

The Effect of Campus Study Spaces on Mental Wellbeing at Dalhousie University:  
Does the Lack of Natural Light in the Killam Library Reduce Students Mental Wellbeing?

ENVS 3502/SUST 3502

Environmental Problem Solving Part II: Campus as a Living Laboratory

Jolly Green Giants (Group 3)

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## Executive Summary

The purpose of this study is to test whether the lack of natural light in the Killam Library reduces the mental wellbeing of students during the winter season at Dalhousie University in Halifax, Nova Scotia. This study is important because the Killam Library stacks do not provide access to adequate natural light, and the lack of natural light has been proven to reduce the mental wellbeing of students (Grimaldil, Partonen, Saarni, Aromaa, & Lonqvist, 2008). As well as this, the mental wellbeing of students has been shown to decrease during the winter season, as there is less daylight hours (Grimaldil et al, 2008). Therefore, it is important to consider how lighting in the winter season affects the mental wellbeing of students at Dalhousie University.

This study focused on students in the stacks of the Killam Library (experiment) and the quiet area of the Collaborative Health Education Building (CHEB) (control). The selection of the two study areas centred around the level of variation between their lighting systems. The Killam Library stacks has minimal window installations and currently supports fluorescent lighting (Dalhousie University, n.d.). The CHEB quiet area is equipped with LED lights, along with floor-to-ceiling windows offering a source of natural light throughout the day (Dalhousie University, n.d.). Students studying in both study areas were surveyed, and information was collected on preference of campus study areas, average time spent per week studying in a specific study area, important qualities of a study area, the value of light quality in a study environment, physical and emotional responses to study spaces, and lastly, suggestions for improvements to study areas.

Overall, 336 students were sampled. Data was analyzed on excel using chi-squared tests. It was found that students studying in the Killam Library had lower energy levels and higher stress levels than students in the CHEB. These results may be due to the poor lighting quality in the Killam Library. As well as this, students from both sample areas primarily suggested that lighting be improved in the stacks of Killam Library. As students studying in this area have lower energy levels and higher stress levels, and low lighting quality has been proven to cause decrease energy and increase stress, it is recommended that the lighting in the Killam Library be improved (Grimaldil et al, 2008). However, creating window space in the Killam Library is not possible due to its structure. Therefore, Seasonal Affective Disorder lights should be installed in the Killam Library stacks to improve the mental wellbeing of students studying in that area.

## Introduction

More than ever, humans are relying on artificial light for the majority of the day (Cho et al, 2015). Due to this increased reliance, it is important to consider the type of lighting installed in buildings in order to support productivity and mental wellbeing. This is especially relevant in public study spaces. The lack of natural light in buildings has been proven to reduce the mental wellbeing of students (Grimaldil, Partonen, Saarni, Aromaa, & Lonnqvist, 2008). In addition to this, it has been shown that reduced daylight hours in the winter season can negatively affect mental wellbeing (Grimaldil et al, 2008). Drawing from the 1999 study of the Heschong Mahone Group, Kenneth Tanner (2013) found that lighting and school design has a great impact on students' performances in their classes. In particular, lighting had the greatest impact on classes concerning reading vocabulary, reading-comprehension, language arts, mathematics, and science (Tanner, 2013). Tanner concluded that light is the most important environmental input, after food and water, in controlling bodily functions such as blood pressure, pulse, respiration rates, and brain activity (2013).

At Dalhousie University in Nova Scotia, Canada, the Killam Library is the university's busiest library (Dalhousie University, 2018). Built in 1971, the library was made to hold 8000 students and has various study areas (Dalhousie University, 2018). The Killam Library was chosen as the focal study area because it was built for the purpose of providing students with a study space (Dalhousie University, 2018). Lighting is an important aspect to consider in this building, as the type of lighting can affect the mental wellbeing of the students studying in that area (Grimaldil et al, 2008). It is particularly relevant performing this research during Atlantic Canada's winter season, as there is a lack of natural light due to the Winter Solstice (Pease, 2013). The shortened length of day, combined with a lack of artificial bright light, has a negative effect on mental wellbeing and can trigger the occurrence of seasonal mental illness on an annual basis (Grimaldil et al, 2008). Therefore, the research question for this experiment was: Does the lack of natural light in the Killam Library reduce student's mental wellbeing during the winter season? Our study objective was to assess if and how lighting effects students' wellbeing. Based on this information, potential improvements to the Killam Library stacks are suggested in order to enhance students' studying experiences.

It was predicted that there would be a statistically significant positive correlation between the quality of light in the Killam Library and the mental wellbeing of students studying in that area. Additionally, it was predicted that, given the option, students would opt to improve the lighting in the Killam Library, specifically within the quiet study areas.

### **Methods**

Research was collected using a survey. The survey, as seen in Appendix A (Figure 1 and 2), gathered demographic information of sex, academic program(s), and year of study. This data was used in correlation to the information collected from participants on: preference of campus study areas, average time spent per week studying in a specific study area, important qualities of a study area, the value of light quality in a study environment, physical and emotional responses to study spaces, and lastly, suggestions for improvements to study areas. Weather conditions were recorded prior to scheduled surveying times (Appendix B, Table 1). Weather conditions included temperature (°C), precipitation (percentage and type) and sky condition (sunny, partly cloudy, or cloudy). In the design of the survey, possible ambiguities and misunderstandings were anticipated and wording was made clear and simple, as this is a key action in a researcher's role in designing questionnaires (Palys & Atchison, 2014; p.145). This information is relevant to the research problem, as the data collected allows for comprehensive data analysis that can be used to convey commonalities in student preferences and recommend next steps in project development.

