

MINNESOTA



POST-OCCUPANCY EVALUATION

**Indoor Environmental Quality + Workplace Environment
Ridgewater College Student Center (Building A) (RCSC-A)
Willmar, MN**

**March 2016, Minneapolis, MN
Sustainable Post-Occupancy Evaluation Survey (SPOES)
B3 Guidelines**

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1.0 Overview

The purpose of this report is to examine the connection between sustainable design criteria used in the design of the Ridgewater College Student Center-Building A (RCSC-A) facility and occupants' satisfaction with their work environments located in the facility. The RCSC-A facility was designed using the B3 Guidelines (formerly known as the Minnesota Sustainable Building Guidelines or MSBG) and completed for occupancy in October 2014. The B3 Guidelines track specific state-funded, B3 buildings as a means of demonstrating real outcomes aimed at the conservation of energy resources, creation and maintenance of healthy environments, and occupants' satisfaction with their work environments. The Sustainable Post-Occupancy Evaluation Survey (SPOES) was developed to assess human outcomes in workplace, classroom, and residence hall settings in compliance with the B3 Guidelines project tracking requirements. This is a report of occupants' (hereafter called employees) responses from the survey conducted in February 2016.

This SPOES report focuses on employees' satisfaction with the physical environment as related to 26 indoor environmental quality (IEQ) criteria such as lighting, thermal, and acoustic conditions in their primary workspaces, i.e., offices. Employees' satisfaction with the facility (site, building, and interior) and the effect of the facility's physical environment on their perceptions of their work performance and health also are included. Finally, a brief look at employees' commuting and physical activities within the building are reported. The report provides descriptive information about employees' perceptions of the IEQ of their work environments. In addition, this information serves the broader development of knowledge regarding the influence of IEQ on employees.

2.0 Method

SPOES consists of a self-administered, Internet-based, questionnaire submitted to and completed by employees. The SPOES questionnaire has been tested for **validity** (measures what it is intended to measure) and **reliability** (repeatability or replicability of findings). Employees rate their level of satisfaction on a **Likert-type scale** (measurement scale) from 1 (very dissatisfied) to 7 (very satisfied) with IEQ of the facility and their primary workspaces. They also rate the influence of their physical environment on their perception of their work performance and health on a scale from 1 (hinders) to 7 (enhances).

The report provides a descriptive summary of the results stated as a **mean** (average of all responses), **standard deviations** (SD) (how different scores are from each other and the mean), and **number of responses** (N) for each question analyzed. The mean for a 7-point scale is 4.00. Lower or higher means reflect stronger tendencies towards dissatisfaction/satisfaction and hinders/enhances. Means that are close to the center of the scale (4) are considered to be neither dissatisfied/hinders or satisfied/enhances.

When interpreting **mean** responses, the following labels were used:

- 1.00 - 3.50 dissatisfied (or hinders)
- 3.51 - 4.50 neither dissatisfied (or hinders) nor satisfied (or enhances)
- 4.51 - 7.00 satisfied (or enhances)

An IEQ Score is also calculated for employees' satisfaction with IEQ criteria in their primary workspaces. This is a statistical combination of all category-level (explained below) IEQ scores, which results in a single IEQ score for all respondents and is reported in an IEQ Scorecard.

2.1 Description of the Questionnaire

Employees first rate their level of satisfaction with the facility (site, building, and interior) and the influence of their physical environment on their perception of their work performance and health. Then they respond to questions about their satisfaction with their primary workspaces in relation to IEQ criteria from the B3 Guidelines. Additionally, employees' demographic, physical activity, and commuting practice data are collected to provide context for the study.

In the SPOES questionnaire, the 26 IEQ criteria listed below are evaluated. There are two levels of criteria, categories and attributes. As shown in the list, the 'overall' criteria are boldfaced and called 'categories' or 'category level' criteria. A category is broader or more general such as Overall View Conditions or Overall Indoor Air Quality. Some categories have 'attributes' or 'attribute level' criteria and provide greater detail about the category. For example, Overall Thermal Conditions is a category level question, and there are four attribute level questions related to thermal conditions such as adjustability, air velocity (draft), humidity, and temperature. Overall Acoustic Conditions is a category with attributes of employees' ability to hear desired sounds and their ability to limit undesired sounds. There are 12 category-level and 14 attribute level questions. Means are calculated and reported for all category and attribute-level criteria.

