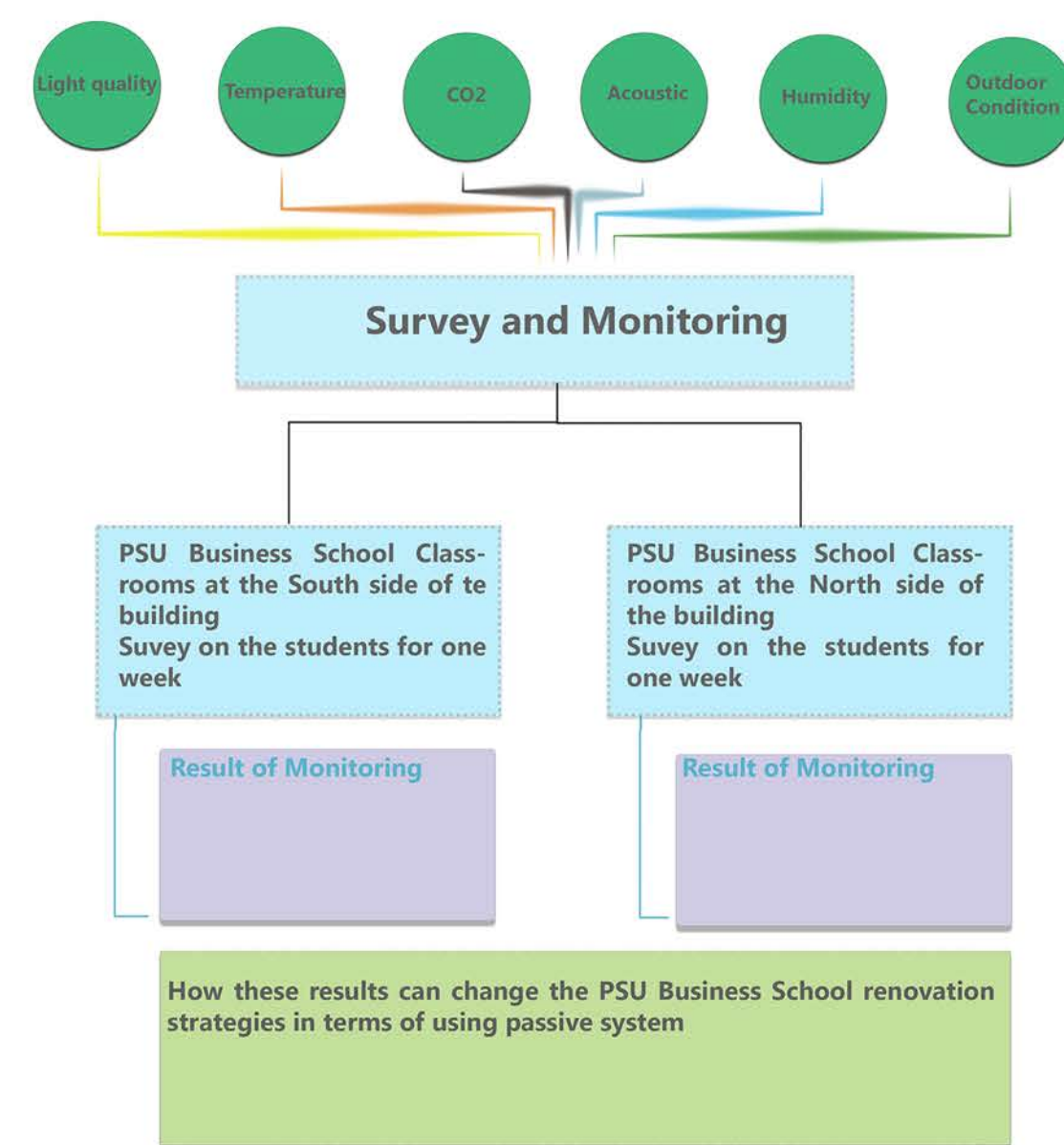
Assessing the Indoor Environmental Quality (IEQ) is the first step to design a low energy building and to ensure the comfort of the occupants are satisfied based on high quality standards. Schools are a category of buildings in which a high level of environmental quality considerably improves occupants' attention, concentration, learning, hearing and performances. A common practice to evaluate thermal comfort and indoor air quality perception is to assess the occupants' satisfaction regarding the indoor environment.

The SRG design group intended to renovate the PSU Business school and use passive strategies in order to reduce the amount of energy. The first step of this renovation was to investigate the current condition of this educational building in terms of temperature, humidity, air quality (CO2), and sound. Therefore, two classrooms have been chosen on the ground floor, one on the south and the other one on the north sides of the building.