Surveying took place in the Killam Library stacks, defined as the small study cubicles located along the perimeter of the library book collections in the Killam Library, and the designated quiet area located on the second floor of the Collaborative Health Education Building (CHEB). The collected data was used to analyze differences and commonalities between students studying in the two buildings. The Killam Library stacks and the quiet area of the CHEB are both designated quiet study areas but have contrasting levels of quality in terms of light exposure and lighting types. The CHEB building provides LED lighting throughout the majority of its public study spaces, as well as natural light sources during daylight hours by way of window installations in the quiet study areas (Dalhousie University, n.d.). In contrast, the Killam Library stacks are equipped with fluorescent bulbs alongside minimal sources of natural lighting. Conducting surveys

in these locations provides data on differing campus study spaces, which can then provide insight concerning the trends of student preferences and mental health.

The survey was given to students studying in both the Killam Library and the CHEB building, according to the assigned schedule (Appendix B, Table 2). Surveying took place on two weekdays and one weekend-day; once during daylight hours and once after dusk each day. All students that were studying in these study areas were approached by a recruiter with a pen and paper survey and were asked to complete the survey. A consent write-up was included at the top of the survey and students were able to opt out of participating in the survey (Appendix A, Figure 1).

In the Killam Library, the recruiter went to the stacks, from the second to fourth floor, and gave each person studying a survey to complete. In the CHEB building, the recruiter went to the quiet area, located on the second floor of the CHEB, and gave each person studying a survey to complete. The recruiter then left the area to allow the students to complete the survey in private.

The survey was designed to maximize data collection with a limited timeframe, as the study required surveying busy university students. Therefore, the survey took approximately 3-5 minutes to complete. The interactive technique of paper and pen surveys protects confidentiality, values all responses equally, collects primary data quickly and directly from respondents, and collects demographic data that enhanced analysis (Palys & Atchison, 2014, p.145). For these reasons, a survey option was the best option for this project.

After 10 minutes, the recruiter returned to the study area and collected the surveys face-down in an opaque box to preserve confidentiality. The data was collected from the surveys and compiled in an excel spreadsheet for further analysis. Data was coded to unify responses, then responses were analyzed using chi-squared tests.

## **Results**

The sample size was N=336, with 150 male respondents, 184 female respondents, and 2 respondents that did not specify their sex. Of this, 29% of respondents were first year students, 30% were second year students, 24% were third year students, and 16% were fourth year students. No student indicated that they were above fourth year, however, some health professions or law students would have completed an undergrad prior to their current program. The most common

average hours studied per week in the Killam Library and the Collaborative Health Education Building was 20+ hours (34% and 27% respectively). For all statistical analyses (chi-squared tests), there was a significant difference between the expected and the observed frequencies of the categories ( $p < 0.05$ ).

Figure 1 (Appendix B) displays the distribution of academic programs of students studying in the Killam Library and the Collaborative Health Education Building. The majority (51%) of students studying in the Killam Library were studying a Bachelor of Science, whereas the majority (46%) of students studying in the Collaborative Health Education Building were studying a Health Profession. The primary study spaces on Dalhousie campus used by students studying in the Killam Library and the Collaborative Health Education Building were those two spaces, with 45% choosing the Killam Library and 43% choosing the Collaborative Health Education Building (Figure 2, Appendix B).

In the Killam Library, the primary reason (56% of responses) for students choosing the Killam Library stacks as a study area was due to the noise level (Figure 3, Appendix B). The secondary reason was because it was a convenient location (25%). In the Collaborative Health Education Building, there were four dominant reasons for choosing this study area (Figure 3, Appendix B). The four main responses were convenient location (26%), comfort (24%), lighting quality (21%) and noise level (20%). These responses were not due to random chance (Killam:  $p < 0.05$ ; CHEB:  $p < 0.05$ ).

In the Killam Library, 39%, 30% and 28% of students responded that lighting was important, mildly important and slightly important, respectively (Figure 4, Appendix B). The remaining 3% of students responded that lighting was not important. In the Collaborative Health Education Building, 81% of students responded that lighting was important, followed by 14% responding that it is slightly important, and 5% mildly important (Figure 4, Appendix B). No students responded that lighting was not important. These responses were not due to random chance (Killam:  $p < 0.05$ ; CHEB:  $p < 0.05$ ).

The type of lighting preferred by students studying in the Killam Library was dominated by natural and bright light, with 50% and 40% responses respectively (Figure 5, Appendix B). 10% of students preferred dim light, and >1% (1 student) chose other. The type of lighting preferred by students studying in the Collaborative Health Education Building was dominated by natural and bright light as well (Figure 5, Appendix B). The primary light preference was natural



light, with 62% of responses and the secondary light preference was bright light with 36% of responses. 2% of students preferred dim light and no students preferred other light types. These responses were not due to random chance (Killam:  $p < 0.05$ ; CHEB:  $p < 0.05$ ).

The average of light quality rating in the Killam Library and Collaborative Health Education Building was 5.1 and 7.4 respectively (Killam:  $p < 0.05$ ; CHEB:  $p < 0.05$ ). The majority of students studying in the Killam Library rated the lighting quality as 7 and 3 with 25% and 19% of responses, respectively (Figure 6, Appendix B). The majority of students studying in the Collaborative Health Education Building rated the lighting quality between 7 and 9, with 37%, 19% and 29% choosing 7, 8 and 9, respectively (Figure 6, Appendix B).

The majority of students in both the Killam Library and the Collaborative Health Education building rated their outlook on the upper end of the 1-9 scale (Figure 7, Appendix B). Students in the Killam Library had an average rating of 5.3 and student in the Collaborative Health Education building had an average rating of 6.5 (Killam:  $p < 0.05$ ; CHEB:  $p < 0.05$ ). The most common rating was 7 in both the Killam Library (28%) and the Collaborative Health Education Building (43%).