An IEQ Satisfaction Score is also calculated for employees' satisfaction with IEQ in their primary workspaces. This is a statistical combination of the 12 category-level criteria only and results in a single, mean IEQ Satisfaction Score for all employees' satisfaction with the physical conditions of their primary workspaces. Attribute-level criteria are not included in the IEQ Score because unequal weight would be given to criteria that have both category and attribute-level questions.

In the following list, **category (boldface)** criteria are listed in alphabetical order. If a category has attributes, they are listed with the category.

Overall Acoustic Quality

- Ability to hear desired sounds
- Ability to limit undesired sounds

Overall Appearance (aesthetics)

Overall Cleaning and Maintenance

Overall Daylighting Conditions

- Amount of daylighting
- Adjustability of daylighting

Overall Electric Lighting Conditions

- Amount of electric lighting
- Adjustability of electric lighting
- Adjustability of task lighting

Overall Furnishings

- Function of furnishings
- Adjustability of furnishings

Overall Indoor Air Quality

Overall Privacy

Overall Technology

- Access to electric outlets

Overall Thermal Conditions

- Adjustability of thermal conditions
- Air velocity (drafty/stagnant)
- Humidity (dry or moist)
- Temperature (hot or cold)

Overall Vibration and Movement

Overall View Conditions

2.2 Limitations

Employees' participation is voluntary, and responses are self-reported. As is true with all survey research, the responses indicate employees' perceptions. There were no physical measurements, e.g., temperature, humidity, or lighting levels of the environment taken. This study is limited to employees' perceptions.

3.0 Sample Description

3.1 Description of Building

The RCSC-A facility is located at 2101 15th Ave, NW, Willmar, MN. The building (see Figure 1) has two stories and contains over 56,000 square feet of renovated space. The redesigned layout unifies the location of student service offices and departments. It includes offices for all student services such as admissions, registration, and financial aid. Additionally, there are a cafeteria, general purpose classrooms, an IT lab, student senate meetings rooms, College bookstore, and College Foundation. There are no faculty offices. Only employees who have assigned primary workspaces in the renovated areas were surveyed.



Figure 1. RCSC-A (Photo courtesy of RCSC-A)

3.2 Description of Respondents

This survey was administered to 35 employees with workspace in the facility during February 2016. The response rate to the questionnaire was approximately 63%. Of those responding, 18% were male and 82% were female. The mean age of respondents was about 44 years, with a range from 24-62 years of age.

The RCSC-A renovation was completed and ready for operation in October, 2014. Since that time, 91% of the respondents reported that they worked at the RCSC-A facility since the renovation and only 9% of the respondents spent less than one year at this site. Relating to hours worked during a typical week at RCSC-A, 41% of employees reported they spend 40+ hours a week in the facility; 55% spend 30-40

hours a week at RCSC-A; 4% spend 20-29 hours at RCSC-A; and no one spends less than 20 hours a week in the RCSC-A facility.

Relating to the time employees spend per week in their primary workspace, 77% spend 76-100% of their time in their primary workspace, 18% spend 51-75% of their time in their primary workspace, and 5% of employees reported they spend 25-50% of their weekly time in their primary workspace. These responses indicate the amount of time employees are exposed to IEQ conditions in their workplace environment. Employees also indicate that 55% of their primary workspaces were located within 15 feet of an exterior window and 45% of employees were not within 15 feet of an exterior window.

4.0 Findings and Discussion

4.1 RCSC-A Facility (Site, Building, and Interior): Overall Satisfaction, Work Performance, and Health

Employees responded to questions concerning the RCSC-A facility (site, building, and interior) and their overall satisfaction with the facility, overall perceptions of their work performance in relation to the facility, and their overall perception of their health in relation to the facility. Table 1 shows the means and standard deviations of their responses as well as how the responses are interpreted. Figure 2 is a graph that shows the mean for each question, which is identified with a blue mark. The standard deviation is shown by the green/red, vertical bar with green representing satisfied (or enhanced) and red representing dissatisfaction (or hindered). Gray represents the 'neither/nor' range of responses. In cases where there were no dissatisfied responses, the bar may be all green or gray and green. This graph is simply a visual image of the findings from Table 1.