## Goals

- 1- Understanding the real environmental condition by monitoring four environmental parameters (Temperature, Relative humidity , CO2, Sound ) and tracking outdoor condition.
- 2- Investigation on the personal comfort of students by questionnaire survey.
- 3- Correlate the monitoring and survey for future passive design strategies and renovation.

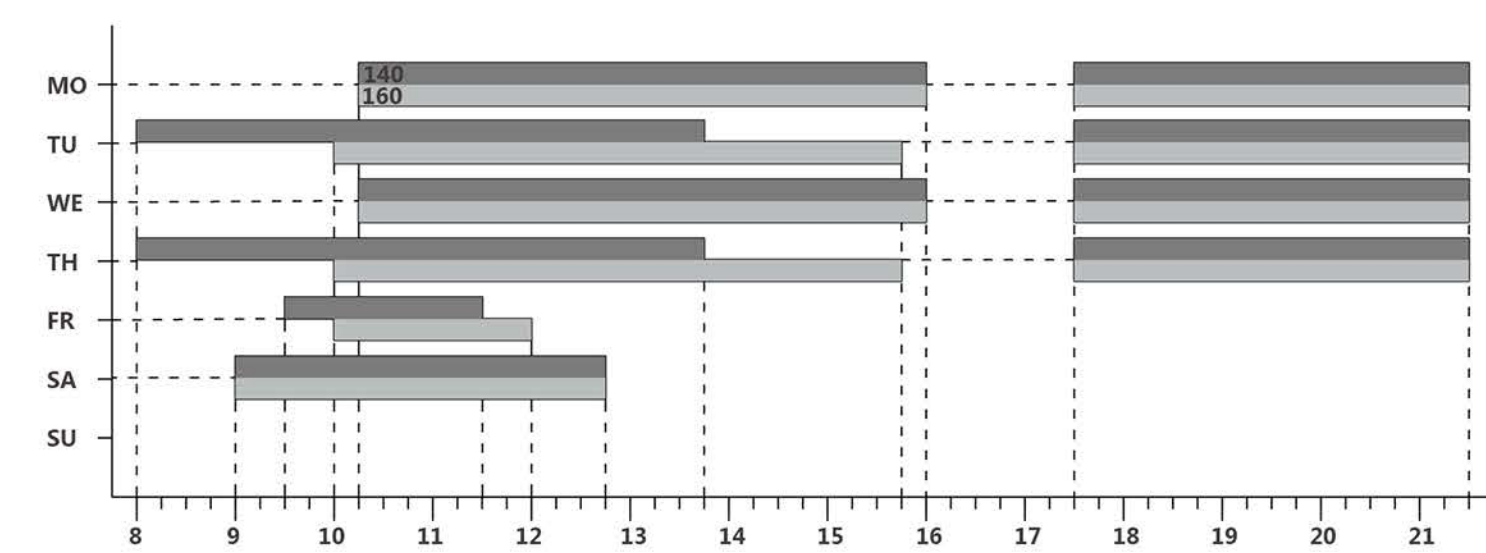
## Methodology



## Monitoring



Class schedule were considered to investigate the effects of the time during the day on the students thermal feelings.