The average rating for the Killam and CHEB was 4.5 and 5.4, respectively ((Killam:  $p < 0.05$ ; CHEB:  $p < 0.05$ ). Students studying in the Killam Library rated their energy level as 3 (26%), 4 (20%) and 6 (18%) most commonly (Figure 8, Appendix B). Students studying in the Collaborative Health Education Building rated their energy level as 7 (33%) primarily. Students in the Collaborative Health Education Building also rated their energy level as 4 and 6 equally (19% each).

The average stress level of students studying in the Killam Library and Collaborative Health Education Building was 5.1 and 5.8 respectively (Killam:  $p < 0.05$ ; CHEB:  $p < 0.05$ ). The stress level of students in the Killam Library after studying was predominantly a level 7 and level 3, with 29% and 24% of students selecting this response, respectively (Figure 9, Appendix B). The stress level of students studying in the Collaborative Health Education Building was predominantly 7 (33%) and 6 (19%).

The average productivity level of students studying in the Killam Library and Collaborative Health Education Building was 5.7 and 7 respectively (Killam:  $p < 0.05$ ; CHEB:  $p < 0.05$ ). Students studying in the Killam Library rated their productivity as 7 (28%) and 6 (20%) most commonly (Figure 10, Appendix B). The majority of students in the Collaborative Health Education Building rated their productivity level as 7 (40%) and 8 (20%).

Students studying in the Killam Library primarily chose that furniture quality (45%) and lighting quality (27%) should be improved (Figure 11, Appendix B). 14% of students selected that decorations and wall colour should be improved and an equal amount (7%) of students selected noise level or other improvements. Students studying in the Collaborative Health Education Building equally (29%) selected that lighting quality and noise level should be improved (Figure 11, Appendix B). The secondary aspect for improvement selected was furniture quality, with 26% selected. An equal amount (8%) of students chose decorations and wall colour or other improvements. These responses were not due to random chance (Killam:  $p < 0.05$ ; CHEB:  $p < 0.05$ ).

The primary location chosen to improve lighting in the Killam Library from the Killam Library and Collaborative Health Education Building samples was the stacks, with 26% of students selecting this response (Figure 12, Appendix B). Secondly, 20% of students chose no improvement. The tertiary and quaternary locations for lighting improvement were everywhere (18%) and the atrium (17%), respectively. These responses were not due to random chance (Killam:  $p < 0.05$ ; CHEB:  $p < 0.05$ ).

## Discussion

The purpose of this research was to find correlations between lighting type, or other study space features, to student mental wellbeing in designated study spaces at Dalhousie University. Furthermore, this study aimed to determine actions that can be taken to improve student experiences and mental wellbeing in campus study areas. Through surveying students in the Killam Library and the Collaborative Health Education Building (CHEB), it was possible to compare responses between study areas to better understand how different study spaces impact student's mental responses.

Dalhousie University has approximately 18,200 students enrolled across all campuses (Dalhousie University, n.d.). To have a confidence level of 95% and a margin of error 5%, this project required a sample size of 377. With 192 samples collected from the Killam Library and 144 samples collected from the CHEB, the total sample size was 336. Being short 41 participants, our study of  $N=336$  has a margin of error 5.3%. Limitations of our study include sample size, survey response errors, and time constraints on the study. As well as this, participants were limited to students who were studying in the Killam Library and Collaborative Health Education Building

during the designated sampling times, highlighted in the schedule in Table 2, Appendix B. With recognition of the limitations and delimitations, the statistical results are representative of the student population of Dalhousie University under the assumption that our sample is homogeneity, with a non-probabilistic sampling technique.

By year of study, the samples were distributed relatively equally with 29% first year students, 30% second year students, 24% third year students, and 16% fourth year students. The average time per week spent studying in the Killam Library and the CHEB was 20+ hours, showing the frequent use of these areas and furthering our reasoning for a need of adequate lighting in these areas.

It was found that students studying in the Killam Library rated their energy level as 3 (26%), 4 (20%) and 6 (18%) most commonly (Figure 8, Appendix B). Whereas students studying in the Collaborative Health Education Building rated their energy level as 7 (33%) primarily, with a rating of 4 and 6 secondarily (19% each). These results of self-reported energy levels may be associated to the light quality of each building. Therefore, with students indicating that the Killam has inadequate lighting, the lack of natural or dim light may result in lower energy levels.

Similarly, the lack of adequate lighting may result in higher stress levels. Students in the Killam Library had higher stress levels than those in the CHEB, with students in the Killam Library rating stress at level 7 (29%) and level 3 (24%) and students in the CHEB rating stress at level 7 (33%) and level 6 (19%). While the primary answer of level 7 was the same in both study spaces, there is a drastic difference between level 3 in the Killam and level 6 in the CHEB. Reduction in light can be linked to high stress levels (Tanner, 2013). As well as this, it has been shown that the length of exposure to various types of light (ex. fluorescent) can have a significant negative effect on stress levels and circadian behaviour (Alves-Simoes, Coleman, Canal, 2015). Therefore, the higher stress levels in students in the Killam Library may be due to the lighting type.

Student responses to question eight, "If you could make one improvement to your current study area, what would it be?", failed to support the hypothesis that the primary location of improvement in the Killam Library would be light quality. Students studying in the Killam Library primarily chose furniture quality (45%), then lighting quality (27%) for improvement (Figure 11, Appendix B). While this does not directly support our hypothesis, 27% of students is a considerable number of students seeking improvements in lighting quality, and therefore these results should be considered. It is also important to note that when asked the reason for choosing

their study area, 50% of respondents in the Killam Library chose natural light but 25% of respondents chose convenient location. There is a strong possibility that while students may prefer natural light, convenience is more important. Further research on this subject is encouraged. As the primary aspect for improvement in the Killam Library was furniture quality, further studies on the relationship between furniture quality and student mental and physical wellbeing should be considered to improve students' studying experiences in Dalhousie Campus study areas.