Table 1. RCSC-A facility - overall satisfaction, work performance, and health

Overall	Mean	SD	N	Interpretation
Satisfaction	5.83	1.20	23	Satisfied
Work Performance	5.52	1.17	23	Enhanced
Health	4.96	0.86	23	Enhanced

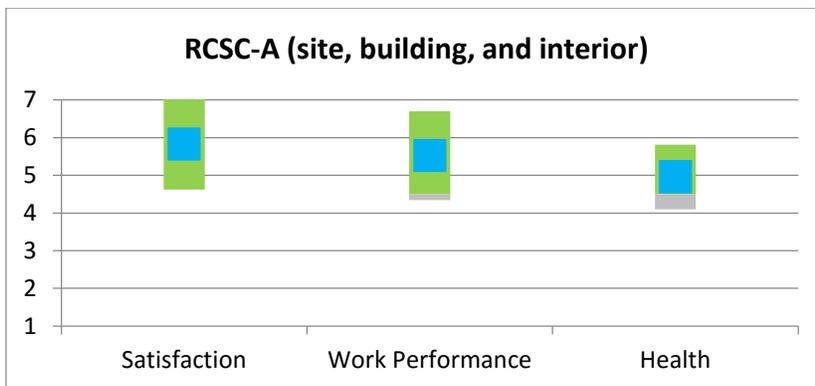


Figure 2. RCSC-A facility - overall satisfaction, work performance, and health

Results indicate that employees were **satisfied (M = 5.83)** with the RCSC-A physical environment of the facility (building, site, and interior) and reported that their work performance was **enhanced (M = 5.52)** by the facility. Employees also reported that their overall health was **enhanced (M = 4.96)** by the facility.

4.2 Primary Workspace: Overall Satisfaction, Work Performance, and Health

Employees responded to questions concerning their overall satisfaction and overall perceptions of their work performance and health as related to their primary workspace (e.g., private office, workstation, or other primary workspace). Table 2 shows the means and standard deviations of their responses as well as how the responses are interpreted. Figure 3 is a visual image of the findings from Table 2; an explanation of the graph was given for Figure 2.

Table 2. RCSC-A primary workspace – overall satisfaction, work performance and health

Overall	Mean	SD	N	Interpretation
Satisfaction	5.48	1.41	23	Satisfied
Work Performance	5.48	1.21	23	Enhanced
Health	5.22	0.83	23	Enhanced

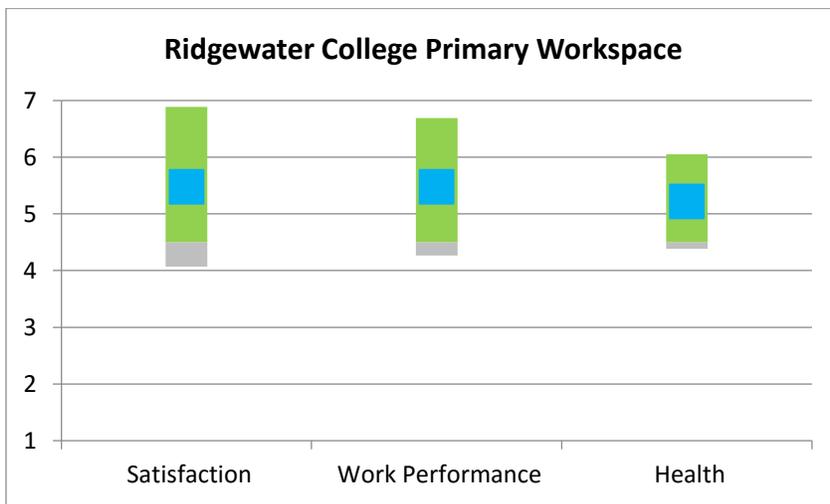


Figure 3. RCSC-A primary workspace - overall satisfaction, work performance, and health

Results indicate that employees were **satisfied (M = 5.48)** with their primary workspace, their overall work performance was **enhanced (M = 5.48)** by their primary workspace, and their overall health also was **enhanced (M = 5.22)** by their primary workspace.

