

MINNESOTA



**POST-OCCUPANCY
EVALUATION**

**Indoor Environment Quality + Classroom Environment
Science Teaching Student Services (STSS)
University of Minnesota, Minneapolis, MN
Report 2**

**March 2015, 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 Science Teaching Student Services (STSS) facility and students' satisfaction with their classroom environments. The STSS facility was designed using the B3 Guidelines (formerly known as the Minnesota Sustainability Guidelines or MSBG) and completed for occupancy in 2010. 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 students) responses at five years post-occupancy. The survey was conducted in February 2015 and is the second of two required survey events for this building. (Report 1 can be found at <http://www.b3mn.org/poe>)

This SPOES report focuses on students' satisfaction with the physical environment as related to 25 indoor environment quality (IEQ) criteria such as lighting, thermal, and acoustic conditions in their primary classrooms. Students' satisfaction with the facility (site, building, and interior) and the effect of the facility's physical environment on their perceptions of their learning experience and health also are included. Finally, a brief look at students' commuting and physical activities within the building are reported. The report provides descriptive information about students' perceptions of the IEQ of their classroom environments. In addition, this information serves the broader development of knowledge regarding the influence of IEQ on students.

2.0 Method

SPOES consists of a self-administered, Internet-based, questionnaire submitted to and completed by students. The SPOES questionnaire has been tested for **validity** (measures what it is intended to measure) and **reliability** (repeatability or replicability of findings). Students 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 classrooms. They also rate the influence of their physical environment on their perception of their learning experience and health on a scale from 1 (hinders) to 7 (enhances). There were no physical measurements taken of environmental conditions such as temperature or acoustic level. This study is limited to students' perceptions.

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

An IEQ Score is also calculated for students' satisfaction with IEQ in their primary classrooms. This is a

statistical combination of all category-level 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

Students 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 learning experience and health. Then they respond to questions about their satisfaction with their primary classrooms in relation to IEQ criteria from the B3 Guidelines. Additionally, students' physical activities and commuting practices are investigated.

In the SPOES questionnaire, the 25 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 students' ability to hear desired sounds and their ability to limit undesired sounds. There are 10 category-level and 15 attribute level questions. Means are calculated and reported for all category and attribute-level criteria.

An IEQ Satisfaction Score is also calculated for students' satisfaction with IEQ in their primary classrooms. This is a weighted mean statistical combination of the 10 category-level criteria only and results in a single, mean IEQ Satisfaction Score for all students' satisfaction with the physical conditions of their primary classrooms. 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 understand desired sounds
- Ability to hear presentations
- Extent of background noise

Overall Appearance (aesthetics)

Overall Cleaning and Maintenance

Overall Daylighting

- Amount of daylighting
- Ability to adjust daylighting

Overall Electric Lighting

- Amount of electric lighting
- Ability to adjust electric lighting

Overall Furnishings

- Function of furnishings
- Ability to adjust the furnishings

Overall Indoor Air Quality

Overall Technology

- Access to electric outlets
- Ability to see materials presented

Overall Thermal Conditions

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

Overall Vibration and Movement

2.2 Limitations

Students' participation is voluntary, and responses are self-reported. As is true with all survey research, the responses indicate students' perceptions. There were no physical measurements, e.g., temperature,

humidity, or lighting levels, of the environment taken.

3.0 Sample Description

3.1 Description of Building

Built in 2010, the five-story, 118,000 square-foot STSS building houses instructional classrooms and administrative offices that service University of Minnesota (UMN) students (see Figure 1). STSS was designed according to the B3 Guidelines and received LEED New Construction (NC) Version 2.2 Gold Certification. The STSS building is located along the East Bank of the Mississippi River in the heart of the UMN Minneapolis campus. The Mississippi River bisects the UMN Minneapolis campus into two campuses that are referred to as the West Bank and East Bank campuses.



Figure 1. STSS building (Photo credit: <http://www1.umn.edu/twincities/maps/STSS/>)

The STSS building integrates both classrooms and student service offices into one facility. The building is occupied throughout the year by students, faculty, staff, and other transient individuals; however, the building has its highest occupancy loads during the fall and spring semesters (September through May). Some of the floors in the building have classrooms adjacent to student services and office areas. Floors 2, 4, and 5 have both classrooms and office areas. Floor 1 contains 10 classrooms. Floor 3 contains four classrooms, student common areas, and the One Stop student service counter (registration, grades, degree planning, and student accounts). Classrooms in this facility include large and small active learning classrooms and small and large lecture presentation classrooms.