All weather was recorded for each sample time. While data analysis was not conducted on weather in relation to survey responses, it was considered notable data. It has been shown that weather can affect the mental wellbeing of a person (Grimaldil, Partonen, Saarni, Aromaa & Lonnqvist, 2008). As seen in Table 1, Appendix A, some sampling days had precipitation (rain or snow), while others had clear weather. This difference has a potential to affect the responses from students at that time, and this limitation is recognized. Further analysis on weather and student mental wellbeing is encouraged.

### **Conclusion**

This study aimed to determine the correlation between lighting and the mental wellbeing of students in the Killam Library and the Collaborative Health Education Building (CHEB) at Dalhousie University. Based on our results, furniture quality should be improved in the Killam Library. However, there was a considerable number of students that selected light quality as their primary improvement. The results of this study show that students who study in the Killam Library have lower energy levels and higher stress levels compared to the students in the CHEB. Therefore, light quality is an important improvement that Dalhousie University should take into consideration. However, installing additional windows in the Killam Library is not possible due to its structure and age. Therefore, the installation of Seasonal Affective Disorder (SAD) lights is recommended as an alternative solution.

Many aspects of a study area, other than lighting quality, may influence mental wellbeing and learning efficiency of students. Therefore, other aspects of a study areas should be further researched. It is important to consider the effect of furniture quality on mental wellbeing and performance in students, as students primarily chose furniture quality as an aspect needing improvement in the Killam Library. As well as this, further analysis on the correlation between

students who prefer natural light, but chose a study area based convenient location, should be conducted. Finally, further analysis on the effect of weather on student stress and productivity levels is needed. Designing and improving campus study spaces is a complex project with many factors to be considered. Therefore, all aspects of a study area should be considered to achieve better working spaces on campus that maximize functions and service efficiency for a broad population of students.

### **Acknowledgements**

This research project would not have been possible without the help of the mentor of this project, Romeet Gonsalves, and the professor of ENV5 3502, Dr. Amy Mui. We thank them for their support, guidance and criticism of this project. We would also like to thank the participants in this study survey for making this project possible.

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## Appendix A

<b>Dalhousie University Study Area Survey</b>
<p>* Upon completion of this survey, you have given consent for the uses of your responses in analyses, project development, and a final report. No identifying information will be shared and your responses will remain anonymous. Thank you for participating.</p>
<p>Sex: _____ Year of Study: _____ Academic Program: _____</p>
<p><i>(Place a (✓) beside the answer that most accurately applies to you)</i></p> <p>(1) Where do you study most on campus?</p> <p>Killam Library _____  Student Union Building _____  Wallace McCain Learning Commons _____  Kings Library _____  Collaborative Health Education Building _____</p> <p>(2) Please number your top 3 study spaces on Campus (number 1 being your top location)</p> <p>Collaborative Health Education Building (CHEB) _____  Goldberg Computer Science Building _____  Killam Library _____  King's Library _____  Life Sciences Centre _____  Marion McCain Arts and Social Sciences _____  Mona Campbell Building _____  Student Union Building (SUB) _____  Wallace McCain Learning Commons _____  Other (please specify): _____</p> <p>(3) On average, how many hours do you study per week in your current study area? (please write a number)</p> <p>_____</p> <p><i>(Place a (✓) beside the answer that most accurately applies to you)</i></p> <p>(4) What aspect of a study area is most important to you?</p> <p>Quiet _____  Comfort _____  Lighting _____  Convenient location _____  Accessibility to services (ex. Food services) _____  Other (please specify) _____</p>

Figure 1: Survey questionnaire page 1.

*(Place a (✓) beside the answer that most accurately applies to you)*

(5) How important is light quality in a study environment to you?  
Low importance \_\_\_\_  
Slightly important \_\_\_\_  
Neutral \_\_\_\_  
Moderately important \_\_\_\_  
Unimportant \_\_\_\_

*(Place a (✓) beside the answer that most accurately applies to you)*

(6) After studying in this current study area, how is your emotional mental state?  
Very bad \_\_\_\_  
Somewhat bad \_\_\_\_  
Neutral \_\_\_\_  
Somewhat good \_\_\_\_  
Very good \_\_\_\_

*(Place a (✓) beside the answer that most accurately applies to you)*

(7) Did you have any previous mental health issues before coming to university?  
Yes (provide specificity if possible) \_\_\_\_\_  
No \_\_\_\_

*(Place a (✓) beside the answer that most accurately applies to you)*

(8) If you selected "no" for question 7, did you develop any mental health issues at university?  
Yes (provide specificity if possible) \_\_\_\_\_  
No \_\_\_\_

*(Place a (✓) beside the answer that most accurately applies to you)*

(9) If you could make one improvement to your current study area, what would it be?  
Noise levels \_\_\_\_  
Light quality \_\_\_\_  
Furniture quality (desk/chair) \_\_\_\_  
Wall color/decorations \_\_\_\_  
Other (please specify) \_\_\_\_\_

Figure 2. Survey questionnaire page 2.



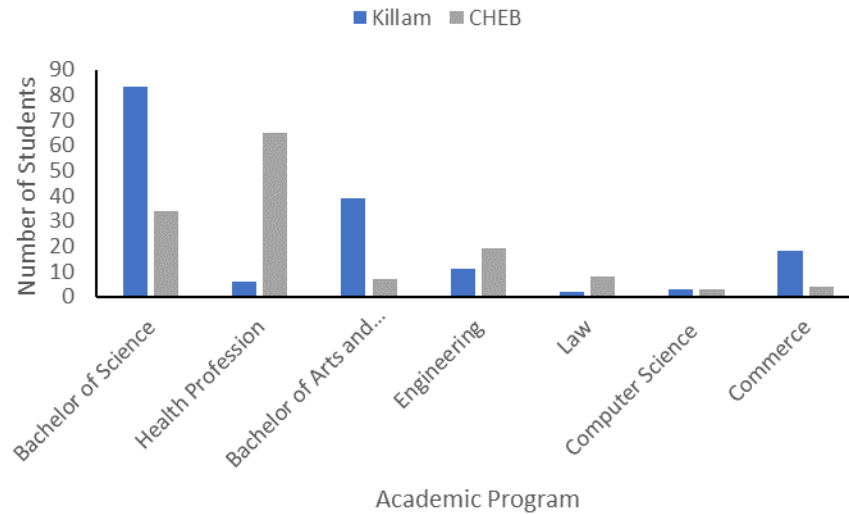
## Appendix B

*Table 1.* Weather recordings in Halifax, Nova Scotia on March 7th, 8th and 10th at various times of surveying.