4.3 Primary Workspace: Satisfaction with Indoor Environmental Quality (IEQ)

Employees responded to questions concerning their satisfaction with IEQ categories (thermal conditions, indoor air quality, acoustic conditions, etc.) related to their primary workspace (e.g., private office, workstation, or other primary workspace). Table 3 shows the means and standard deviations of their responses in order from highest to lowest mean, as well as how the responses are interpreted. Figure 4 is a visual image of the findings from Table 3; an explanation of the graph was given for Figure 2.

Table 3. RCSC-A primary workspace - satisfaction with IEQ criteria

#	IEQ Criteria (1-26) (Category level criteria are bold face)	Mean	SD	N	Interpretation S = Satisfied D = Dissatisfied
1	Overall technology	5.91	0.90	22	Satisfied
2	Overall appearance (aesthetics)	5.82	1.11	22	Satisfied
3	Overall vibration and movement	5.55	1.12	22	Satisfied
4	Overall electric lighting conditions	5.45	1.20	22	Satisfied
5	Humidity (dry or moist)	5.41	1.34	22	Satisfied
6	Amount of electric light	5.36	1.33	22	Satisfied
7	Ability to hear desired sounds	5.33	1.32	21	Satisfied
8	Overall indoor air quality	5.32	1.29	22	Satisfied
9	Overall furnishings	5.23	1.31	22	Satisfied
10	Air velocity (drafty or stagnant)	5.18	1.40	22	Satisfied
11	Function of furnishings	5.14	1.22	22	Satisfied
12	Adjustability of task lighting	5.00	1.41	22	Satisfied
13	Adjustability of furnishings	4.95	1.43	21	Satisfied
14	Overall daylighting conditions	4.86	1.96	22	Satisfied
15	Amount of daylighting	4.86	2.01	22	Satisfied
16	Overall thermal conditions	4.77	1.51	22	Satisfied
17	Adjustability of task lighting	4.71	1.45	21	Satisfied
18	Overall privacy (sound and visual privacy)	4.71	1.45	21	Satisfied
19	Overall view conditions	4.68	1.43	22	Satisfied
20	Overall cleaning and maintenance	4.64	1.58	22	Satisfied
21	Overall acoustic quality	4.62	1.62	21	Satisfied
22	Adjustability of daylighting	4.50	1.95	22	Neither S or D
23	Access to electric outlets	4.50	1.50	22	Neither S or D
24	Ability to limit undesired sounds	4.41	1.67	22	Neither S or D
25	Temperature (hot or cold)	4.27	1.66	22	Neither S or D
26	Adjustability of thermal conditions	3.50	1.73	22	Dissatisfied