3.2 Description of Respondents

The STSS had approximately 4,100 students taking classes in the facility during the spring semester period and administration of the survey event. The response rate to the questionnaire was approximately 28%. Of those responding, 39% were male and 61% were female. The median age of respondents was slightly over 21 years; the mode was age 19, with a range of 18 to over 65 years.

Students responded that 33% of them spend up to 1-2 hours a week in their primary classroom (the one they related all responses to); 50% spend 3-4 hours a week, and 17% spend more than 5 hours per week in their primary classroom. Regarding the amount of time students spend in other parts of the STSS facility, 80% of students reported they spend 1-2 hours per week in other parts of STSS; 11% spend 3-4

or more hours, 5% spend 5-6 hours, and 4% spend more than 7 hours in STSS other than their primary classroom.

Next, students were asked about their satisfaction with the course they were taking in the STSS classroom and the amount they learned in this class. Results indicated that students were **satisfied (M = 5.38)** with the course and were satisfied with the amount learned (**M = 5.37**).

Finally, students are exposed to concerns for the environment and sustainable initiatives throughout social media, initiatives on campus, and courses of study. Students were asked how important sustainability was to their own point of view. The mean score relating to the importance of sustainability was **5.82**.

4.0 Findings and Discussion

4.1 STSS Facility (Site, Building, and Interior): Overall Satisfaction, Learning Experience, and Health

Students responded to questions concerning the STSS facility (site, building, and interior) and their overall satisfaction with the facility, overall perceptions of their learning experience 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 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). In cases where there were no dissatisfied responses, the bar will be all green. Gray represents the 'neither/nor' range of responses. This graph is simply a visual image of the findings from Table 1.

Table 1. STSS facility - overall satisfaction, learning experience, and health

Facility (Site, Building, and Interior)	Mean (1-7)	SD	N	Interpretation
Overall Satisfaction	5.93	1.12	1167	Satisfied
Overall Learning Experience	5.45	1.20	1169	Enhances
Overall Health	4.95	1.18	1169	Enhances

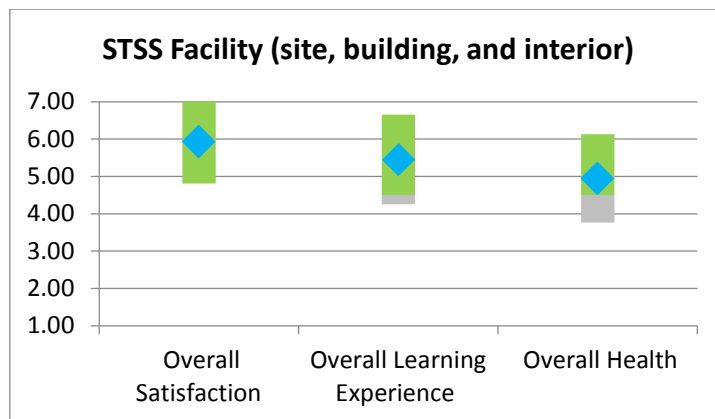


Figure 2. STSS facility - overall satisfaction, learning experience, and health

Results indicate that students were **satisfied (M = 5.93)** with the STSS facility (building, site, and interior) and reported that their overall learning experience was **enhanced (M = 5.45)** by the facility. Students reported that their overall health was **enhanced (M = 4.95)** by the facility.

4.2 Primary Classroom: Overall Satisfaction, Learning Experience, and Health

Students responded to questions concerning their overall satisfaction and overall perceptions of their learning experience and health as related to their primary classroom. 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.

Table 2. Primary classroom – overall satisfaction, learning experience, and health

Primary Classroom Environment	Mean (1-7)	SD	N	Interpretation
Overall Satisfaction	5.50	1.39	1166	Satisfied
Overall Learning Experience	5.29	1.38	1167	Enhances
Overall Health	4.85	1.19	1164	Enhances

