

**Dalhousie University, Studley Campus Energy Audit
Killam Computer Labs: Are they a waste of energy?**

Final Research Report
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ENVS/SUST 3502: Campus as a Living Laboratory
Professor: Tarah Wright
Mentor: Eliza Jackson

Writers: Christina Martin, Sarah Colley, Darlynton Nonju, and Katie Bartlett
(Team Young)

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2. Executive Summary

The purpose of this research study is to advance Dalhousie University's sustainability initiatives related to energy usage and consumption. Recently, the number of computers and computer usage has increased significantly on university campuses. This report addresses the energy usage of computer labs in the Killam Memorial Library, which is located on Studley campus. The computer labs involved in the study include the Learning Commons on the main floor and the Learning Commons on the second floor of the library. The results from this study provide recommendations for future measures that could be taken in order to reduce energy inefficiencies associated with these computer labs on campus.

A quantitative methodological approach was used when conducting the research study. In order to measure the energy use of computer labs, the research team conducted an energy audit. The energy audit involved probabilistic observations. Observations were recorded to indicate the state of both the computer and the monitor. Observations took place for a week throughout various times of the day. The hourly data collection period times for Monday and Friday were 9am-12pm, and 5pm-8pm. The collection periods for Sunday were 11am-2pm, and 7pm-11pm. The different computer states recorded were on, asleep, or off. The state of the computers revealed patterns of computer usage in the Killam Memorial Library.

The results of the observational study displayed that computers are used consistently throughout the day. However, many computer users fail to initiate power management strategies such as turning computers off or using sleep mode when computers are not in use.

The recommendations include implementing two policies that would create more energy efficient computer labs in the Killam Library: (1) to have a set timer for computers to either enter sleep mode or turn off at certain times of the day, and (2) to automatically initiate sleep mode when computer users log-off. These policies are recommendations for Dalhousie University to adopt in order to reduce energy inefficiencies of the Killam Memorial Library computer labs.

3. Introduction

3.1 Research Purpose and Question

Dalhousie University has displayed the institution's commitments related to sustainability when the university signed the Talloires Declaration (University Leaders For A Sustainable Future, 2001). Globally, over 350 university and college President's have signed this Declaration (University Leaders For A Sustainable Future, 2001). The commitment of universities to create a sustainable future is extremely important as campus research can initiate sustainable change at a global scale. The 1990 Report and Declaration of the President's Conference highlighted the importance of sustainability at universities across the country (University Leaders For A Sustainable Future, 2001). "Universities educate most of the people who develop and manage society's institutions. For this reason, universities bear profound responsibilities to increase the awareness, knowledge, technologies, and tools to create an environmentally sustainable future" (University Leaders For A Sustainable Future, 2001).

The Office of Sustainability at Dalhousie University formed in January 2008 (Owen, 2015). The Office is composed of a variety of different groups on campus such as administrative, college, student office, and research groups (Owen, 2015). Sustainability Tracking, Assessment and Rating System also referred to, as STARS is a credit rating system (Owen, 2015). This year, Dalhousie improved from silver to a gold rating based on this system (Owen, 2015). However, the energy section rated 0, as Dalhousie University did not meet the threshold under this category (Owen, 2015). The energy category of the STARS rating system is based on both building energy consumption and clean and renewable energy (AASHE, 2015). The building energy consumption includes lab and energy intensive spaces such as computer labs on campus (AASHE, 2015). Although the campus has made significant improvements and a variety of sustainability accomplishments, energy usage is an area that still needs to be improved. Thus, the topic of this research project relates to the campus sustainability issue of energy.

The purpose of this research project is to address the energy usage of computer labs located in the Killam Memorial Library. The research project is an energy audit that uses a quantitative methodological approach. The findings of this research will aid in making future recommendations to reduce the energy use on campus associated with the computer labs located in the library. The research question of this project is stated below:

- What are the energy inefficiencies in the Killam computer labs and what measures could be taken in order to reduce these inefficiencies?

3.2 Research Team

The researchers involved in this project come from a variety of different backgrounds. The research team consists of a third year student, Christina Martin, who is majoring in Urban Planning and Environmental Sustainability. Sarah Colley is a fourth year student researcher who is studying Environment, Society & Sustainability (ESS) and International Development. Katie Bartlett is a fourth year student completing a Bachelor's of Science in Biology and Environmental Studies. Darlynton Nonju is a fourth year student researcher who is passionate about Earth and Environmental Sciences. This diversity will be beneficial as sustainability issues are often complex and require a multidisciplinary approach. The different educational backgrounds of this research team will collaborate in order to effectively undertake this research project for ENVS/SUST 3502: Campus as a Living Laboratory. All researchers share a common goal of promoting sustainability on their university campus.

3.3 Study Location

The location of this research project will take place on Dalhousie University's Studley campus, which is also the main campus (see Appendix 1). The Killam Memorial Library is the largest library on campus (Fraser-Brace Maritimes Limited, n.d.). The library is located on University Avenue. The construction of the Killam Library started in 1965 when Dorothy Killam donated \$30 million dollars (Fraser-Brace Maritimes Limited, n.d.). The library was officially completed in 1971 and has been renovated twice since (Fraser-Brace Maritimes Limited, n.d.).

3.4 Research Scope

The scope of this research project focuses on two computer labs in the Killam Library, which is located on Studley campus. Individuals who use the computers in this library are Dalhousie University students, faculty, and staff. Essentially the computers located in this building are accessible to anyone who has a Net ID and password. The computer labs that will be observed for data collection include the learning commons on the main floor and on the second floor of the library. The learning commons on the main floor is referred to as the South Learning Commons (see Appendix 2). The South Learning Commons has a total of 123 desktop computers. This includes 14 Mac's and 109 PC's. The computer lab on the second floor quiet room is referred to as the Upper Learning Commons (see Appendix 3). This computer lab has a total of 46 desktop computers. This includes 5 Mac's and 41 PC's. The energy audit for this research study focuses strictly on the energy consumption associated with the desktop computers in the labs identified above. This does not include the energy associated

with the printers or scanners that are sometimes used in conjunction with these desktop computers.

As this research project is using quantitative measures rather than qualitative measures, there are not any significant limitations surrounding the populations that are under study. However, the scope of the data collection process is limited due to the time constraints of this course and the availability of the research team. If more time were allotted for data collection, the results of this research would contain a higher level of validity. Another limitation to this research project is the time of year the data is being collected. To ensure greater validity, the research conducted in this project would have to take place in both the fall and winter terms, as well as off-peak library times such as the summer, Christmas Break, and Reading Week. However, the results of energy use from this project can be used as a general template for future research studies.

Due to the observational nature of the scope of our research and recommendations, a budget is not required.

4. Background and Literature Review

There is an emerging need for environmental initiatives related to energy efficiency on university and college campuses. Institutions such as universities and colleges are molding the future leaders and are key places to begin combatting the issues of sustainability (Finlay & Massey, 2012). The concern for environmental sustainability has been increasing since the 1970s and institutions of higher education (HE) are seen as having the ability to become leaders in global sustainability (Finlay & Massey, 2012). Jessica Finlay and Jennifer Massey (2012) state that university and college campuses have a variety of environmental impacts, which range from air and water pollution and waste, to the vast energy sources they consume. In 1990, the Talloires Declaration was composed, and universities worldwide signed the declaration in their commitment to environmental sustainability. As of July 2014, there are 472 signatories, which include Dalhousie University (ULSF, 2001). Universities and colleges are being held accountable to environmental sustainability by their students, and more commonly, the offices and centers opening up on campuses specifically focused on environmental responsibility (Finlay & Massey, 2012). HE institutions have been identified as some of the most computer-dense settings, and with this comes the need for energy efficiency and monitoring (Hirst, Kaplan, Miller & Reed (2013).

In order to commit to environmental sustainability, HE institutions need to focus on the largest energy consuming aspects of their campuses. For the purpose of this research project, we will look into the energy efficiency of computer labs on Dalhousie

campus, namely in the Killam Memorial Library, as computer and IT technology account for a large amount of energy consumption in these settings (Hirst et al., 2013).

There is a substantial amount of literature that touches on the issue of power management within the computing and IT industry. Other similar research projects in this field have: investigated the benefits of default energy-saving settings in computers, established the connection of Energy Star criteria development with desktop computers' energy efficiency, led to the development of tools to estimate the energy consumption of computer software, and examined university campus buildings' energy consumption in the IT sector.

The default or built-in energy-saving settings on computers have a significant impact on energy consumption (Hirst et al., 2013). Hirst et al., (2013) discuss the nature of humans in choosing the option that requires the least amount of effort, therefore proving that having energy-saving settings on computers such as the initiation of sleep-mode or powering down after a specific amount of idle time, are viable methods of energy conservation. This research demonstrated a weighty cost and energy savings when explored across university campuses (Hirst et al., 2013).