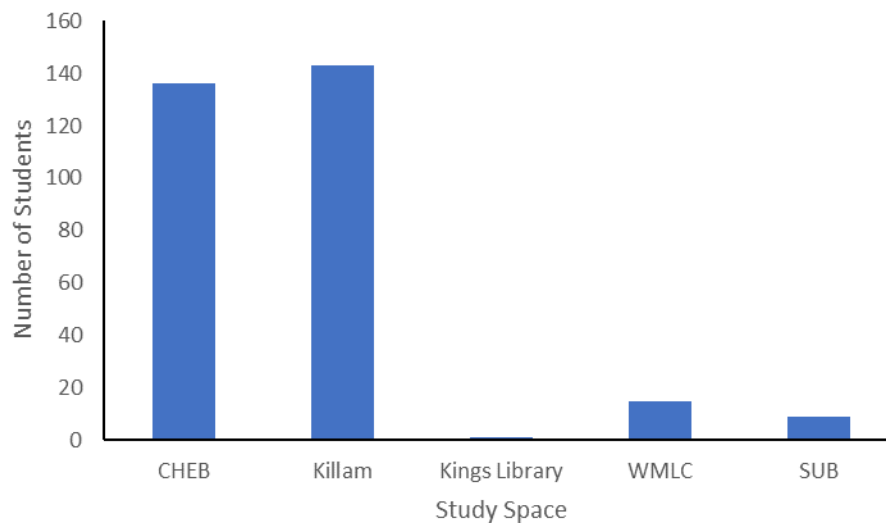
<b>Date</b>	<b>Time</b>	<b>Weather</b>
March 7 <sup>th</sup> , 2018	13:20	5°C; Overcast
March 7 <sup>th</sup> , 2018	15:00	4°C; Mostly Cloudy, Dark
March 7 <sup>th</sup> , 2018	20:00	0°C; Cloudy, Dark
March 8 <sup>th</sup> 2018	15:05	5°C; Overcast
March 8 <sup>th</sup> , 2018	16:30	0°C; Overcast
March 8 <sup>th</sup> , 2018	19:00	2°C; Rainy, Dark
March 10 <sup>th</sup> , 2018	15:00	3°C; Light Snow, Sunny
March 10 <sup>th</sup> , 2018	19:00	0°C; Dark, Cool, Dry

*Table 2.* Schedule of date, time and location of sampling.

<b>Sample</b>	<b>Date</b>	<b>Time</b>	<b>Location</b>
1	Wednesday, March 7 <sup>th</sup> 2018	13:20	Killam Library
2	Wednesday, March 7 <sup>th</sup> 2018	20:00	Killam Library
3	Wednesday, March 7 <sup>th</sup> 2018	15:00	CHEB
4	Wednesday, March 7 <sup>th</sup> 2018	20:00	CHEB
5	Thursday, March 8 <sup>th</sup> 2018	15:00	Killam Library
6	Thursday, March 8 <sup>th</sup> 2018	19:00	Killam Library
7	Thursday, March 8 <sup>th</sup> 2018	16:30	CHEB
8	Thursday, March 8 <sup>th</sup> 2018	19:00	CHEB
9	Saturday, March 10 <sup>th</sup> 2018	15:00	Killam Library
10	Saturday, March 10 <sup>th</sup> 2018	19:00	Killam Library
11	Saturday, March 10 <sup>th</sup> 2018	15:00	CHEB
12	Saturday, March 10 <sup>th</sup> 2018	19:00	CHEB



*Figure 1.* Academic program of students surveyed in the Killam Library (Killam) and the Collaborative Health Education Building (CHEB) at Dalhousie University in Halifax, Nova Scotia. Academic programs consist of; Bachelor of Science, Health Profession, Bachelor of Arts and Social Science, Engineering, Law, Computer Science and Commerce. The full list of undergraduate programs within these categories is available through the Dalhousie University Website at <https://academiccalendar.dal.ca/>.



*Figure 2.* Primary study spaces of students studying in the Killam Library and Collaborative Health Education Building at Dalhousie University in Halifax, Nova Scotia.