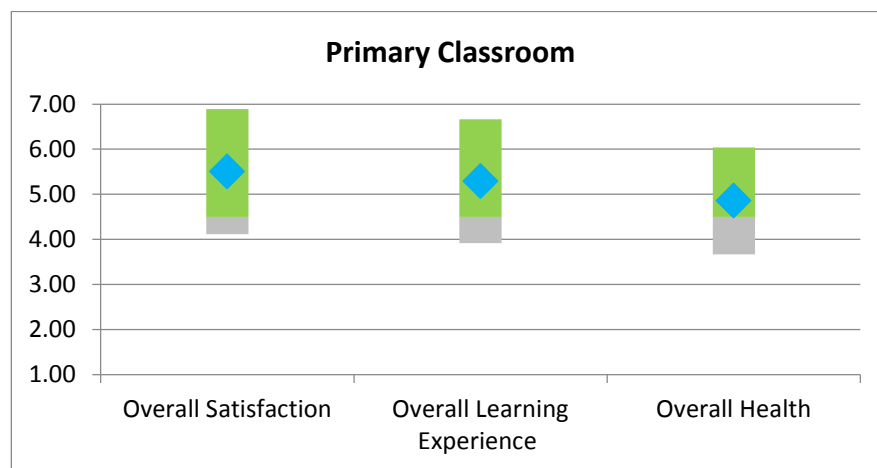


Figure 3. Primary classroom - overall satisfaction, learning experience, and health

Results indicated that employee were **satisfied (M = 5.50)** with their primary classroom, their overall learning experience was **enhanced (M = 5.29)** by their primary classroom, and their overall health was **enhanced (M = 4.85)** by their primary classroom.

4.3 Primary Classroom: Satisfaction with Indoor Environment Quality (IEQ)

Students responded to questions concerning their satisfaction with IEQ criteria (thermal conditions, indoor air quality, acoustic conditions, etc.) related to their primary classroom. Table 3 shows the means and standard deviations of their responses as well as how the responses are interpreted. It must be noted that all responses, regardless of the classroom, were combined so these are composite means of all classrooms in STSS. Figure 4 is a visual image of the findings in Table 3.

Table 3. Primary classroom - satisfaction with IEQ conditions

#	IEQ Criteria (1-25) (Category level criteria are bold face)	Mean (1-7)	SD	N	Interpretation (D = Dissatisfied) (S = Satisfied)
1	Overall cleaning and maintenance	6.20	1.01	1162	Satisfied
2	Overall appearance (aesthetics)	5.99	1.17	1167	Satisfied
3	Overall indoor air quality	5.99	1.10	1170	Satisfied
4	Amount of electric lighting	5.98	1.14	1170	Satisfied
5	Overall electric lighting	5.98	1.18	1168	Satisfied
6	Ability to hear presentations	5.93	1.20	1171	Satisfied
7	Overall vibration and movement	5.87	1.17	1162	Satisfied
8	Access to electric outlets	5.87	1.44	1166	Satisfied
9	Ability to understand desired sounds	5.85	1.21	1166	Satisfied
10	Overall technology	5.85	1.32	1166	Satisfied
11	Humidity (dry or moist)	5.83	1.19	1170	Satisfied
12	Ability to see materials presented	5.75	1.43	1164	Satisfied
13	Air velocity (drafty or stagnant)	5.75	1.29	1167	Satisfied
14	Overall acoustic quality	5.74	1.25	1169	Satisfied
15	Ability to adjust electric lighting	5.72	1.30	1161	Satisfied
16	Function of the furnishings	5.72	1.41	1166	Satisfied
17	Overall thermal conditions	5.69	1.29	1172	Satisfied
18	Overall furnishings	5.67	1.43	1165	Satisfied
19	Extent of background noise	5.67	1.40	1167	Satisfied
20	Ability to adjust the furnishings	5.53	1.49	1165	Satisfied
21	Temperature (hot or cold)	5.53	1.46	1170	Satisfied
22	Overall daylighting	5.49	1.56	1161	Satisfied
23	Amount of daylighting	5.38	1.63	1162	Satisfied
24	Ability to adjust daylighting	5.21	1.64	1159	Satisfied
25	Adjustability of the thermal conditions	5.11	1.51	1158	Satisfied