Energy Star is a criteria that was developed to provide consumers with information regarding the energy performance of products such as computers, refrigerators, and other technologies (Lim & Schoenung, 2011). Energy Star undertook a study of desktop computers' energy efficiencies in relation to the required standards already developed by their criteria. The study demonstrated that computer manufacturers do in fact have a focus on reducing the energy consumption of their machines rather than attaining the Energy Star label (Lim & Schoenung, 2011).

Green Tracker, a tool being developed by Nadine Amsel and Bill Tomlinson (2010), has been generated to determine the amount of energy that different computer software consume and to provide awareness regarding these software systems. Amsel and Tomlinson (2010), outline the environmental issue of computers' energy consumption. They discuss the environmental and fiscal importance of proper power-management of computers, for example, the CO₂ emissions that could be avoided, and the money that could be saved in electricity costs (Amsel & Tomlinson, 2010). Though our study does not focus on individual software energy usage in Killam Memorial Library computers, it is important to note that proper power-management of computer labs on Dalhousie campus could reduce electricity costs to the University while also reducing CO₂ emissions.

In 2009, the University of San Diego conducted research regarding the energy consumption of buildings on their campus, with a focus on the energy consumption of

computer and IT equipment (Agarwal, Gupta & Weng, 2009). Agarwal et al. (2009) stated that, "...a good fraction of energy use in mixed-use buildings is in fact by the IT and communications/networking equipment, accounting for approximately 20% of the total energy use, second only to lighting" (p.55). This study is valuable to our research, as we will be investigating the energy usage in computer labs in the Killam Memorial Library, a mixed-use building.

Universities, colleges and other educational institutions provide computers on their campuses for students and faculty members to make use of. The computers and IT equipment on campuses consume a vast amount of electricity and contribute to CO₂ emissions. The research on the energy inefficiencies of Killam Memorial Library computer labs is important because Dalhousie has committed to environmental sustainability, and a large part of that is reducing electricity usage on campus. Other universities such as the University of San Diego, Northwestern University, the University of Waterloo, the University of British Columbia, and the University of Calgary have made commitments to sustainable power-management of computer and IT equipment on their campuses (Agarwal et al., 2009., Allford, 2013., Northwestern University, 2009., Tufts University, n.d., University of Waterloo, n.d.). There is no lack of literature stating that proper power management of computer labs on HE campuses is necessary. Dalhousie University could benefit from the environmental and economic implications of enhanced power management of computers on campus. The benefits of powering-down computers is evident. The task for many HE institutions is finding an incentive for faculty, students and other members of the university community to engage in powering-down, or at least initiating sleep mode for computers when they are no longer in use.

5. Research Methods

5.1 Description of Sample

This study audited the energy usage of the computers found on first and second floor Learning Commons of the Killam Memorial Library. The only computers considered for this study were ones that required a valid Net ID and password to successfully access the computer; they were either PC's or Macs. Using the maps found by the main entrance of each Learning Commons, the computers were numbered and the pathway for data collection was determined. These maps can be found in Appendix 4: Figure 4.1 and Appendix 5: Figure 5.1. Using the previously mentioned maps and also observation skills, data collection was completed by determining if the monitor was on, off, or asleep and if the computer was on, off, or asleep.

Every PC sample then received a rank on a scale of zero to three, while every Mac sample was placed on a scale of zero to two. This ranking scale was determined by the condition of the computer and monitor together (PC's) or of just the computer (Macs). For the PC's, a score of zero meant the entire PC was off. A score of one meant that one piece of the PC (computer or monitor) was off, while the other piece of the PC was asleep. A score of two meant that one piece of the PC was on, while the other piece of the PC was asleep. While a score of three meant the entire PC was on. For the Macs, a score of zero meant the Mac was off. A score of one meant the Mac was asleep, while a score of two meant the Mac was awake.

5.2 Description of Procedure

Due to a lack of availability and overall time for data collection, data collection was restricted to three specific days: Monday March 16th, Friday March 20th, and Sunday March 22nd. Data collection would start one to two hours after the Learning Commons were open for general use and was collected for the following three hours. Then there would be a five-hour break; with data collection starting again after the break was concluded. Evening data collection lasted for the same amount of time as the morning data collection. On both Monday and Friday, the data collection times were 9am, 10am, 11am, 12pm, 5pm, 6pm, 7pm, and 8pm. For Sunday, the data collection times were 11am, 12pm, 1pm, 2pm, 7pm, 8pm, 9pm, and 10pm.

It was determined that there would be a total of six different sets of data, one for each morning of each day and one for each evening of each day. Two members of the team would follow the pathway previously mapped out in Appendix 4: Figure 4.1. During the first and third data collection times, only the odd numbered computers were considered for the study. During the second and four data collection times, only the even numbered computers were considered for the study. Using Appendix 5: Table 5.1, the pair would look at every other PC/Mac and determine if the monitor was on, off, or asleep and if the computer was on, off, or asleep. Appendix 6: Table 6.1 is a table with columns that allow for the pair to check off what condition the computer and monitor are in.

To determine the condition of the PC's, the pair would first look at the monitor display. Should the display be lit up, both the computer and monitor were considered as on. Should the display be black, a member of the pair was expected to observe the power buttons on both the computer and the monitor. If the computer had a green light lit up directly beside the computer's power button, the computer would be considered as on. If there were no light beside the computer's power button, the computer would be considered as off. If the monitor had a blue light lit up directly on the monitor's power button, the monitor would be considered as on. If there was a yellow light lit up directly

on the monitor's power button, the monitor would be considered as asleep. If there were no light directly on the monitor's power button, the monitor would be considered as off.

To determine the condition of the Macs, the pair would first look at the screen. Should the screen be lit up, the computer was considered as on. Should the display be black, a member of the pair was expected to shake the mouse. Should the computer come to life after a mouse shake, it was considered as asleep. Should the screen stay black after a mouse shake, the computer is considered as off.

After data collection was completed, the watt consumption was estimated using the methods found on Green Education Foundation: Computer Lab Energy Audit. All PC's will be assumed to consume the same amount of energy as each other, just as all Macs will be assumed to consume the same amount of energy as each other. If a PC or Mac was found as on, off, or asleep, it was assumed that the computer was in that state, consuming that much energy, for an hour.

5.3 Data Analysis

The data collected from this probabilistic observation study was entered into Excel in an organized manner. Each PC then received a ranking score of zero to four, while each Mac received a ranking score of zero to two. These rankings were then used to compile graphs and averages for each of the six different data sets, which allowed for each data set to be compared to one another.

5.4 Delimitations and Limitations

There were a few limitations found with this study. The first groupings of concerns all involved the study location. Dalhousie University is a university that can be found in more than one city of Nova Scotia. This study only looked at the Killam Memorial Library, which is found in one city, on one campus. This is a very small representation of Dalhousie's entire campuses combined. Another concern over study location is that the Killam Memorial Library is one of the busiest buildings on the Studley campus, which means that the less busy buildings are not well represented with this data.

The next set of concerns surround the timing of the study. Only a few hours of Monday, Friday, and Sunday were covered in this study, meaning over half of the week is missing raw data. Another concern is over the timing of the year. The study took place about halfway through the winter semester, meaning there is no raw data from any other time of the year or time of the semester. If the study were to take place during the middle of May, there would be significantly different results than if the study were to

take place during April. This difference would be caused from the timing of exams in April and that most students do not take summer/spring courses.

A few recommendations for further studies would be to replicate these methods at different times of the year, the semester, the week, and hours of the day. A second recommendation for further studies would be to have more overall raw data collection time and to extend the replicated methods to other buildings that belong to Dalhousie University.

6. Results

6.1 Monday, March 16th 2015 Results

After completing the raw data collection for both the first and second floor Learning Commons on Monday, March 16th 2015, the frequencies of PC's based on ranking value were revealed. During the early morning times, such as 9am and 10am, there were a handful of PC's found with a ranking value of either two or three. Then as the day progressed, there was an increase in frequency of PC's found with a ranking value of three. The majority of PC's remained with a ranking value of three as the evening data collection concluded. The overall mean ranking value for Monday's data collection of PC's was 2.775.