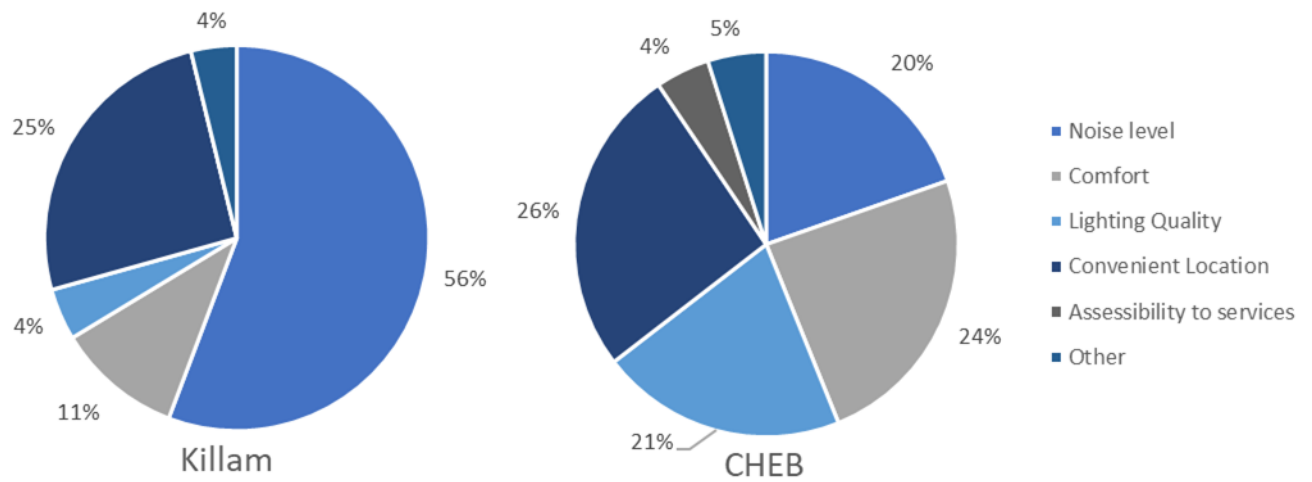


Figure 3. Students reasons for chosen study space in the Killam Library (Killam) and Collaborative Health Education Building (CHEB) at Dalhousie University in Halifax, Nova Scotia.

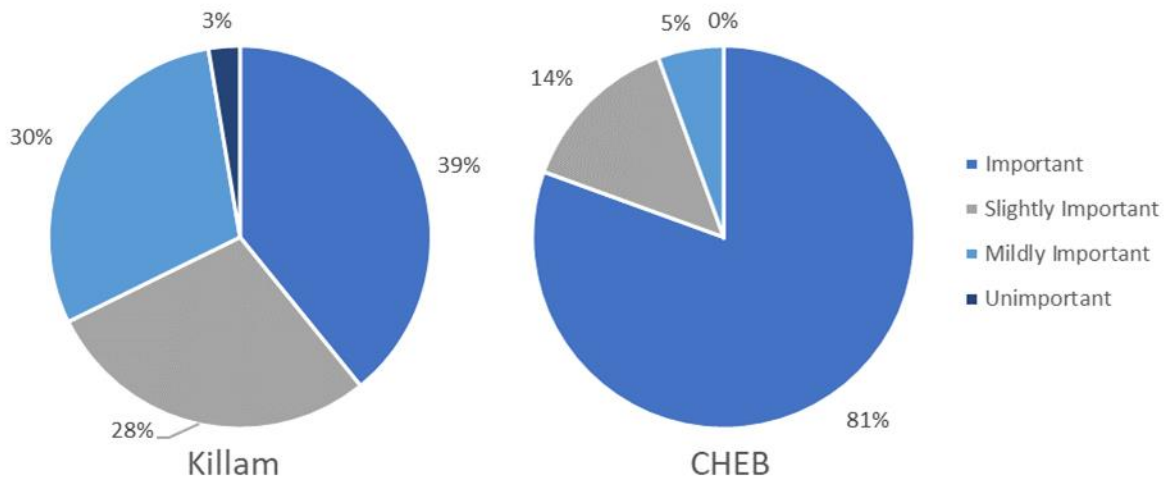


Figure 4. Importance of lighting for students studying in the Killam Library (Killam) and the Collaborative Health Education Building (CHEB) at Dalhousie University in Halifax, Nova Scotia.

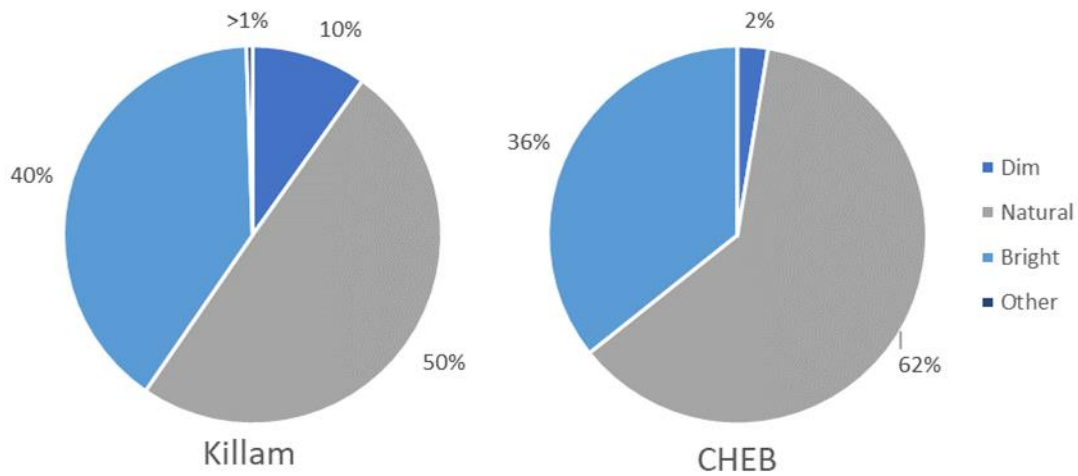


Figure 5. Type of lighting preferred by students studying in the Killam Library (Killam) and Collaborative Health Education Building (CHEB) at Dalhousie University in Halifax, Nova Scotia.