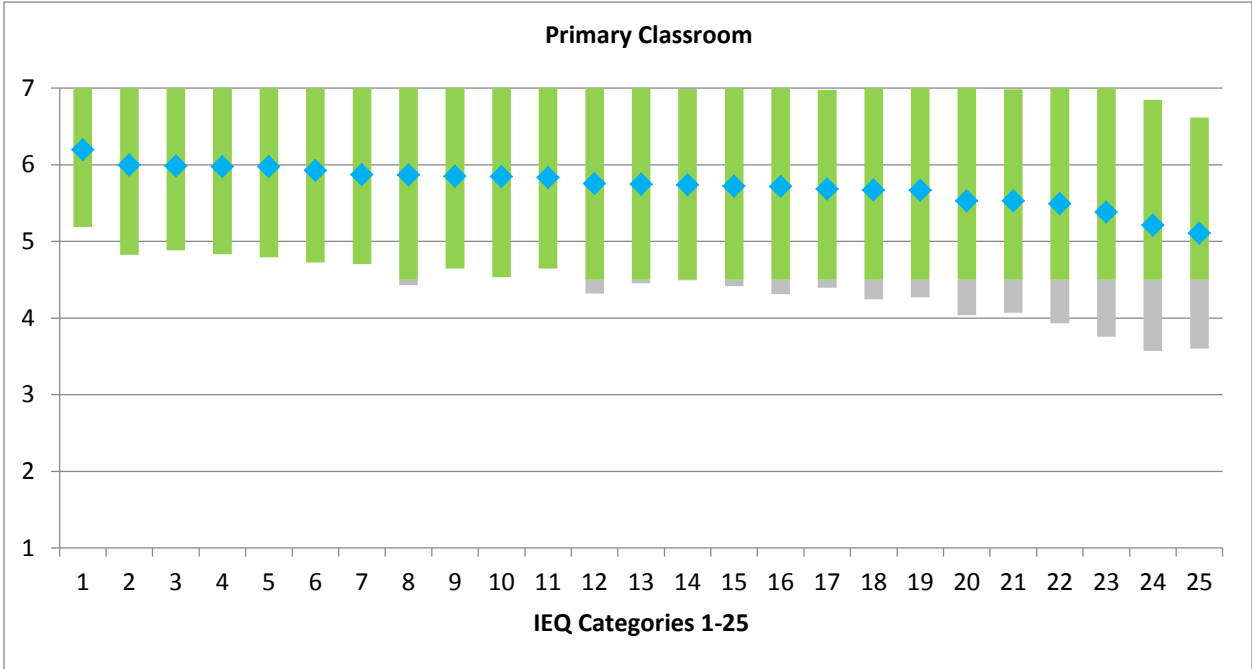


Figure 4. Primary classroom - satisfaction with IEQ criteria (IEQ 1-25 are listed in Table 3 above)

Results indicate that students were satisfied with all of the IEQ criteria in their primary classrooms; none fell below a mean of 5.11. These findings support the **moderate to high level of student satisfaction** with the IEQ of their classrooms. Further information about their perceptions 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 all overall category level IEQ criteria. At this time, all variables 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 students' satisfaction with the physical environment of their primary workspace. As shown in Figure 5, the **IEQ Satisfaction Score** for STSS is **5.85**.

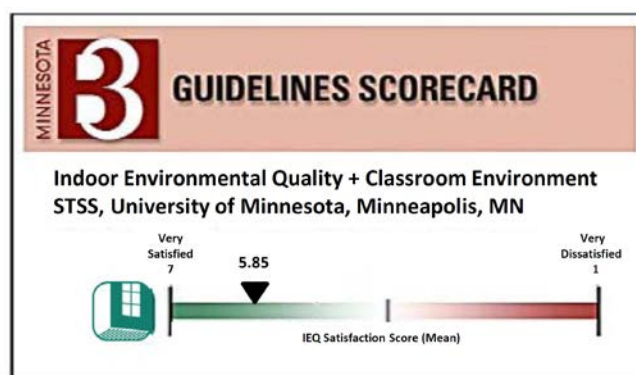


Figure 5. Primary Classroom - IEQ Satisfaction Score

Overall, the students showed a highly positive satisfaction level with the IEQ of STSS classrooms as indicated by the mean score of **5.85**. As shown in Table 3, six IEQ categories were above 5.85 with **Overall cleaning and maintenance** showing the highest at **6.20**, followed by **Overall appearance (aesthetics) (M = 5.99)**, **Overall indoor air quality (M = 5.99)**, and **Overall electric lighting (5.98)**. IEQ categories that received somewhat lower scores, **Overall thermal conditions (M = 5.69)**, **Overall furnishings (M = 5.67)**, and **Overall daylight (M = 5.49)** are still in the moderately high satisfaction range. Please note that the IEQ Satisfaction Score only uses the category level criteria (those labeled 'Overall'; see section 2.1, paragraph 3 for explanation). This high IEQ score sets a high benchmark for continued assessment of students' satisfaction.

5.0 Physical Activity Engagement and Commuting Practices

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

5.1 Physical Activity Engagement

Providing students with opportunities for alternative paths of travel around the classroom building, 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 learning environment can be associated with healthier lifestyles.

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

STSS facility (site, building, and interior)	Mean (1-7)	SD	N	Interpretation
Overall physical activity (walking, stair use, etc.)	5.43	1.22	1,151	Enhances

Results indicated that students felt that STSS **enhanced** ($M = 5.43$) their physical activities (walking, stair use, etc.). Further, 76% of the students indicated that the facility **enhanced** their overall physical activity.