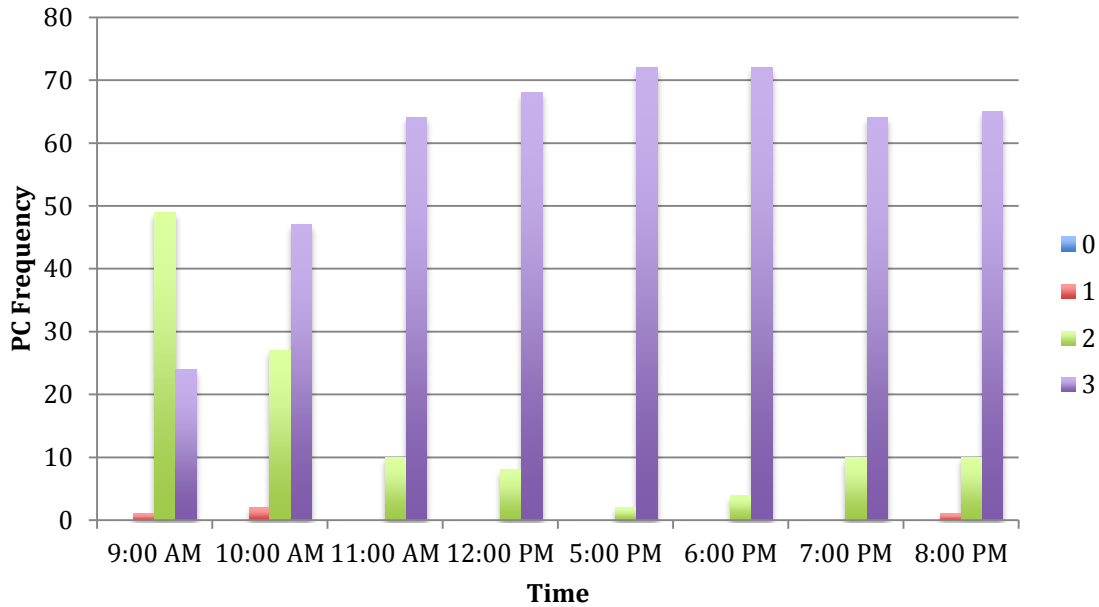


Figure 6.1 A representation of Monday’s, March 16th 2015, PC data collection from the first and second floor Learning Commons of the Killam Memorial Library found on Dalhousie University, Halifax. The times of data collection can be found on the x-axis, while the frequency of PC’s can be found on the y-axis. Blue represents a score of zero, meaning the entire PC was off. Red represents a score of one, meaning that one piece of the PC (computer or monitor) was off, while the other piece of the PC was asleep. Green represents a score of two, meaning that one piece of the PC was on, while the other piece of the PC was asleep. Purple represents a score of three, meaning the entire PC was on.

Table 6.1 Monday’s, March 16th 2015, PC data collection was compiled from the first and second floor Learning Commons of the Killam Memorial Library found on Dalhousie University, Halifax. The times of data collection can be found in the first column, while the frequency for each score can be found in the top row. A score of zero means the entire PC was off. A score of one means one piece of the PC (computer or monitor) was off, while the other piece of the PC was asleep. A score of two means one piece of the PC was on, while the other piece of the PC was asleep. A score of three means the entire PC was on.

	0	1	2	3
9:00 AM	0	1	49	24
10:00 AM	0	2	27	47
11:00 AM	0	0	10	64
12:00 PM	0	0	8	68
5:00 PM	0	0	2	72
6:00 PM	0	0	4	72
7:00 PM	0	0	10	64
8:00 PM	0	1	10	65

After completing the raw data collection for both the first and second floor Learning Commons on Monday, March 16th 2015, the frequencies of Macs based on

ranking value were revealed. During the early morning times, such as 9am, 10am, and 11am, the Macs could be found with all three different ranking values. Then once 12pm hit until the end of evening data collection, there was an increase in frequency of Macs found with a ranking value of two. The overall mean ranking value for Monday's data collection of Macs was 1.60625.

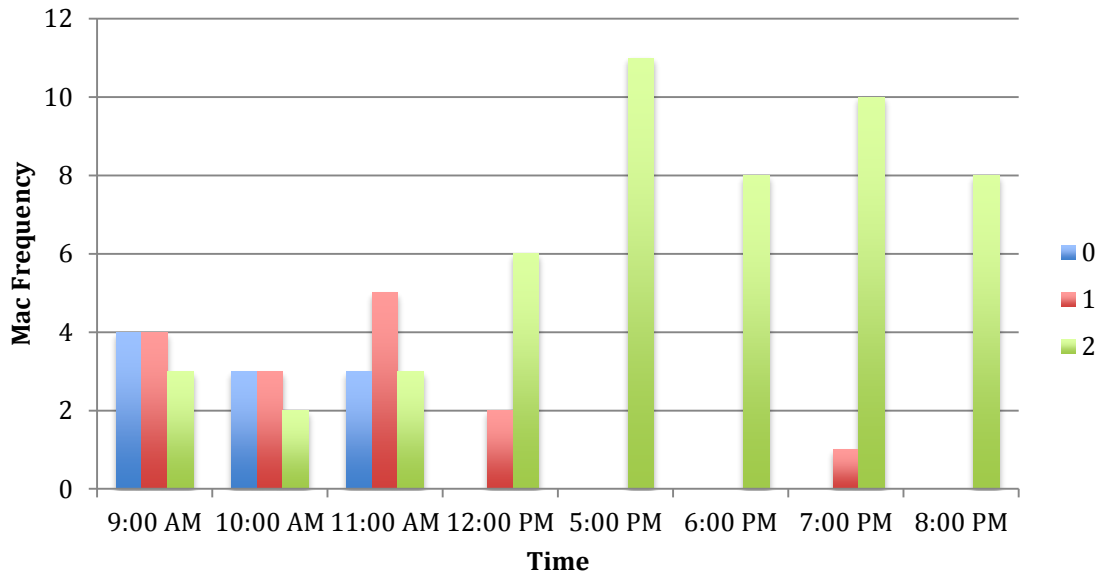


Figure 6.2 A representation of Monday's, March 16th 2015, Mac data collection from the first and second floor Learning Commons of the Killam Memorial Library found on Dalhousie University, Halifax. The times of data collection can be found on the x-axis, while the frequency of Macs can be found on the y-axis. Blue represents a score of zero, meaning the Mac was off. Red represents a score of one, meaning that the Mac was asleep. Green represents a score of two, meaning that the Mac was on.

Table 6.2 Monday's, March 16th 2015, Mac data collection was compiled from the first and second floor Learning Commons of the Killam Memorial Library found on Dalhousie University, Halifax. The times of data collection can be found in the first column, while the score of each Mac can be found in the top row. A score of zero means the Mac was off. A score of one means the Mac was asleep. A score of two means the Mac was on.

	0	1	2
9:00 AM	4	4	3
10:00 AM	3	3	2
11:00 AM	3	5	3
12:00 PM	0	2	6
5:00 PM	0	0	11
6:00 PM	0	0	8
7:00 PM	0	1	10
8:00 PM	0	0	8

6.2 Friday, March 20th 2015 Results

After completing the raw data collection for both the first and second floor Learning Commons on Friday, March 20th 2015, the frequencies of PC's based on ranking value were revealed. During the morning data collection, there was a portion of PC's found with a ranking value of two and this portion decreased as the morning went on. This means that the portion of PC's with a ranking value of three increased as the morning went on. Once the evening hit, there was approximately one third of the PC's found with a ranking score of two, while the remaining two thirds of the PC's found had a ranking score of three. As the evening progressed, about one half of the PC's were found with a ranking value of two; with the other half of the PC's found having a ranking value of three. The overall mean ranking value for Friday's data collection of PC's was 2.68125.

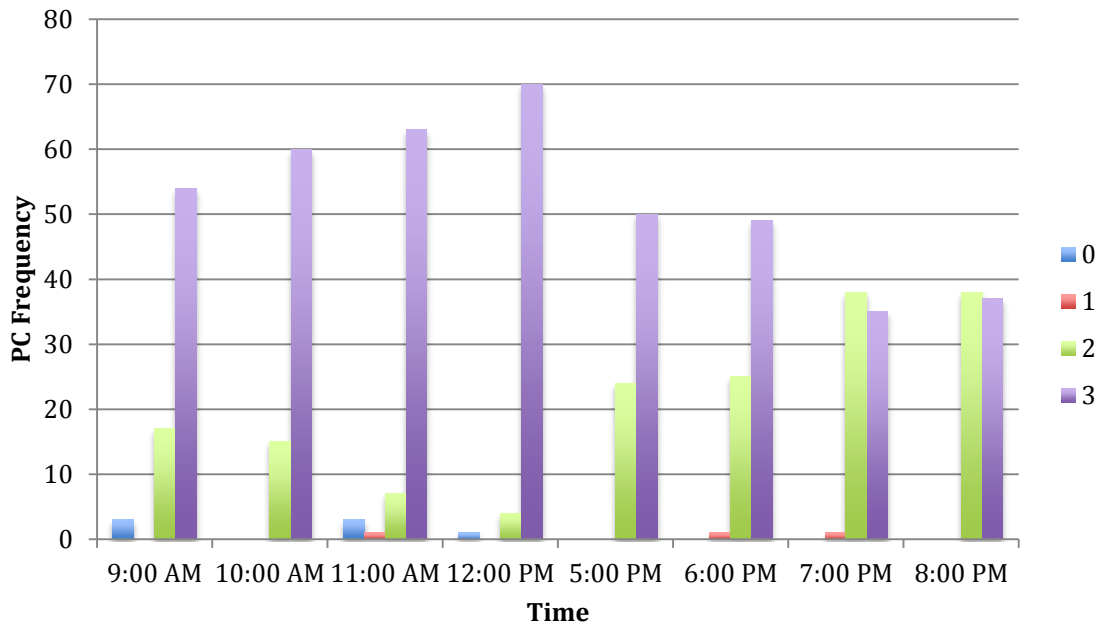


Figure 6.3 A representation of Friday's, March 20th 2015, PC data collection from the first and second floor Learning Commons of the Killam Memorial Library found on Dalhousie University, Halifax. The times of data collection can be found on the x-axis, while the frequency of PC's can be found on the y-axis. Blue represents a score of zero, meaning the entire PC was off. Red represents a score of one, meaning that one piece of the PC (computer or monitor) was off, while the other piece of the PC was asleep. Green represents a score of two, meaning that one piece of the PC was on, while the other piece of the PC was asleep. Purple represents a score of three, meaning the entire PC was on.