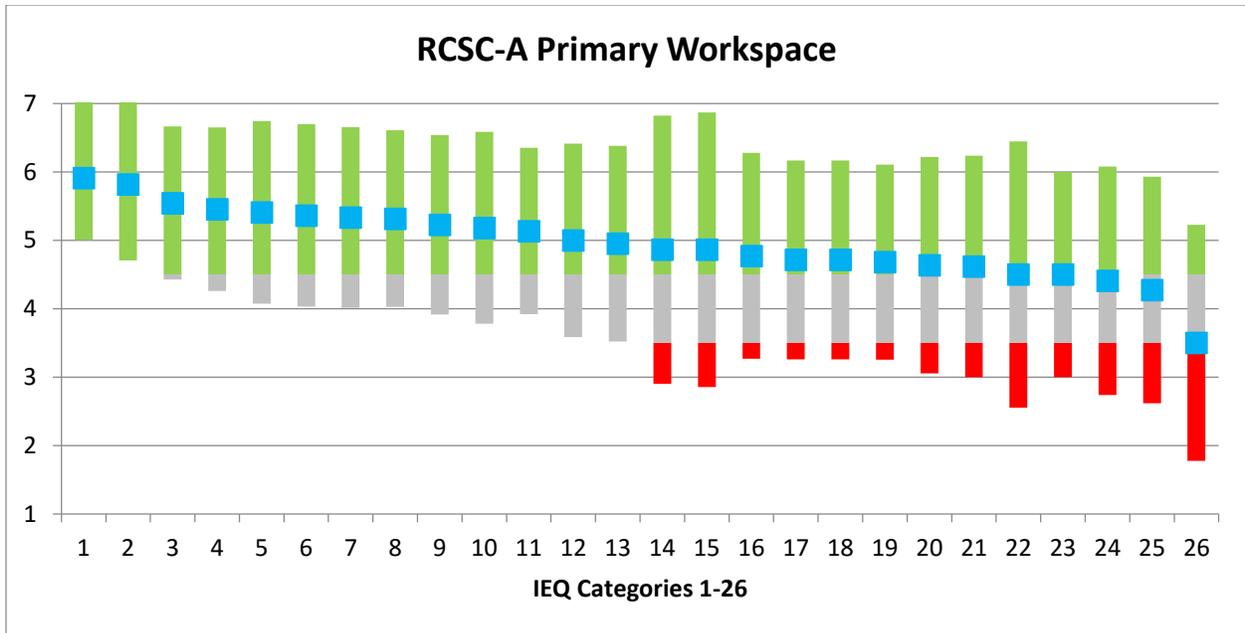


Figure 4. RCSC-A primary workspace - satisfaction with IEQ criteria (IEQ 1-26 are listed in Table 3)

Results indicate that employees were **satisfied** with 21 of the IEQ criteria in their primary workspaces, i.e., means at or above 4.50. Employees were **neither satisfied nor dissatisfied** with four of the IEQ criteria, ranging from a mean of 4.27 (temperature) to 4.50 (adjustability of daylighting). Further, employees indicate that they were **dissatisfied** with only one IEQ criteria, adjustability of thermal conditions (3.50). The criteria that employees are ‘neutral’ or dissatisfied with are ripe for change to improve employees’ satisfaction with their primary workspaces. Potential for change will be addressed in Section 6.2 Recommendations. Further explanation of these scores also can be found in Appendix A. Open-Ended Responses.

4.4 IEQ Satisfaction Scorecard

The IEQ Satisfaction Score is determined by calculating a mean of the 12 ‘Overall’ category level IEQ criteria. At this time, criteria are weighted equally in this calculation as little evidence exists that provides rationale for weighting some criteria heavier than others. The IEQ mean is representative of a fair overall IEQ score and can serve as a benchmark of employees’ satisfaction with the physical environment of their primary workspace. As shown in Figure 5, the **IEQ Satisfaction Score** for RCSC-A is **5.13**, which falls into the **satisfied** range. The large number of criteria with scores above the mean contribute to this positive IEQ Score.

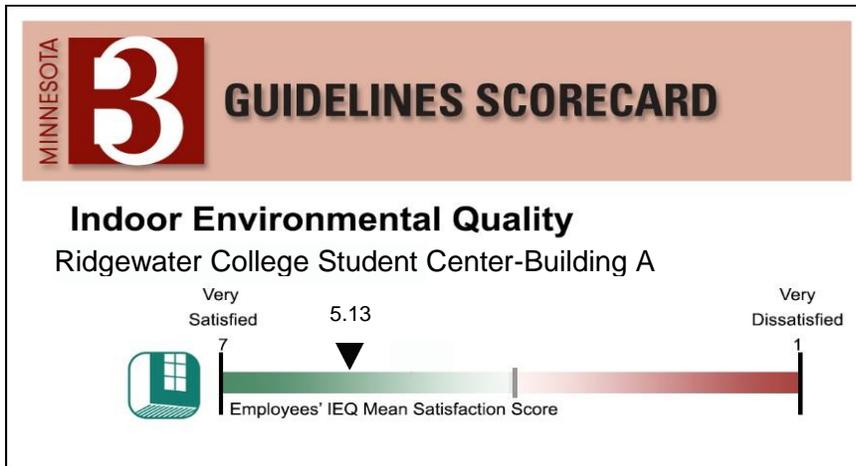


Figure 5. RCSC-A primary workspace - IEQ Satisfaction Score

As shown in Table 3, satisfaction with Overall technology, Overall appearance, and Overall vibrations and movement were the criteria with the highest satisfaction means (5.55 or higher) and pulled the IEQ Satisfaction Score in a positive direction. Please note that the IEQ Satisfaction Score only uses the category level criteria (those labeled ‘Overall’; see section 2.1, paragraph 3 for explanation).