5.2 Commuting Practices

STSS is located on the East Bank of the University of Minnesota. The east bank campus is located north of metropolitan hub providing bus and light rail transit service through the campus environment. The University provides several parking facilities, bike paths, and sidewalks throughout the campus and adjacent to the STSS facility.

Table 5 provides results on students' primary mode of transportation; Table 6 summarizes commuting distances between home and the STSS facility; and Table 7 summarizes students' ability to commute using alternative choices (walk, public transit, bike, van, or carpool, etc.). These results, although not related to IEQ, do offer the University insight into students' commuting behaviors and opinions. These data can provide important information about commuting practices that can reduce transportation energy consumption.

Table 5. Commuting Practices – STSS Primary mode of transportation

Primary Mode of Transportation Commuting Practices to STSS	Drive alone (or with children <16)	Public Transit	Bike	Walk	Car/Van Pool	Other
Students commuting mode (%)	10%	30%	4%	52%	2%	2%

Related to primary modes of transportation, 10% of students drive alone (or with children under 16), 30% use public transit, 4% use a bicycle, 52% walk, 2% car van pool, and 2% use a combination of commuting options (e.g., driving and biking).

Table 6. Commuting Practices – STSS Commuting distance traveled

Commuting Distance – Home to STSS				
Miles Traveled One Way	0-5 miles	6-15 miles	16-30 miles	31+ miles
Percent of students travel	71%	15%	9%	5%

Results indicate that the large majority of students (71%) commuted 0-5 miles one-way between home and STSS, followed by 15% who commute 6-15 miles, 9% commute between 16-30 miles, 4% commute 31 and over. All of these are one-way miles. As this is a metro area and many students live on campus or in near-by apartments, the commute is short.

Table 7. Commuting practices – STSS location and alternative commuting behaviors

STSS – Ability to commute in alternative ways				
F (SBI) Location	Mean (1-7)	SD	N	Interpretation
Students commuting practices	4.83	1.40	1154	Enhances

Results indicate that the location of the STSS **enhanced (M = 4.83)** students' ability to commute to class in alternative ways, e.g., walk, bicycle, public transit, van or carpool, etc. Further, of the 1,154 respondents to this question, 53% said the location **enhanced** their commuting options, 37% felt that this location neither enhanced nor hindered their ability to commute in alternative ways.

6.0 Conclusions

6.1 Summary

A post-occupancy evaluation was conducted of students of STSS at approximately five years after its renovation in 2010. About 28% of the students who are enrolled in classes in STSS responded to the survey.

The survey included questions related to students' overall satisfaction with the facility (site, building, and interior) and influence of the facility on their overall learning experience and health. Students were **satisfied** with the facility (**M = 5.93**); they found the facility **enhances** their overall learning experience (**M = 5.45**) and **enhances** their overall health (**M = 4.95**). When students were asked these same questions about their primary classroom, they reported overall **satisfaction (M = 5.50)** with their primary classrooms. They also reported that their overall learning experience was **enhanced (M = 5.29)** by their primary classrooms, and their overall health was **enhanced (M = 4.85)** by their primary classroom. As the range of scores was from 1-7, these scores indicate low to moderate satisfaction.

Most of the survey questions related to students' satisfaction with the IEQ criteria in their primary classrooms. Students' responses showed they were **satisfied** with the all of the IEQ criteria. There were no mean satisfaction scores below 5.11 (Adjustability of thermal conditions), and the highest was 6.20 (Overall cleaning and maintenance). This is a moderate level of satisfaction for several IEQ criteria and high satisfaction for most of them.

From the students' responses, an IEQ Score was developed and shows respondents' satisfaction with the IEQ of all category level criteria. For STSS, the IEQ Satisfaction Score was **5.85**. This score reflects a moderately high satisfaction level with IEQ categories. Finally, students reported that STSS **enhances** their physical activity, which is one of the sustainable design criteria that influences occupant behavior.

6.2 Recommendations

The satisfaction scores are certainly in the positive direction, however, it is important to maintain a high level of satisfaction as the building continues to age. It is appropriate to consider a continuing assessment, and recommendations below can assist in this plan. For IEQ categories that have physical measurement possible, e.g., thermal, acoustic, and lighting, it is recommended that these measurements be taken in all classrooms. Recommendations 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 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, air conditioning; HVAC) running.
- Identify students' acoustic concerns via focus groups and/or log complaints relative to acoustical conditions for further evaluation.