Table 6.3 Friday's, March 20th 2015, PC data collection was compiled from the first and second floor Learning Commons of the Killam Memorial Library found on Dalhousie University, Halifax. The times of data collection can be found in the first column, while the frequency for each score can be found in the top row. A score of zero means the entire PC was off. A score of one means one piece of the PC (computer or monitor) was off, while the other piece of the PC was asleep. A score of two means one piece of the PC was on, while the other piece of the PC was asleep. A score of three means the entire PC was on.

	0	1	2	3
9:00 AM	3	0	17	54
10:00 AM	0	0	15	60
11:00 AM	3	1	7	63
12:00 PM	1	0	4	70
5:00 PM	0	0	24	50
6:00 PM	0	1	25	49
7:00 PM	0	1	38	35
8:00 PM	0	0	38	37

After completing the raw data collection for both the first and second floor Learning Commons on Friday, March 20th 2015, the frequencies of Macs based on ranking value were revealed. During the first data collection time, 9am, most of the Macs could be found with a ranking value of one. Then the Macs ranking value was split evenly between one and two. For the remainder of the day, most Macs could be found with a ranking value of two. The exception to the previous statement is the data collection at 7pm. Almost all Macs could be found with a ranking value of one. The overall mean ranking value for Friday's data collection of Macs was 1.5125.

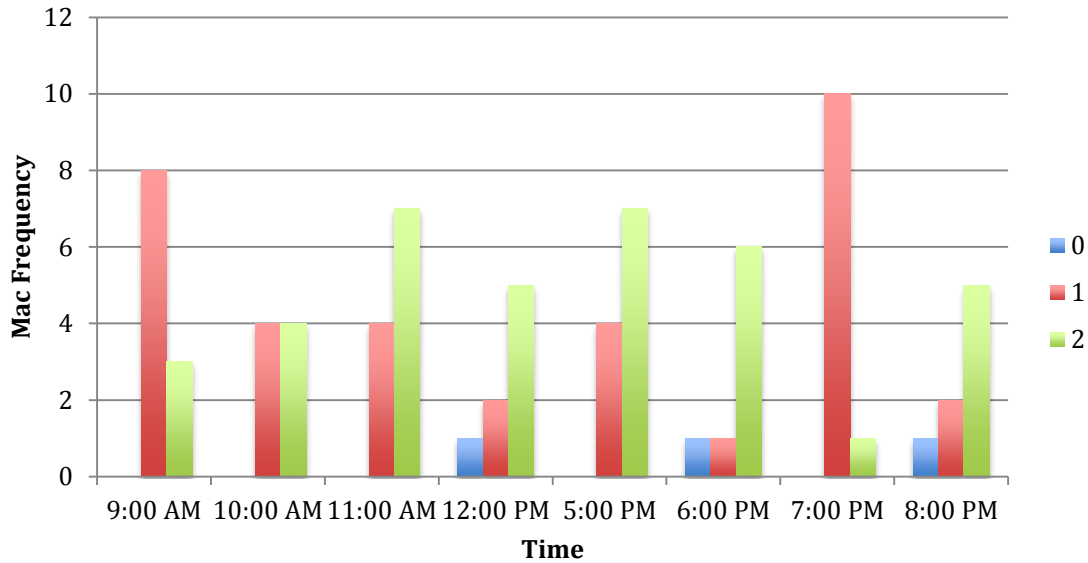


Figure 6.4 A representation of Friday's, March 20th 2015, Mac data collection from the first and second floor Learning Commons of the Killam Memorial Library found on Dalhousie University, Halifax. The times of data collection can be found on the x-axis, while the frequency of Macs can be found on the y-axis. Blue represents a score of zero, meaning the Mac was off. Red represents a score of one, meaning that the Mac was asleep. Green represents a score of two, meaning that the Mac was on.

Table 6.4 Friday's, March 20th 2015, Mac data collection was compiled from the first and second floor Learning Commons of the Killam Memorial Library found on Dalhousie University, Halifax. The times of data collection can be found in the first column, while the score of each Mac can be found in the top row. A score of zero means the Mac was off. A score of one means the Mac was asleep. A score of two means the Mac was on.

	0	1	2
9:00 AM	0	8	3
10:00 AM	0	4	4
11:00 AM	0	4	7
12:00 PM	1	2	5
5:00 PM	0	4	7
6:00 PM	1	1	6
7:00 PM	0	10	1
8:00 PM	1	2	5

6.3 Sunday, March 22nd 2015 Results

After completing the raw data collection for both the first and second floor Learning Commons on Sunday, March 22nd 2015, the frequencies of PC's based on ranking value were revealed. During the initial morning data collection, 11am, more PC's received a ranking value of two than any other ranking value. As the day

progressed, the amount of PC's with a ranking value of three increased and stabilized. The overall mean ranking value for Sunday's data collection of PC's was 2.58125.

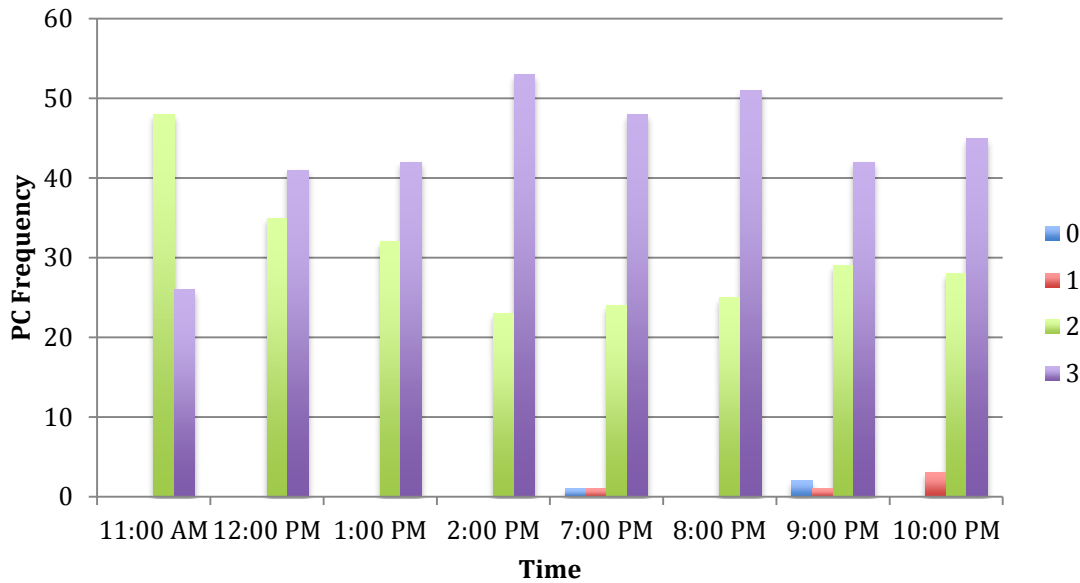


Figure 6.5 A representation of Sunday's, March 22nd 2015, PC data collection from the first and second floor Learning Commons of the Killam Memorial Library found on Dalhousie University, Halifax. The times of data collection can be found on the x-axis, while the frequency of PC's can be found on the y-axis. Blue represents a score of zero, meaning the entire PC was off. Red represents a score of one, meaning that one piece of the PC (computer or monitor) was off, while the other piece of the PC was asleep. Green represents a score of two, meaning that one piece of the PC was on, while the other piece of the PC was asleep. Purple represents a score of three, meaning the entire PC was on.

Table 6.6 Sunday's, March 22nd 2015, PC data collection was compiled from the first and second floor Learning Commons of the Killam Memorial Library found on Dalhousie University, Halifax. The times of data collection can be found in the first column, while the frequency for each score can be found in the top row. A score of zero means the entire PC was off. A score of one means one piece of the PC (computer or monitor) was off, while the other piece of the PC was asleep. A score of two means one piece of the PC was on, while the other piece of the PC was asleep. A score of three means the entire PC was on.