5.0 Physical Activity Engagement and Commuting Practices

In the final section of the survey, employees responded to questions regarding their overall physical activity while at RCSC-A (site, building, and interior) and their commuting practices.

5.1 Physical Activity Engagement

Providing employees with opportunities for alternative paths of travel around the workplace, e.g., taking stairs as opposed to the elevator, provides opportunities to engage in additional types of physical activities. Engaging in physical travel throughout the work environment can be associated with healthier lifestyles.

Table 4. Overall physical activity (walking, stair use, etc.) affected by the RCSC-A facility

RCSC-A Facility (site, building, and interior)	Mean	SD	N	Interpretation
Overall physical activity (walking, stair use, etc.)	5.18	1.18	22	Enhanced

Results indicate that employees felt that RCSC-A **enhanced (M = 5.18)** their physical activities (walking, stair use, etc.).

5.2 Commuting Practices

RCSC-A is centrally located on the Ridgewater College campus and in close proximity to the Central Community Transit (CCT) pickup shelter. CCT provides daily service to the College between 9:00 am and 4:00 pm and on-call service. The College also provides several fee-based parking facilities adjacent to RCSC-A and throughout the campus. Sidewalks/walking paths are available on the east and west side of campus for employees who live within walking distance of the College.

Table 5 provides results on employees’ primary mode of transportation; Table 6 summarizes commuting distances between home and the RCSC-A facility; and Table 7 summarizes employees’

ability to commute using alternative choices (walk, public transit, bike, van, or carpool, etc.). These results, although not related to IEQ, do offer Ridgewater College insight into employees' commuting behaviors and opinions. These data can provide important information about commuting practices that can reduce transportation energy consumption.

Table 5. Commuting Practices – RCSC-A Primary mode of transportation

Primary Mode of Transportation (N=22)	Drive Alone (or with children <16)
RCSC-A Employees	100%

Related to primary modes of transportation, 100% of employees drive alone (or with children under 16).

Table 6. Commuting Practices – RCSC-A Commuting distance traveled

Miles Traveled (N=22)	0-5 miles	6-15 miles	16-30 miles	31-45 miles	46+ miles
Home-to-RCSC-A (One-way)	32%	36%	9%	14%	9%

Results indicate that 32% of employees commuted 0-5 miles one-way between home and the RCSC-A, followed by 36% who commute 6-15 miles, 9% who commute between 16-30 miles, and 23% who commute over 31+- miles to the RCSC-A facility. All of these are one-way miles.

Table 7. Commuting practices – RCSC-A location and alternative commuting behaviors

Alternative Commuting	Mean	SD	N
Ability to commute in alternative ways	3.14	1.39	22

Results indicate that location of the RCSC-A **hindered** (M = 3.14) employees' ability to commute to work in alternative ways, e.g., walk, bicycle, public transit, van or carpool, etc. It is likely this outcome is due to the location of the campus and that many employees live in other cities. Although busing services are available, the bus schedule is not conducive to the work schedule.

6.0 Conclusions

6.1 Summary

A post-occupancy evaluation was conducted of employees of RCSC-A at approximately 17 months after it was renovated. The RCSC-A facility is used by employees of Ridgewater College who focus on student services. This survey reports the responses from employees and their satisfaction with the physical environment of the facility and their primary workspaces.

The survey included questions related to employees' satisfaction with the facility (site, building, and interior) and influence of the facility on their work performance and health. Employees were **satisfied** with the facility (M = 5.83); they found the facility **enhanced** their work performance (M = 5.52) and **enhanced** their health (M = 4.96). In addition, similar results were reported when employees were asked these same questions about their primary workspaces (private office, shared office, cubicles, etc.). They reported **satisfaction** (M = 5.48) with their primary workspaces, that their work performance was **enhanced** (M = 5.48), and their health was **enhanced** (M = 5.22) by their primary workspace. As the range of scores was from 1-7, mean scores showed moderately high levels of satisfaction.