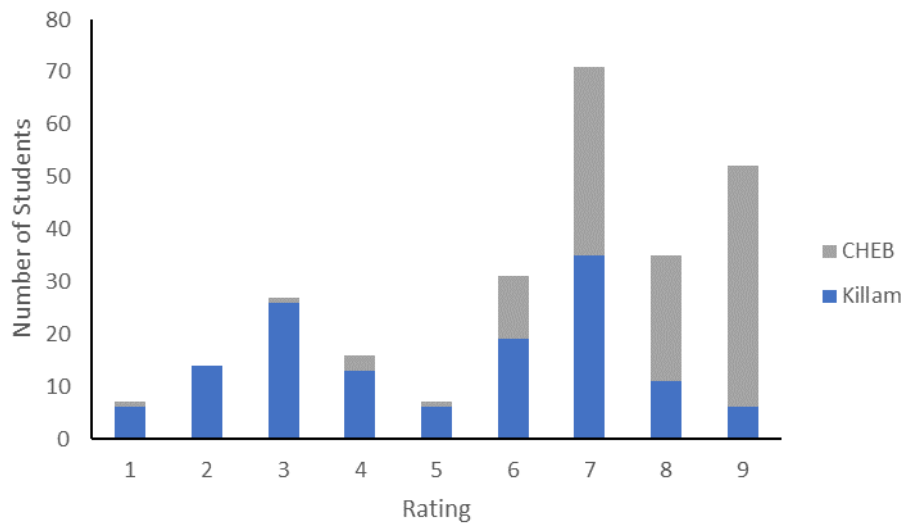


Figure 6. Student ratings of lighting quality in the Collaborative Health Education Building (CHEB) and the Killam Library (Killam), where 1=poor lighting quality and 9=excellent lighting quality.

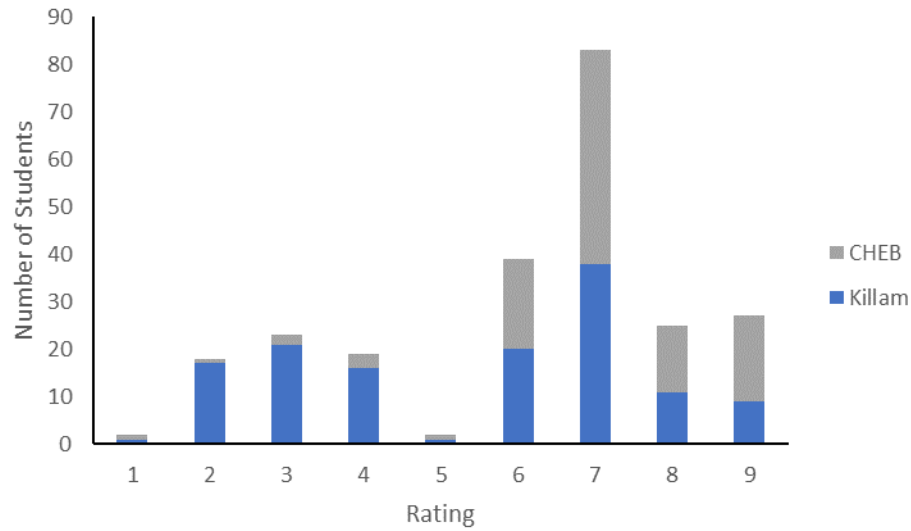


Figure 7. Student ratings of their outlook after studying in the Collaborative Health Education Building (CHEB) and the Killam Library (Killam), where 1=negative outlook and 9=positive outlook.

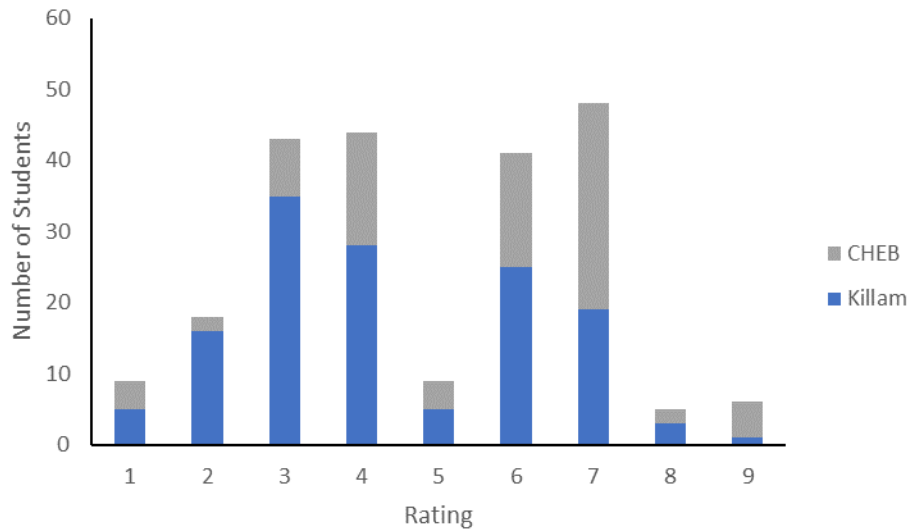


Figure 8. Student ratings of their energy level after studying in the Collaborative Health Education Building (CHEB) and the Killam Library (Killam), where 1=fatigued and 9=energetic.

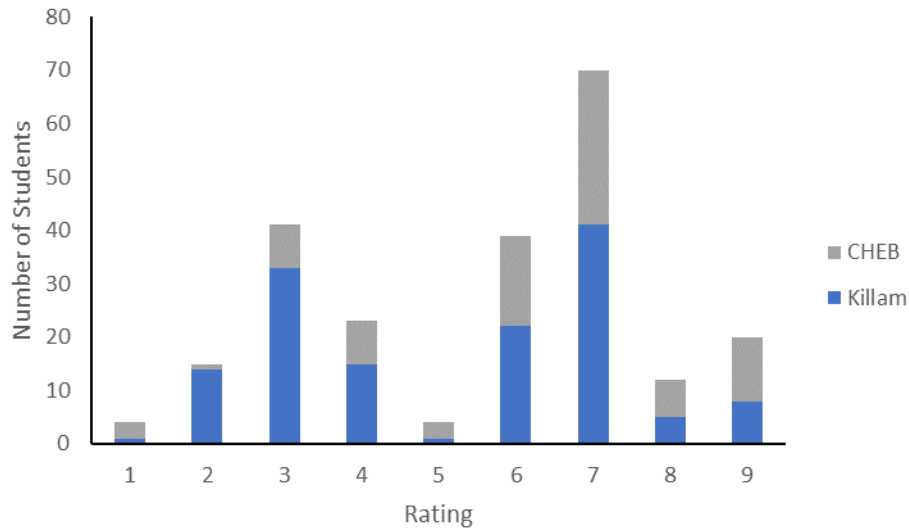


Figure 9. Student ratings of their stress level after studying in the Collaborative Health Education Building (CHEB) and the Killam Library (Killam), where 1=stressed and 9=calm.