	0	1	2	3
11:00 AM	0	0	48	26
12:00 AM	0	0	35	41
1:00 PM	0	0	32	42
2:00 PM	0	0	23	53
7:00 PM	1	1	24	48
8:00 PM	0	0	25	51
9:00 PM	2	1	29	42
10:00 PM	0	3	28	45

After completing the raw data collection for both the first and second floor Learning Commons on Sunday, March 22nd 2015, the frequencies of Macs based on ranking value were revealed. During the initial morning data collection, 11am, more Macs received a ranking value of one than any other ranking value. As the day progressed, one would find about half of the Macs with a ranking value of two, while the other half of Macs had a ranking value of one. This trend remained until evening data collection concluded. The overall mean ranking value for Sunday's data collection of Macs was 1.575.

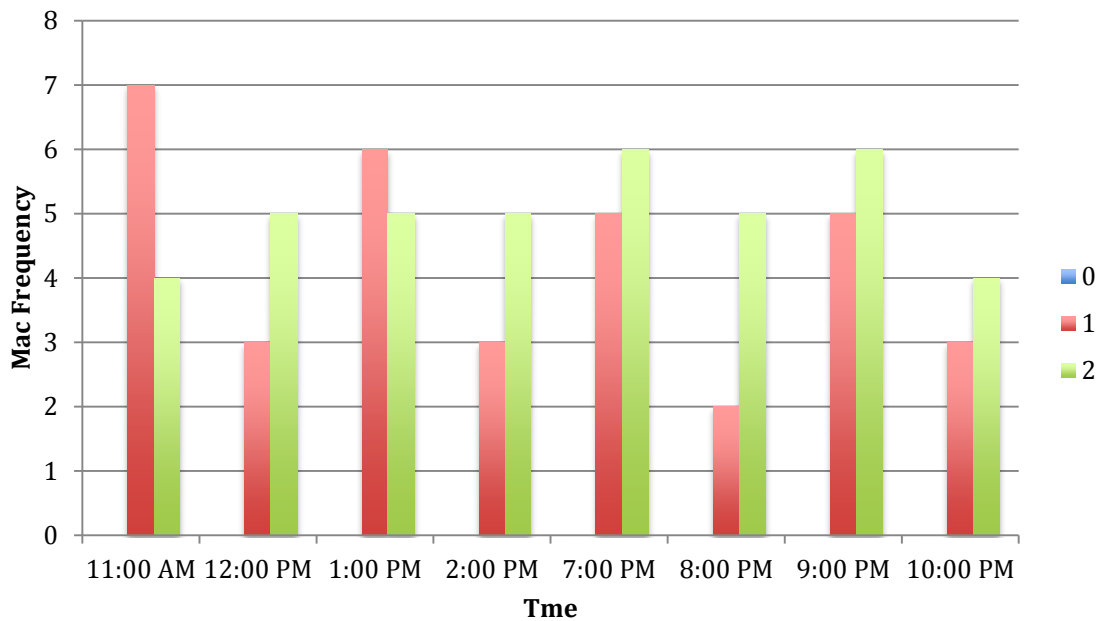


Figure 6.7 A representation of Sunday's, March 22nd 2015, Mac data collection from the first and second floor Learning Commons of the Killam Memorial Library found on Dalhousie University, Halifax. The times of data collection can be found on the x-axis, while the frequency of Macs can be found on the y-axis. Blue represents a score of zero, meaning the Mac was off. Red represents a score of one, meaning that the Mac was asleep. Green represents a score of two, meaning that the Mac was on.

Table 6.7 Sunday's, March 22nd 2015, Mac data collection was compiled from the first and second floor Learning Commons of the Killam Memorial Library found on Dalhousie University, Halifax. The times of data collection can be found in the first column, while the score of each Mac can be found in the top row. A score of zero means the Mac was off. A score of one means the Mac was asleep. A score of two means the Mac was on.

	0	1	2
9:00 AM	0	7	4
10:00 AM	0	3	5
11:00 AM	0	6	5
12:00 PM	0	3	5
5:00 PM	0	5	6
6:00 PM	0	2	5
7:00 PM	0	5	6
8:00 PM	0	3	4

6.4 Combined Results

The percent distribution was then calculated on the raw data to reveal which ranking value contained the largest portion of PC's. It turns out for Monday, there were no PC's found with a ranking value of zero. About one fifth of the PC population could be found with a ranking value of two, while the remaining PC population could be found with a ranking value of three. For Friday, about one third of the PC population was found with a ranking value of two, while most of the remaining two thirds of the PC population was found with a ranking value of three. For Sunday, a majority of the PC population was found with a ranking value of three; with most of the remaining PC population found with a ranking value of two.

Table 6.8 A representation of the PC's percent distribution (%) of Monday's, Friday's, and Sunday's data collection found on the first and second floor Learning Commons of the Killam Memorial Library at Dalhousie University, Halifax was based on ranking value. A score of one means one piece of the PC (computer or monitor) was off, while the other piece of the PC was asleep. A score of two means one piece of the PC was on, while the other piece of the PC was asleep. A score of three means the entire PC was on.

	0	1	2	3
Monday	0	0.83	19.87	79.3
Friday	1.19	0.51	33.96	64.35
Sunday	0.5	0.83	40.67	58

The percent distribution was then calculated on the raw data to reveal which ranking value contained the largest portion of Macs. It turns out for Monday, that there was a good portion of the Mac population with a ranking value of zero and one. Then

about two thirds of the Mac population can be found with a ranking value of two. For Friday, about half of the Mac population was found with a ranking value of one, while the other half of the Mac population was found with a ranking value of two. For Sunday, there were similar results to Friday. About half of the Mac population was found with a ranking value of one, while the other half of the Mac population was found with a ranking value of two.

Table 6.9 A representation of Macs percent distribution (%) of Monday's, Friday's, and Sunday's data collection found on the first and second floor Learning Commons of the Killam Memorial Library at Dalhousie University, Halifax was based on ranking value. A score of zero means the Mac was off. A score of one means the Mac was asleep. A score of two means the Mac was on.

	0	1	2
Monday	12.5	18.75	68.75
Friday	2.82	46.48	50.7
Sunday	0	45.95	54.05

Watt consumption (kWh/hr) was then calculated on the raw data to reveal how much energy was used by the PC's for each ranking value. Watt consumption was calculated based on the method outlined by Green Education Foundation: Computer Lab Energy Audit. Each value provided by the Green Education Foundation: Computer Lab Energy Audit was then multiplied by two due to the fact that our sample only included half of the PC population during each data collection. It has been assumed for this study that when a PC is off and received a score of zero, that the watt consumption would also be zero. Should a PC receive a score of one, its watt consumption would be assumed to be 0.0006 kWh/hr based on information collected from Mother Jones (2010). Should a PC receive a score of two, its watt consumption would be assumed to be 0.0726 kWh/hr based on information collected from Mother Jones (2010) and HP Support Center. Should a PC receive a score of three, its watt consumption would be assumed to be 0.081kWh/hr based on information collected from HP Support Center and Michael Bluejay (2012).

The amount of watt consumption increased with each ranking value. There was no watt consumption for PC's with a ranking value of zero. There was an extremely small amount of watt consumption for the frequency of PC's with a ranking value of one. There were medium amounts of watt consumption for the frequency of PC's with a ranking value of two. There were larger amounts of watt consumption for the frequency of PC's with a ranking value of three.

Table 6.10 A representation of the PC's watt consumption (kWh/hr) of Monday's, Friday's, and Sunday's data collection found on the first and second floor Learning Commons of the Killam Memorial Library at Dalhousie University, Halifax was based on ranking value. Watt consumption was determined using the method outlined by Green Education Foundation: Computer Lab Energy Audit. A score of zero means the entire PC was off. A score of one means one piece of the PC (computer or monitor) was off, while the other piece of the PC was asleep. A score of two means one piece of the PC was on, while the other piece of the PC was asleep. A score of three means the entire PC was on.

	0	1	2	3
Monday	0	0.0048	17.424	77.112
Friday	0	0.0036	24.3936	67.716
Sunday	0	0.006	35.4288	56.376

Watt consumption (kWh/hr) was calculated on the raw data to reveal how much energy was being used by the Macs based on each ranking value. Watt consumption was calculated based on the method outlined by Green Education Foundation: Computer Lab Energy Audit. Each value provided by the Green Education Foundation: Computer Lab Energy Audit was then multiplied by two due to the fact that our sample only included half of the Mac population during each data collection. It has been assumed for this study that when a Mac is off and received a score of zero, that the watt consumption would also be zero. Should a Mac receive a score of one, its watt consumption would be assumed to be 0.0105 kWh/hr based on information collected from Michael Bluejay (2012). Should a Mac receive a score of two, its watt consumption would be assumed to be 0.03 kWh/hr based on information collected from Michael Bluejay (2012).