## Survey Consequences

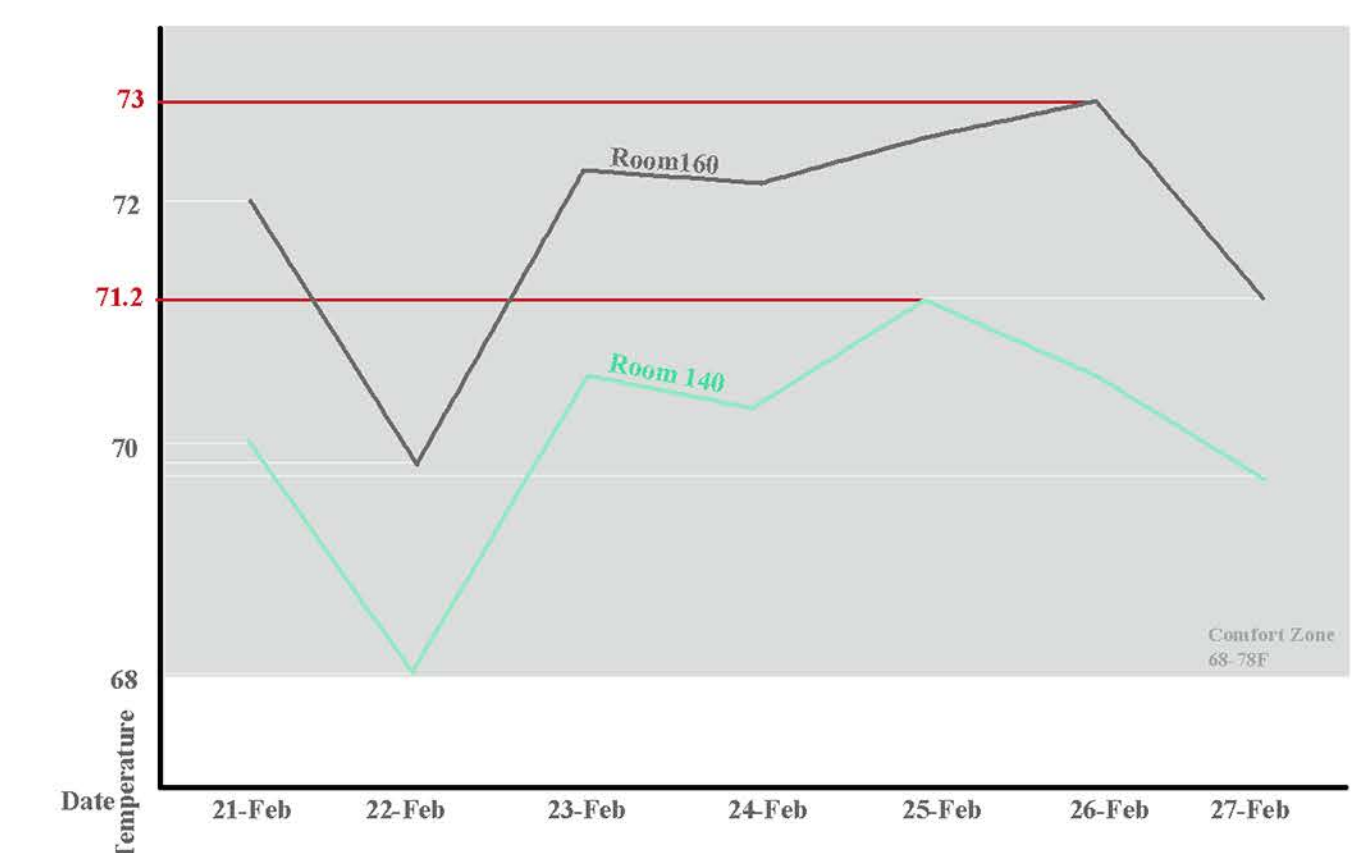
	140 (South)			160 (North)		
	Satisfied	Neutral	Unsatisfied	Satisfied	Neutral	Unsatisfied
Temperature Satisfaction	78%	15%	9%	72%	12%	16%
Temperature Fluctuation	12%	18%	70%	6%	22%	72%
Cold Neutral Hot	13%	66%	21%	17%	56%	27%
Overall Temperature Rate Satisfaction	75%	12%	13%	58%	19%	23%
<b>Lighting:</b>						
Bright Neutral Dim	32%	44%	24%	24%	65%	11%
Blind( Close Neutral Open)	55%	28%	17%	16%	32%	52%
Overall lighting quality	58%	20%	22%	57%	33%	10%
Noise Level Satisfaction	48%	35%	17%	65%	23%	12%
Air Quality Satisfaction	46%	46%	8%	48%	14%	38%
Overall the Comfort Level Satisfaction	55%	25%	20%	54%	30%	16%

The following items are the most distracting elements that students feel making noise.

- | Room           | Noise Sources  |
|----------------|--|
| Room 140 South | <ol style="list-style-type: none"> <li>1- People Talking outside room</li> <li>2- Outdoor Traffic Noise</li> <li>3- MAX Passing</li> <li>4- Other External Noise</li> <li>5- Car Passing and Internal Classroom noise</li> <li>6- Room Lighting or Mechanical Noise</li> </ol> |
| Room 160 North | <ol style="list-style-type: none"> <li>1- People Talking outside room</li> <li>2- MAX Passing</li> <li>3- Other External Noise</li> <li>4- Interior Classroom Noise and Traffic Noise</li> <li>5- Car Passing and Room Lighting and Mechanical Noise</li> </ol>                |

Sound 71-89 (db)  
 Normally, the sound's decibel is around 76. Mostly car passing in the parking lot at the South side of the building makes lots of noises in rush hours (89db).