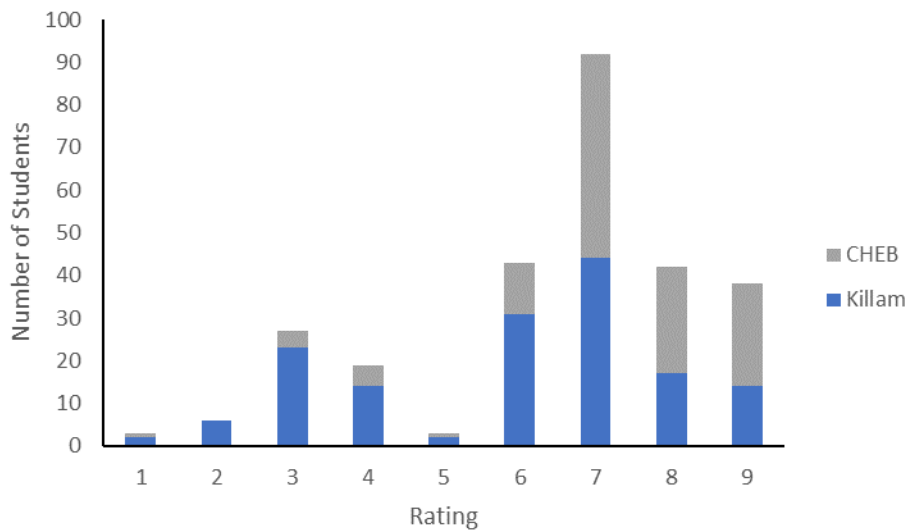


Figure 10. Student ratings of their productivity level after studying in the Collaborative Health Education Building (CHEB) and the Killam Library (Killam), where 1=unproductive and 9=productive.

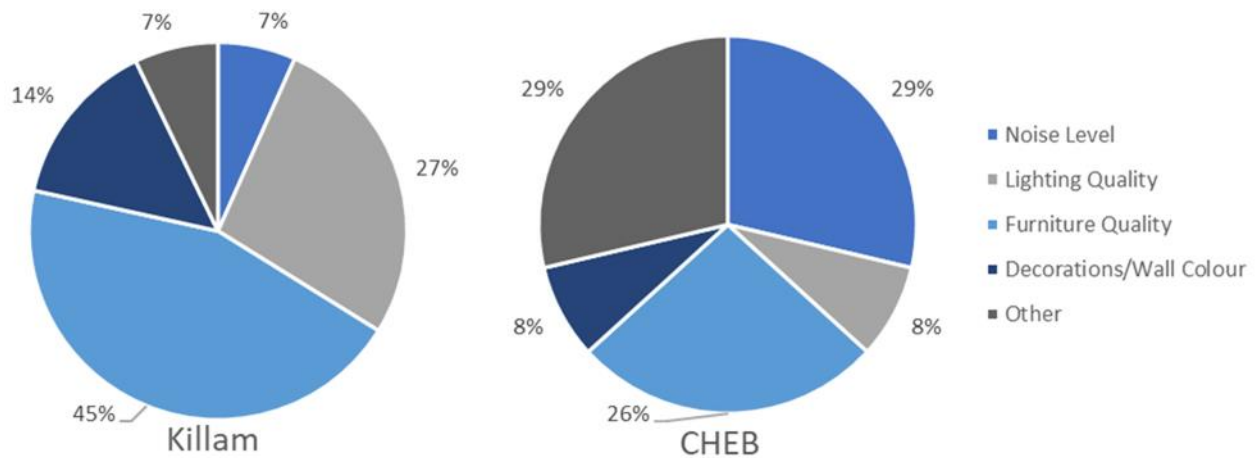


Figure 11. Improvements students studying in the Killam Library (Killam) and the Collaborative Health Education Building (CHEB) recommend for their current study spaces at Dalhousie University in Halifax, Nova Scotia.

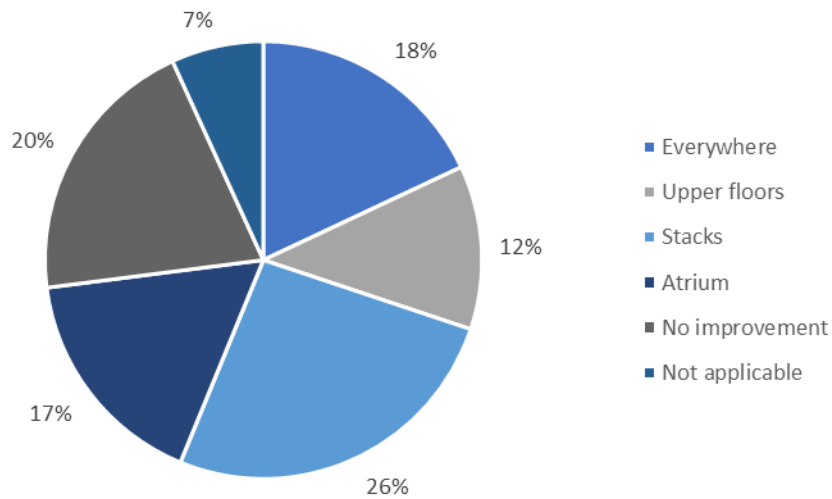


Figure 12. Locations to improve lighting in the Killam Library, recommended by students studying in the Killam Library and Collaborative Health Education Building at Dalhousie University in Halifax, Nova Scotia.