The amount of watt consumption increased with each ranking value. There was no watt consumption for the frequency of Macs with a ranking value of zero. There was a small amount of watt consumption for the frequency of Macs with a ranking value of one. There was still a small amount of watt consumption for the frequency of Macs with a ranking value of two.

Table 6.11 A representation of the Macs watt consumption (kWh/hr) of Monday's, Friday's, and Sunday's data collection found on the first and second floor Learning Commons of the Killam Memorial Library at Dalhousie University, Halifax was based on ranking value. Watt consumption was determined using the method outlined by Green Education Foundation: Computer Lab Energy Audit. A score of zero means the Mac was off. A score of one means the Mac was asleep. A score of two means the Mac was on.

	0	1	2
Monday	0	0.0315	3.06
Friday	0	0.0735	2.28
Sunday	0	0.0735	2.46

Then the dollar value (\$/hr) was calculated on the data found in Table 6.10 to reveal the cost of watt consumption for each ranking value. The dollar value was

calculated based on Nova Scotia Power: 2015 Electricity Rate. Each value provided by the Nova Scotia Power: 2015 Electricity Rate was then multiplied by two due to the fact that our sample only included half of the PC population during each data collection. After using basic algebra, 1 kWh of energy equals about \$0.1928.

The dollar value increased with each ranking value. There was no dollar value for the frequency of PC's with a ranking value of zero. There was an extremely small dollar value for the frequency of PC's with a ranking value of one. The dollar value actually reached whole value for the frequency of PC's with a ranking value of two. Then the dollar value increased to over ten dollars an hour for the frequency of PC's with a ranking value of three.

Table 6.12 A representation of the PC's dollar value (\$/hr) of Monday's, Friday's, and Sunday's data collection found on the first and second floor Learning Commons of the Killam Memorial Library at Dalhousie University, Halifax was based on ranking value. Dollar value based on Nova Scotia Power: 2015 Electricity Rate. A score of one means one piece of the PC (computer or monitor) was off, while the other piece of the PC was asleep. A score of two means one piece of the PC was on, while the other piece of the PC was asleep. A score of three means the entire PC was on.

	0	1	2	3
Monday	0	0.00092544	3.3593472	14.8671936
Friday	0	0.00069408	4.70308608	13.0556448
Sunday	0	0.0011568	6.83067264	10.8692928

The dollar value (\$/hr) was calculated on the data found in Table 6.11 to reveal the cost of watt consumption for each ranking value. The dollar value was calculated based on Nova Scotia Power: 2015 Electricity Rate. Each value provided by the Nova Scotia Power: 2015 Electricity Rate was then multiplied by two due to the fact that our sample only included half of the Mac population during each data collection. After using basic algebra, 1 kWh of energy equals about \$0.1928.

The dollar value increased with each ranking value. There was no dollar value for the frequency of Macs with a ranking value of zero. There was an extremely small dollar value for the frequency of Macs with a ranking value of one. Then there was still a small dollar value for the frequency of Macs with a ranking value of two.

Table 6.13 A representation of the Macs dollar value (\$/hr) of Monday's, Friday's, and Sunday's data collection found on the first and second floor Learning Commons of the Killam Memorial Library at Dalhousie University, Halifax was based on ranking value. Dollar value based on Nova Scotia Power: 2015 Electricity Rate. A score of zero means the Mac was off. A score of one means the Mac was asleep. A score of two means the Mac was on.

	0	1	2
Monday	0	0.0060732	0.589968
Friday	0	0.0141708	0.439584
Sunday	0	0.0141708	0.474288

7. Discussion

7.1 Summary of Research Question

The purpose of this study was to further the understanding of sustainable methods concerning the computer labs on Dalhousie University campus. It was questioned whether or not the computer labs across campus were wasting valuable energy due to incorrect power saving methods, such as shutting down or starting sleep mode manually. The computers found in the Learning Commons on the first and second floors of the Killam Memorial Library were the focus point for this study. There was a total of three days considered for this study: Monday, March 16th 2015, Friday, March 20th 2015, and Sunday, March 22nd 2015. Each day had two data collection periods, one that occurred during the morning hours and one that occurred during the evening hours.

Each PC received a ranking value based on whether the computer was on, off, or asleep and whether the monitor was on, off, or asleep. If the entire PC were off, a score of zero would be received. If one piece of the PC (monitor or computer) were off while the other piece of the PC was asleep, a score of one would be received. If one piece of the PC were on while the other piece of the PC was asleep, a score of two would be received. If the entire PC were on, a score of three was received. Each Mac received a ranking value based on whether the computer was on, off, or asleep as well. If the Mac were off, a score of zero would be received. If the Mac were asleep, a score of one would be received. If the Mac were on, a score of two would be received.

The raw data from each day was analyzed to reveal frequencies and averages for both PC's and Macs. Then percent distribution was calculated for each day. Next, the watt consumption (kWh/hr) was calculated based on the method outlined by Green Education Foundation: Computer Lab Energy Audit and multiplied by two to represent the entire PC and Mac population. Using the Nova Scotia Power: 2015 Electricity Rate, a dollar value was then placed on the watt consumption.

7.2 Monday, March 16th 2015 Discussion

The results for the frequency of PC's based on ranking values were unexpected. The expected results were that more PC's would be found with lower ranking values during the beginning of the morning data collection and at the end of the evening data collection than any other time of day. The first half of the expected results held true but the second part contained the unexpected results. Instead of the PC's frequency of lower ranking values increasing towards the end of the evening data collection, they remained stable; the same amount of PC's that received the highest-ranking value remained at the highest-ranking value all night. These unexpected results could be a coincidence, but there are a number of reasons these results appeared. The data collection time may have ended too early, which prevented the data collection of expected results. Students may regularly spend time in the Killam Memorial Library even after 8pm. The timing within the semester could have prevented data collection of expected results. More students may be staying later due to midterms or assignment deadlines.

The results for the frequency of Macs based on ranking values were anticipated after analyzing the results of the PC's. The original expected results were that more Macs would be found with lower ranking values during the beginning of the morning data collection and at the end of the evening data collection than any other time of day. After the unexpected results for the PC's, the Mac results were not that surprising.

7.3 Friday, March 20th 2015 Discussion

The results for the frequency of PC's based on ranking values were unexpected results, especially after taking the results from Monday into consideration. During the morning data collection, there was a higher frequency of PC's that received higher-ranking values than expected. The evening data collection revealed the originally expected results, displaying that the frequency of PC's with a higher-ranking value decreased as the night progressed. These results could be caused from the day of the week chosen for data collection. Many students could be taking Friday night off from studying for personal activities.

The results for the frequency of Macs based on ranking values were unorganized results. There was no overall pattern spotted, no expected results, and no unexpected results. This could be due to the fact that the Mac population has a small sample size.

7.4 Sunday, March 22nd 2015 Discussion

The results for the frequency of PC's based on ranking values were unexpected in a similar way as previously mentioned with Monday's results. The early morning had an increased frequency of PC's with a lower-ranking value, as expected, while the entire evening had a stable frequency of PC's with a higher-ranking value, which were unexpected.

The results for the frequency of Macs based on ranking values were mostly expected results. The early morning and later evening had an increased frequency of Macs with a lower-ranking value. This is the only set of data that held true to the anticipated results. This could be a false positive due to the Mac sample population size being so small.

7.5 Combined Discussion

The results revealed that the PC's energy consumption equals out to be about 17.8964 \$/hr, while the Macs energy consumption equals out to be about 0.5128 \$/hr. Making the assumption that every day energy consumption is about the same and that the computers are available for student usage for at least sixteen hours a day, the PC's consume about 286.3424 \$/day and the Macs consume about 8.2048 %/day.

8. Conclusions

8.1 Major Contribution of the Study

The major contribution of this study is its potential to increase Dalhousie University's sustainability initiative regarding energy consumption. The results from research undertaken in this study found that computers in the Killam Memorial Library Learning Commons, both South and Upper, are consistently used throughout the day. Most computer users fail to initiate sleep-mode or turn off computer monitors when they are finished using them. This practice contributes to more energy consumption than necessary.

Results from the research showed that both the PC and Mac computers were left on for the majority of each day that observation was held, rather than in a sleep or low-power mode. Killam Memorial Library would benefit from better power management of computers. Power management of computers revolves around entering a computer into a low-power or sleep mode when it is idle, or after it has been idle for a specific amount of time, and ensuring a computer is off when it is not in use (Energy Star, n.d.). Power management of computers can greatly reduce the energy consumption, and has a potential to significantly reduce costs associated with energy use (Bray, 2006). The

recommendations in this study are based on improved power management of computers in both Learning Commons in the Killam Memorial Library. Though the study only looked at two computer labs on Dalhousie campus, the recommendations drawn from this research could be applied to other labs throughout the campus to further reduce energy consumption.