Lighting Conditions

- Identify students' lighting performance criteria that are to be met to achieve goals by conducting onsite measurements of existing illumination and compare them to standards for students' 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 if 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 log of complaints relative to adjustability.

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 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 students' satisfaction with the facility and primary classrooms of the STSS facility. IEQ satisfaction is individual, but the results of the survey show a central tendency of moderate to high satisfaction with the facility and all IEQ criteria. The results can be used as a diagnostic tool to aid in improving IEQ conditions for students and to set the benchmarks from which improvement can be measured in the future.

Appendix A. Open-Ended Responses

Students had the opportunity to raise specific concerns on the overall facility and their primary classrooms. Important information can be gleaned from the open-ended responses. The results of this survey included 415 open-ended responses on the facility (site, building, and interior) and 242 open-ended responses on their primary classroom. Students' comments reflected both positive and negative concerns about the physical environment across category and attribute level IEQ criteria.

The quantity and quality of their feedback requires an additional level of analysis (text mining) to better understand student feedback on the physical environment. Future studies can associate student comments with their respective classroom type (windowless classrooms to those with penetrating glare from windows); classroom size (less than 30 students to 100+ students); classroom type (large scale-up active learning spaces to lecture / seminar halls). In addition to identifying important aspects of the IEQ conditions in the physical environment, additional analysis can examine their self-reported classroom learning and course satisfaction with their satisfaction with the physical environment.

The following is a small sample selected from the qualitative responses for both the facility (site, building, and interior) and their classroom environment. These responses include classrooms with and without windows, active learning classrooms, lecture halls, and classrooms throughout the five-story building.

Facility and Classroom Environments

- The round table classroom design is absurd. It is impossible to see the professor and what he is presenting at the same time. Professors barely know how to operate the equipment and many resort to using camera mode to display a screen. Pins in the connectors for some display equipment are broken. The screens use analog propagation of signal so all displays are blurry and strain my eyes to see fine text.
- The rows of desks in the floor 2 lecture halls (220 and 230) do not have enough vertical distance between them, resulting in my view of the board being obstructed at times. Also, the main lecturer's "desk" is centered on the left side of the room (facing the lecturer), and since I usually sit on the right side this along with tall people in front of me make it difficult to see. This position also affects my ability to hear the lecturer since he sometimes faces the far left side of the board (away from me) and does not talk loud enough for the right side to hear what is going on. I think moving that podium more toward the center might help, but given its symmetry to both the layout of the whiteboards and the projection screens it seems like these halls may have been doomed from the beginning. Seats are really comfortable though and the folding desks are some of the better one's I've used.
- From some seats, I am not able to see the board because the chairs are all at an even level. However, I love the fact that there is SO much foot space. If someone comes to class late, they can easily get to a chair in the middle of the row without disturbing others because there's enough room to walk through.
- The way the classrooms are set up make group work awesome, but lectures are harder to pay attention during because of the set up.
- It seems difficult to follow the teacher when presenting because of the position the teacher takes in the classroom- he/she has to turn around in order to face everyone. It is very uncomfortable to face teacher's backs when he/she is teaching
- Should have let more natural light in, very cold in my classrooms, what good is the technology if

a lot of teachers and students don't know how to use it? The outside looks nice, the inside does not.

- The classroom set up leaves something to be desired. Classrooms like STSS 330 are set up in such a distracting manner! Having the room situated so that the professor is facing away from half of the class at any moment is really bizarre. The classroom is not set up adequately for note taking. Sure it can accomplish a group project atmosphere, (something that can happen in any classroom by standing and moving) but it hinders every day learning. The televisions for every table seem to be a gimmick at best. The story of working with businesses to see what they wanted is an awesome story, but it doesn't seem to accomplishing anything!
- More tables and chairs outside of the classrooms would be nice too, since they seem to fill up quickly.
- It would be more comfortable if the tables were the correct height for the chairs. I like the comfortable chairs, but I do not like the way I need to hunch over to complete my homework, or eat.
- If there were more tables for students to sit in and study it would be more helpful. The larger classrooms feel awkward with the professor in the middle. Some professors can work with the space others make it more uncomfortable.
- The weird rooms with table pods and TVs are only helpful in group work classes, otherwise half the class can't see the lecturer. God forbid the lecturer wants to write on a board.
- Quality and number of whiteboards is adequate
- Can't see what is written on whiteboard. Horrible lounge areas.
- With the acoustics in the room, anyone who is talking -- even at a whisper, can be heard very easily in the lecture hall, which is very distracting to those sitting around the one whispering, and it often times blocks the audibility of the lecture.
- The walls are thin and we can hear the groups/class next door. There was a choir group the other night and it was super distracting to the group presentation happening in our class.
- The walls are not sound proof- in fact the vents produce a lot of noise.
- I like the microphones and speakers at the tables in 1-114. It's a big classroom and with a lot of students, I can't always hear someone on the other end. The microphone allows me to hear them at my table as if they were sitting there with me.
- We had a problem just a few times at the end of the semester with static coming from somewhere in the room. It was so distracting that *the professor decided to just end class and hour early*. The screens would randomly shut off during every class and we would have to wait for them to turn back on.
- Get rid of the stupid microphone clicking noise, very distracting
- The microphones make it hard to see important screens
- Microphones never seem to work, always *makes for an awkward pause* when going around the room from group to group and each table has to find a microphone that works.
- Light from the window shines across projection screens in the small rooms on the 5th floor. In STSS room 420B, between 9:45am - 11:00 the sun manages to shine through the window in such a way that it is difficult to see the screen when something is being projected (at least during the spring semester).
- Can't see out windows. Classrooms feel like prison cells.
- I wish the classrooms has larger windows
- I find it the one of the rare buildings that is very bright and inspiring for studying.
- Due to the large amounts of sunlight in STSS I feel happier studying there, more alert during classes, and happier to be in class.