## Monitoring Results



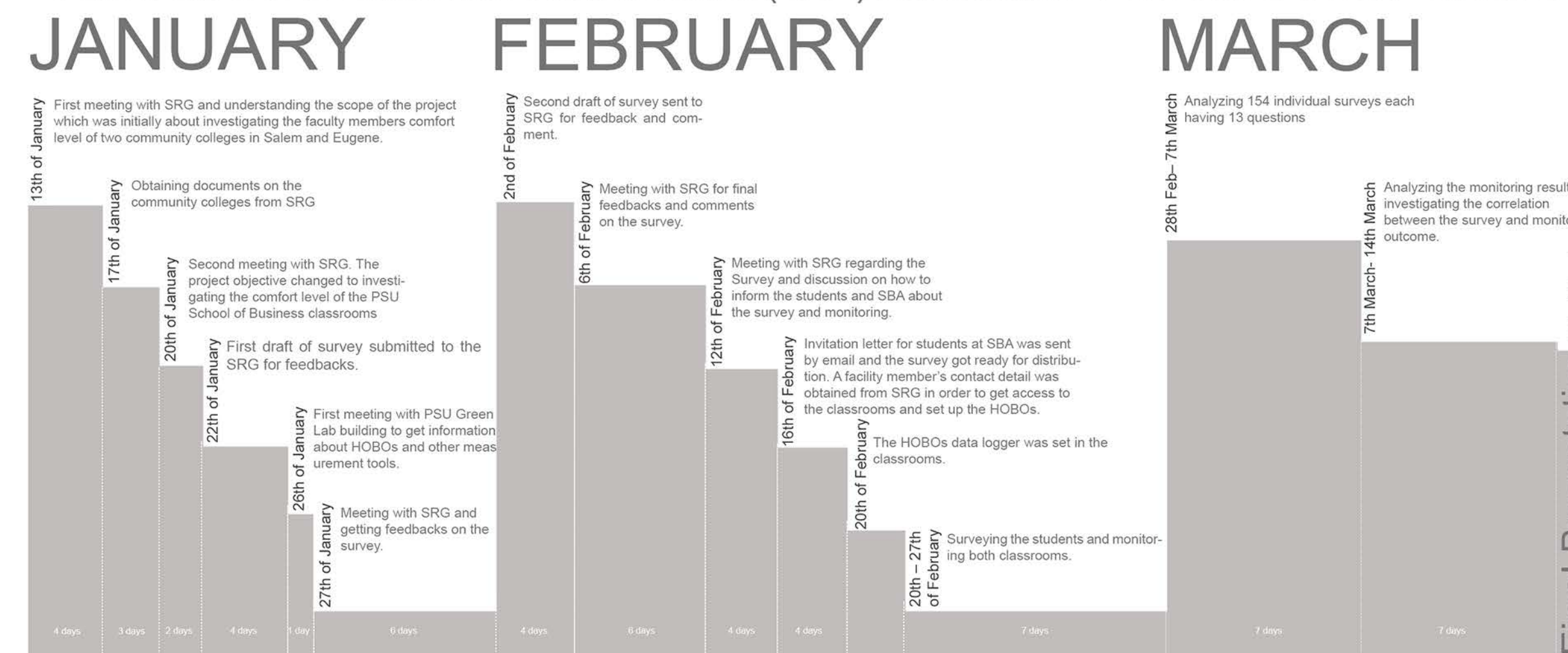
The average of the relative humidity in one week is in a comfort zone for

	Room 140	Room 160
Relative Humidity	32.8	30.52

Carbon Dioxide has a normal rate in these two classrooms.

	CO2
	481-750

## PSU's School of Business Administration (SBA) Renovation+Personal Comfort Timeline



## Final Result

Based on the survey's results, the temperature is satisfactory in these two classrooms and it is not fluctuating a lot while the class is operating. Moreover, students who said that the rooms are hot are double than students who claimed that classrooms are cold. Additionally, based on the monitoring, classroom 160 has a higher temperature about 2 degrees Fahrenheit as compared to 140. This fact has been approved by the students in the survey. In general, people are satisfied with the rooms' temperature.

Lighting intensity in these two rooms are bright and satisfactory. Students at room 140 prefer to close the blinds while they are at the class. On the other hand, students who are in the 160 prefer to open the blinds. Overall, students are satisfied with the lighting quality.

The noise level and air quality are satisfactory in these two classrooms. For 140 people talking outside the room are making most of the noises following by outdoor traffic noises and MAX respectively. For this reason using operable windows to renovate PSU Business School is not a good idea. For 160 as 140, people talking outside the room is the most important factor that makes noise. Because this room is not close to the parking lot and street, therefore, the outdoor traffic noises are least factors that make noises. But MAX passing has the second position in this list. Perhaps having a solution to keep indoor people noises away from these classrooms would be the first step to enhance the noise level in these two classrooms.

In conclusion, people are satisfied with the thermal comfort of these two rooms. However, lots of suggestions in their renovation strategies could enhance the air quality, temperature, relative humidity, and sound in these two classrooms.