8.2 Recommendations to Dalhousie University

The results from study can provide future recommendations to Dalhousie University. Two policies could be introduced in the Killam Memorial Library Learning Commons to ensure computer lab energy usage is more efficient. First, it is possible to set a timer for a computer to either enter sleep-mode, or actually turn on or off at a certain times of day (Energy Star, n.d.). This would mean that computers on campus can be put into sleep-mode or turned off during the Library's closed-hours overnight. Second, it would be beneficial if sleep-mode was automatically initiated when computer users log-out of their accounts, or similarly if computer monitors could be programmed to automatically shut-off after user log-out. This would mean less computer monitors would be found left on and not in use, and ultimately reduce the energy consumption of Killam Memorial Library computer labs. These strategies for better power management could also significantly reduce the costs of energy consumption for Dalhousie University.

8.3 Recommendations for Further Research

This study does not recommend reducing the number of computers in the Learning Commons in the Killam Memorial Library. However, other computers on campus, in buildings such as the Marion McCain, the Kenneth Rowe, and the LSC, are not included in this study, but would benefit from similar research. Further research in other computer labs on Dalhousie Campus may identify that the number of computers could be reduced to increase energy efficiency across the Studley, Sexton, and Carleton campuses. The re-creation of this study in other buildings on Dalhousie campus could identify computer labs that do not have as many users during off-peak hours, for example, evenings and weekends. This study could also help to determine a number of computer labs that could be closed during these times in order to reduce energy inefficiencies.

The results of energy consumption of computer labs in this project can be used as a general template for further research studies in this field. The research team has compiled the following recommendations for further research. This project could have produced higher levels of legitimacy if more time was allotted for data collection. The observational research was undertaken towards the end of the winter semester. The

research team believes the data would have greater validity if observation periods took place in both the fall and winter terms, as well as during off-peak times of the year such as Christmas Break and Reading Week. Further, it would be beneficial to recreate this study after replacing all of the current computer models in the Learning Commons with more energy-efficient models. These recommendations for further research could be implemented at Dalhousie University and other institutions of Higher Education.

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10. Acknowledgements

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11. Appendices

Appendix 1

Dalhousie University: Halifax Campuses

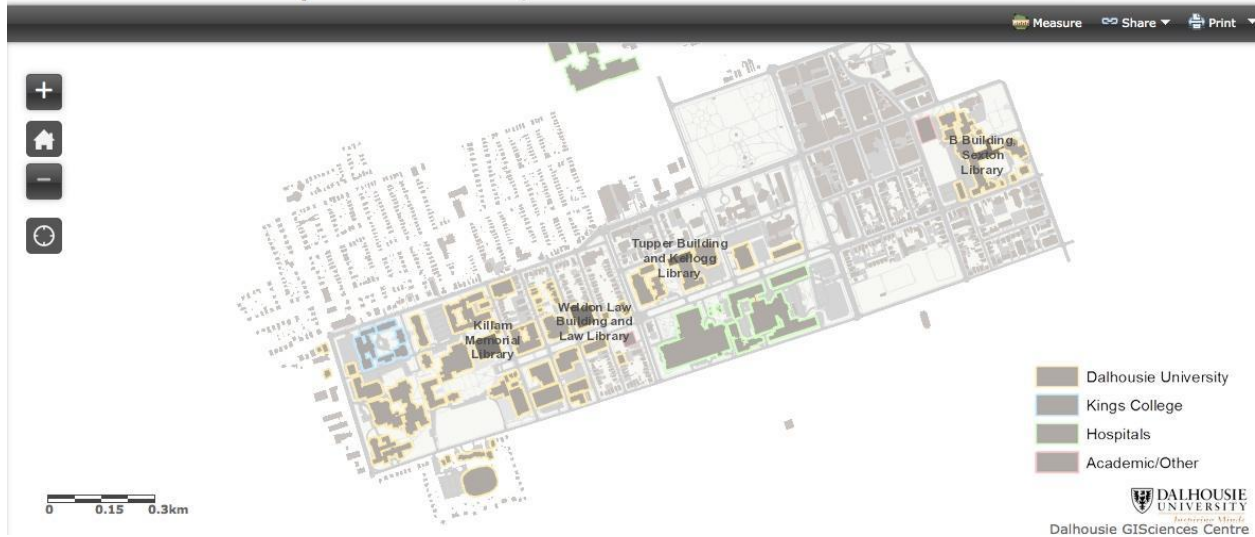


Figure 1.1 A map including at three Dalhousie campuses found in Halifax, Nova Scotia. Map Source: (Dalhousie GIS Centre, n.d.)

Appendix 2

Killam Library: First Floor

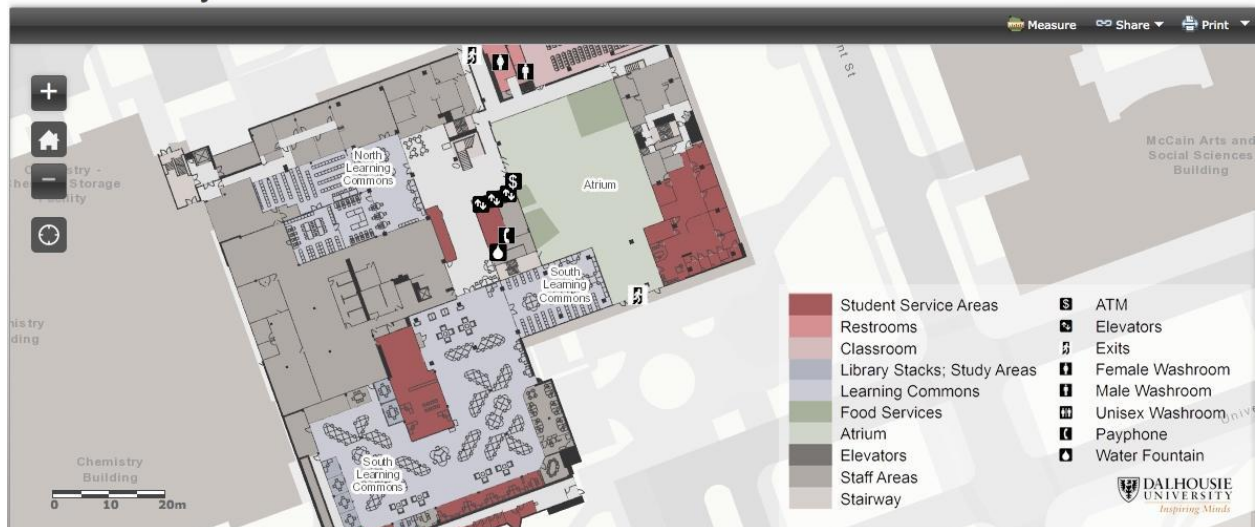


Figure 2.1 A map of the second floor Learning Commons in Dalhousie Killam Memorial Library. Map Source: (Killam Memorial Library, n.d.)

Appendix 3

Killam Library: Second Floor

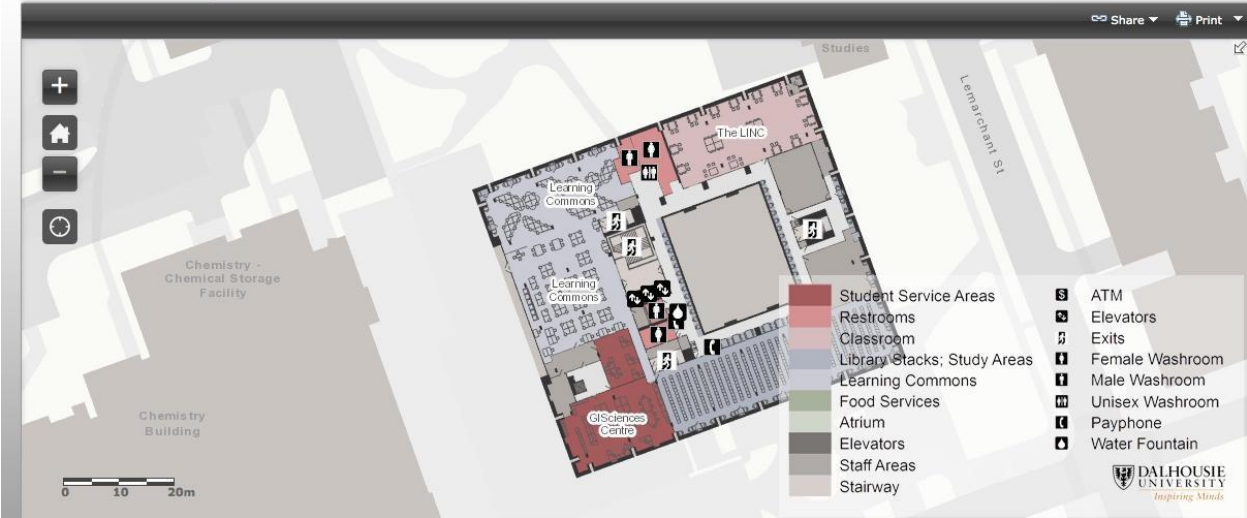


Figure 3.1 A map of the second floor Learning Commons in Dalhousie Killam Memorial Library. Map Source: (Killam Memorial Library, n.d.)