- I love the amount of windows! The natural sunlight is nice. The art in the middle of the staircase is so wonderful too!
- It gets way too hot when they class rooms hold many students, 100 or so.
- I had a class in 312 last semester that was 2 1/2 hours long, and it got extremely hot and stuffy in there. We would have to leave the doors open, which made for distractions.
- Air vents in the floors are poorly located. Cold air continually blows on you if a vent is located under your table.
- The air vents in the floor are extremely annoying. Sometimes if there is enough air pressure they will rotate and be really noisy not to mention that they push out cold air so if you have to sit on top of one you better have your thermal underwear on.
- With double layered pants, a sweatshirt, scarf and coat, I am still cold in my class. This makes taking notes and concentrating VERY difficult.
- The Wi-Fi is pretty terrible up on the top floors, or the lowest floors. Wi-Fi needs to be MUCH stronger throughout the building too, as it is a hub for students!
- Wi-Fi in bottom floor sucks. It won't connect and when it says it's connected it won't work
- STSS was great. I liked all of the technological features of the classroom space (multiple screens for viewing slideshows, microphones at all tables, etc.) as well as the fact that the building is energy efficient in many ways. For the large number of people we had in our class, it was the ideal space. It was definitely the best large class I have had at the UMN in terms of location.
- I really like STSS, it's a wonderful building for classes & whenever a classroom/building ISN'T dingy/redone it is definitely a negative experience, but the one thing I hate about STSS and most UMN buildings is that the desk portion of the seating is absolutely WAY TOO SMALL. Way too small. Can't fit an 8.5x11 on there, let alone your laptop.
- There should be seminars for professors on how to use the audio and visual displays and troubleshoot common problems so that class is facilitated by technology and not hindered by it.
- I am in a flipped class in a normal style lecture hall. It is incredibly difficult to do this class style in such a terrible room for it.
- Not enough outlets, the spiral staircase is very busy, the rooms have ancient input methods, the rooms often smell like onions or other things...
- The lights give me headaches, both from the light and the hum. Also, they flicker a lot.
- The building itself is very beautiful. I enjoy walking around and looking at the unique architecture. I feel very comfortable attending class in STSS and would recommend it to new students as a place to quietly study. Plus, the close proximity to the green line and bus stop makes it perfect for public commuters.
- The classrooms are awesome, I love the setup and class dynamic they foster. However, the stair design is probably the worst I have ever seen out of every building I have ever been in.
- I love the uniqueness of the building structure with the big glass windows and the spiral staircases. I also love the chairs and study spaces everywhere, but I feel like there could be more chairs added in certain places.
- STSS is honestly one of my favorite buildings; I'd study there more often if I had the chance. It's beautiful inside and out and has a very uplifting feel. The classrooms don't hold quite the same feeling I think; they're not as artistic, but I still like them a lot. They're very open, though I wish people opened the blinds for the windows in there more.
- More space is needed for seating, specifically with lower tables for sitting to write and work on homework before class, low cell phone service does happen in this building which is not problematic, but could be improved and a water fountain with the availability to place your water bottle under (i.e. purified water fountain for water bottles and drinking water) would be

nice to have in this building.