Most of the survey questions related to employees' satisfaction with IEQ criteria in their primary workspaces (private office, cubicles, etc.). Employees' responses showed they were **satisfied** with 21 of the 26 IEQ criteria. The mean satisfaction scores ranged from **4.62** (Overall acoustics) to **5.91** (Overall technology). This shows a moderately positive level of **satisfaction**. Employees responded **neither dissatisfied nor satisfied** to four IEQ criteria and were **dissatisfied** with only one IEQ criteria: Adjustability of thermal conditions (3.50).

From employees' responses, an IEQ Score was developed and shows respondents' satisfaction with the IEQ of all category level criteria. For RCSC-A, the IEQ Satisfaction Score was **5.13**. This score reflects a moderately high satisfaction level with many IEQ categories. Finally, employees reported that RCSC-A **enhances (5.18)** their physical activity, which is one of the sustainable design criteria that influences occupant behavior.

6.2 Recommendations

Most IEQ criteria satisfaction scores are in the positive direction, however, improvement on the 'neutral' and dissatisfied criteria may be possible. For IEQ categories that can be physically measured (e.g., thermal, acoustic, and lighting), it is recommended that these measurements be taken in the primary workspaces. The rest of the criteria can receive some attention as well. Exploring these areas in more detail and making adjustments may increase overall satisfaction at the primary workspace. It must be noted that the expense of building and operating a facility is second only to employee-related expenses over the life of the building. Therefore, maintaining or improving employees' satisfaction is a sound investment, which, in turn affects their performance and their health. Specific recommendations for the most common areas of occupants' concern follow:

Acoustic Conditions

- Identify acoustic criteria for overall requirements.
- Determine if any task areas differ now from their original spatial layout/use (i.e., collaborative work spaces now located adjacent to focused work areas, individual workstations).
- Develop specialized acoustical performance requirements to support functional programming employees' tasks (e.g., sources of recurrent noise that need to be controlled, special user populations that may have distinct auditory performance limitations, or multiple uses of building spaces that may have different acoustic criteria). Identify and apply appropriate acoustics modeling software for the project.
- Measure acoustic performance onsite with full building systems (heating, ventilation, and air conditioning) running.
- Identify employees' privacy concerns via focus groups and/or log complaints relative to acoustical conditions for further evaluation.
- Consider employees' tasks within shared spaces to determine if spatial layout changes can be made for increased acoustic control.

Lighting Conditions

- Identify employees' lighting performance criteria that are to be met to achieve goals by conducting onsite measurements of existing illumination and compare them to standards for employees' tasks as identified by the Illuminating Engineering Society (IES).
- Determine if any task areas differ now from original intent to be sure illumination quantity and quality are not impeded by physical changes to the space (i.e., walls, ceilings, furnishings, fixtures, or equipment).

- Develop additional quality lighting criteria as needed for special facility (e.g., influence of daylight quality or quantity) or employee (e.g., age, task duration) issues.
- Log complaints related to lighting conditions for further evaluation.
- Identify poor lighting conditions in the workspace caused by a lack of control over daylighting, which can cause glare and eyestrain.

Personal Adjustability

- Determine what adjustability issues arise with temperature, lighting, or furnishings via a focus group.
- Identify personal, individual problem areas and relate them to other IEQ issues via a log of complaints relative to adjustability.
- Provide education to employees about any existing/achievable adjustment options, e.g., furnishings, air diffusers, lighting, temperature control, etc.

Privacy Conditions

- Identify employees' privacy concerns via focus groups or log complaints relative to privacy to determine if visual or audio privacy is most affected.
- Determine if any task areas or responsibilities differ from original intent and develop alternatives or modifications.
- Consider adding noise masking equipment and/or visual screening depending on the nature of the complaints.
- Document and compare acoustic privacy problem areas with acoustic measurements to pinpoint specific problem areas.

Thermal Conditions

- Measure thermal performance conditions on site.
- Log complaints related to thermal conditions for further evaluation.
- Determine special thermal comfort requirements or problems that may be encountered in the building due to physicality of work activities, duration of sitting, or design/layout considerations. Focus groups can be useful in identifying problem locations.
- Determine if any employees' task areas differ now from original layout to determine if air flow is meeting systems design intent.
- Review conditions that affect thermal comfort using ASHRAE Standard 55-2004 or *Human Factors Design Handbook* (see B3 Guidelines).