- The staircase is poorly designed - having to walk back around on every level and having a column right in the walkway. Also, why is the newest building the only one without water bottle fillers? Why doesn't the most convenient door on the north side open from the outside?
- The design of the interior main spiral staircase is HORRIBLE. You can't walk around the entire thing, instead it directs the flow of traffic through a singular point rather than allowing multiple ways to walk around STSS. This doesn't help traffic when 10 different full-sized lecture halls all let out at the same time of the day and everyone just wants to leave.
- As an engineering student, I am very aware of building design and flow. Upon entering the STSS building I am immediately annoyed daily, due to the inconvenient layout of the staircase. This is referring to the entrance on the southwest corner. The top of the staircase is physically RIGHT next to the door, but in order to get to it, one is made to walk all the way around the staircase, when a pathway could easily be placed connecting the door to the stair, or better yet, there could be more doors going into the building. As of current, it is a building I loathe having classes in because aside from Anderson hall, it is one of the most obnoxiously-designed buildings on campus. I get that it's pretty on the inside, but beauty should NEVER come before function in design. It has been so bad that I have had 2 classes this year where the instructor has specifically requested for us to be moved to a different building.
- I actually look forward to doing this survey whenever I have a class in STSS, because I hate this building. The locations, aesthetics are whatever, they're fine. I hate the layout of the building, can you change that? Probably not, but I'll give my thoughts anyways in case one decides to build another such structure. I hate the central spiral staircase. It's cool looking, but insanely impractical when there are several classes getting out at the same time. I shouldn't have to shuffle, slowly, along with and against the crowd of other students to get into or out of that place. Also, more doors!! Sheesh. Two doors on the first level is not enough. And they're really heavy doors. I see they need to be heavy to accommodate heating and cooling, but those things are ridiculous. Oh, and more tiered sitting please. Onto changes that could actually be made to the current STSS building. Those low chairs with low tables are the dumbest implementation ever for a busy student learning building. And then the other option is a small high top table with three chairs, that realistically only one person could sit and study at? It's a waste. I would much prefer long, normal heighted tables/chairs, that multiple people can sit at, or single (again, chairs of normal height) with tables or side desks. Last thing: more outlets would be nice. That's about all I care to say. I just hate the building in general. More than anything, it's not a practical studying space and it's impossible to move when classes are just letting out. For actual class, it's fine. Using all the extra technology is okay, I prefer a normal lecture hall, but that's just me...
- The floors need more outlets for charging. There are very few by the sit down locations and very few in the classrooms on the second floor.
- The study space in STSS is valued for its natural lighting and open feel. Consider placing more tables, chairs and power strips in areas near the windows to enhance the quality and quantity of available study space.
- The lines at the bathroom are always incredibly long during busy times (typically when classes are close to beginning or when large classes end). Additionally, there are a lack of tables with chairs throughout the building that are conducive to studying (while the benches and low chairs with tables are nice, they aren't ideal always for studying). Also, it would be nice if the larger classrooms (i.e., 230) had plug-ins in some of the rows or built into the chairs.
- There could be a better study space. The chairs are always full, and it's a really nice spot to spend time.

- The classroom is far too small for the size of our class. I feel it is very hard to see, concentrate and learn with how cramped it is.
- I don't really like having no "front" of the classroom- several classes I have are more lecture based.
- Many lectures are placed in the round-table rooms which are not at all conducive to such a setup; this makes the class very unenjoyable. In addition, the lighting in the basement can be pretty harsh after a while. Also, the staircase is REALLY annoying. I have to go around the whole thing to get to the next level.
- The Windows provide an openness to the world that feels peaceful. If there were more tables for students to sit in and study it would be more helpful. The larger classrooms feel awkward with the professor in the middle. Some professors can work with the space others make it more uncomfortable.
- Needs more chairs in which writing or computer typing for long periods of time is reasonable. There is definitely space for them.
- More tables to study throughout the building would be nice. Some kind of system for people in the active learning classroom that lets you know who is speaking into the microphone would be nice.
- The rows of desks in the floor 2 lecture halls (220 and 230) do not have enough vertical distance between them, resulting in my view of the board being obstructed at times. Also, the main lecturer's "desk" is centered on the left side of the room (facing the lecturer), and since I usually sit on the right side this along with tall people in front of me make it difficult to see. This position also affects my ability to hear the lecturer since he sometimes faces the far left side of the board (away from me) and does not talk loud enough for the right side to hear what is going on. I think moving that podium more toward the center might help, but given its symmetry to both the layout of the whiteboards and the projection screens it seems like these halls may have been doomed from the beginning. Seats are really comfortable though and the folding desks are some of the better one's I've used.

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 are 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).