This study investigated employees' satisfaction with the facility and primary workspaces. IEQ satisfaction is individual, but the results of the survey show a central tendency of moderate satisfaction with the facility and most of the IEQ categories. The results can be used as a diagnostic tool to aid in improving IEQ conditions for employees and to set the benchmarks from which improvement can be measured in the future.

Appendix A. Open-Ended Responses

Employees had the opportunity to raise specific concerns on the overall facility and their primary workspaces. Important information can be gleaned from the open-ended survey responses. RCSC-A employees raised specific concerns about acoustics and thermal conditions. The comments do give insight into specific issues that should be addressed by building management. Generally, the comments are shown as written.

Overall Positive

- The Student Center turned out wonderfully! So happy with my workspace and surrounding areas.

Acoustics

- Sitting very near the front reception desk, which is by an open stairway to the student center/cafeteria, means it is always very noisy with students playing pool or when speakers are in the cafeteria. Not only is it noisy with the upstairs noise, it is also noisy with the activity at the front desk, all of which can be heard by employees in nearby offices.
- The pipes for the heating/cooling of our area are very noisy.

Daylighting

- I love the new building, and my only complaint is that I no longer have an exterior window in my office. I work with many prospective students and families, and I feel as though an office window would enhance meetings with prospective students.

Electric Lighting

- The lighting is not great. I needed to purchase a lamp for my desk.

Furniture

- The desk is not ergonomically set up for using a computer - I have to adjust my chair to the highest setting and use a footrest in order to have correct posture. I also have to have my monitor on a monitor stand.
- It would have been nice to have a desk that had an adjustable area for the computer.
- I have a U shaped desk. The back of the desk is not great for working as the file cabinet is under one side of the U and there is no space to put your legs.
- The desk unit is all one piece and very difficult to move.
- There seems to be something in our office suite that makes us all sneeze more than usual.

Maintenance and Cleaning

- Trash could be picked up more frequent

Technology

- I have one outlet that is not covered by my desk unit. It is nearly impossible to plug something in on my desk.

Thermal

- Front reception desk area is very drafty with cold air coming in the front door.
- We do not have adjustable thermostats, so have a space heater in my office, which runs most of the time to keep my feet warm.

- My office is almost always cold.
- It is always hot in the backroom. Even though we have the thermostat set as low as possible (64 degrees), it is always at least 73 degrees in the backroom. The custodians have not been able to figure out why it is so hot. It makes it very uncomfortable when checking in freight, doing book buy back and online orders, etc. The front of the store is always cold which is probably because we have so many windows and the Bookstore front door is right by the outside front door of the students services building. When working in both environments, staff are constantly having to take off and put on layers of clothing.

Appendix B. Glossary

Descriptive statistics

Statistics used to summarize large sets of data (i.e., means, frequencies, medians). Descriptive statistics describe only the sample under consideration and are not intended to infer results to the larger population.

Frequency

A descriptive statistic that provides information about how many of a particular response or measurement is observed.

Likert-type scale

A measurement technique, employed in questionnaires and interviews, that utilizes a range of standardized response categories such as strongly agree, agree, etc.

Mean

The average score of a set of data calculated by adding all scores together, then dividing by the number of scores.

N

The number of subjects or participants responding to the questions, or a single question, in the study.

Reliability

The repeatability or replicability of findings; the same results are produced each time. Instruments and procedures should produce the same results when applied to similar people in similar situations, or on a second occasion.

Standard deviation

A statistic used to measure the variability of a group of scores (how different scores are from each other and the mean). For example, if the range of scores is 1-7 and the mean (average) is 5.0 with a standard deviation of 1.0, then the scores are closely clustered around the mean, i.e., there is one unit of variation among all scores. If the mean was 5.0 and the SD was 3.0, there is a broader range of variation among the scores...a smaller SD means the scores are similar and the mean score is likely to be more accurate and more useful (this is better!).

Validity

The extent to which an instrument or procedure measures what it is intended to measure (internal validity). The generalizability of results to another population (external validity).