Appendix 4

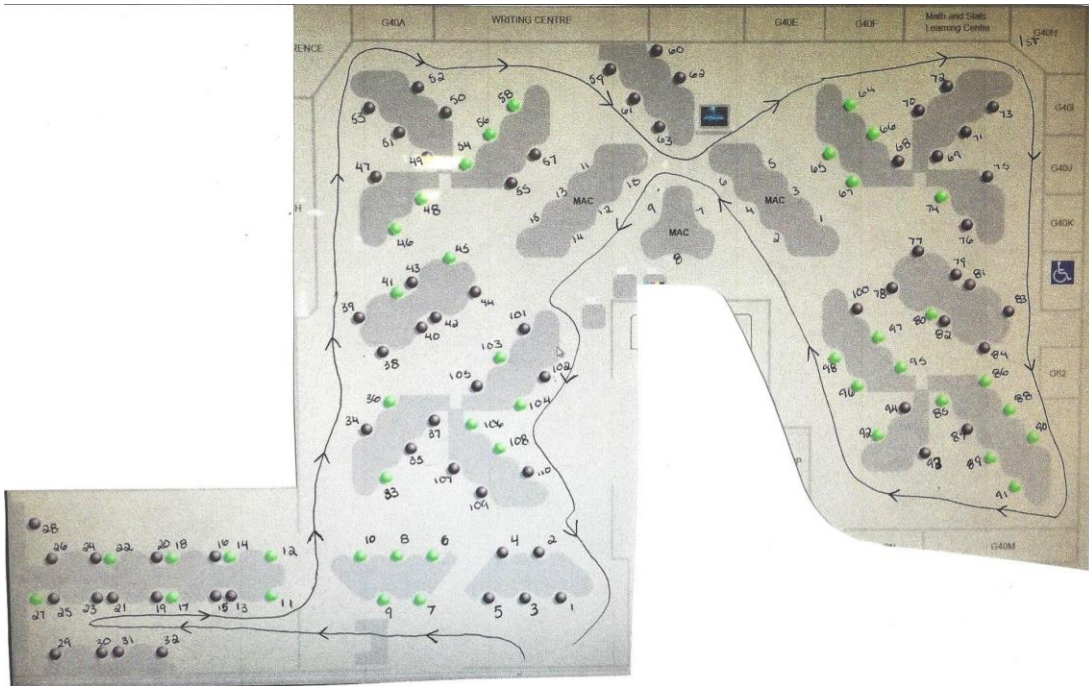


Figure 4.1 A map of the first floor Learning Commons in Dalhousie Killam Memorial Library. The pathway and computers are marked.

Appendix 7

Table 7.1 Monday, March 16th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 9am.

	Monitor	Computer	Ranking
1 Mac	NA	Off	0
3 Mac	NA	Off	0
5 Mac	NA	On	2
7 Mac	NA	Off	0
9 Mac	NA	Asleep	1
11 Mac	NA	Asleep	1
13 Mac	NA	Asleep	1
15 Mac	NA	Off	0
17 PC	On	On	3
19 PC	On	On	3
21 PC	On	On	3
23 PC	Asleep	On	2
25 PC	Asleep	On	2
27 PC	Asleep	On	2
29 PC	On	On	3
31 PC	On	On	3
33 PC	Asleep	On	2
35 PC	Asleep	On	2
37 PC	Asleep	On	2
39 PC	Asleep	On	2
41 PC	Asleep	On	2
43 PC	Asleep	On	2
45 PC	Asleep	On	2
47 PC	Asleep	On	2
49 PC	Asleep	On	2
51 PC	On	On	3
53 PC	On	On	3
55 PC	Asleep	On	2
57 PC	Asleep	On	2
59 PC	Asleep	On	2
61 PC	Asleep	On	2
63 PC	Asleep	On	2
65 PC	On	On	3
67 PC	On	On	3
69 PC	Asleep	On	2
71 PC	Asleep	On	2

73 PC	Off	On	2
75 PC	Asleep	On	2
77 PC	Asleep	On	2
79 PC	Asleep	On	2
81 PC	Asleep	On	2
83 PC	On	On	3
85 PC	On	On	3
87 PC	Asleep	On	2
89 PC	On	On	3
91 PC	Asleep	On	2
93 PC	On	On	3
95 PC	Asleep	On	2
97 PC	Asleep	On	2
99 PC	Asleep	On	2
101 PC	On	On	3
103 PC	Asleep	On	2
105 PC	Asleep	On	2
107 PC	Asleep	On	2
109 PC	Asleep	On	2
111 PC	Asleep	On	2
113 PC	On	On	3
115 PC	Asleep	On	2
117 PC	On	On	3
119 PC	On	On	3
121 PC	Asleep	On	2
123 PC	Asleep	On	2

Table 7.2 Monday, March 16th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 10am.

	Monitor	Computer	Ranking
2 Mac	NA	Off	0
4 Mac	NA	Off	0
6 Mac	NA	Asleep	1
8 Mac	NA	On	2
10 Mac	NA	Off	0
12 Mac	NA	On	2
14 PC	On	On	3
16 PC	On	On	3
18 PC	On	On	3
20 PC	On	On	3
22 PC	On	On	3

24 PC	On	On	3
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	Asleep	On	2
34 PC	Asleep	On	2
36 PC	Asleep	On	2
38 PC	On	On	3
40 PC	On	On	3
42 PC	On	On	3
44 PC	On	On	3
46 PC	On	On	3
48 PC	On	On	3
50 PC	On	On	3
52 PC	Asleep	On	2
54 PC	On	On	3
56 PC	Asleep	On	2
58 PC	On	On	3
60 PC	Off	On	2
62 PC	On	On	3
64 PC	Asleep	On	2
66 PC	On	On	3
68 PC	On	On	3
70 PC	Asleep	On	2
72 PC	On	On	3
74 PC	Asleep	On	2
76 PC	Asleep	On	2
78 PC	Asleep	On	2
80 PC	Asleep	On	2
82 PC	On	On	3
84 PC	On	On	3
86 PC	Asleep	On	2
88 PC	On	On	3
90 PC	Off	On	2
92 PC	Asleep	On	2
94 PC	On	On	3
96 PC	Asleep	On	2
98 PC	Asleep	On	2
100 PC	On	On	3
102 PC	On	On	3
104 PC	Asleep	On	2

106 PC	On	On	3
108 PC	Asleep	On	2
110 PC	On	On	3
112 PC	On	On	3
114 PC	On	On	3
116 PC	On	On	3
118 PC	Asleep	On	2
120 PC	On	On	3
122 PC	On	On	3

Table 7.3 Monday, March 16th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 11am.

	Monitor	Computer	Ranking
1 Mac	NA	Asleep	1
3 Mac	NA	Off	0
5 Mac	NA	Off	0
7 Mac	NA	Asleep	1
9 Mac	NA	On	2
11 Mac	NA	Asleep	1
13 Mac	NA	Asleep	1
15 Mac	NA	On	2
17 PC	On	On	3
19 PC	On	On	3
21 PC	On	On	3
23 PC	On	On	3
25 PC	On	On	3
27 PC	On	On	3
29 PC	On	On	3
31 PC	On	On	3
33 PC	On	On	3
35 PC	On	On	3
37 PC	On	On	3
39 PC	On	On	3
41 PC	On	On	3
43 PC	On	On	3
45 PC	On	On	3
47 PC	On	On	3
49 PC	On	On	3
51 PC	On	On	3
53 PC	On	On	3
55 PC	On	On	3

57 PC	On	On	3
59 PC	On	On	3
61 PC	On	On	3
63 PC	On	On	3
65 PC	On	On	3
67 PC	On	On	3
69 PC	On	On	3
71 PC	On	On	3
73 PC	On	On	3
75 PC	On	On	3
77 PC	On	On	3
79 PC	On	On	3
81 PC	On	On	3
83 PC	On	On	3
85 PC	On	On	3
87 PC	On	On	3
89 PC	On	On	3
91 PC	Asleep	On	2
93 PC	On	On	3
95 PC	On	On	3
97 PC	On	On	3
99 PC	On	On	3
101 PC	On	On	3
103 PC	On	On	3
105 PC	On	On	3
107 PC	On	On	3
109 PC	On	On	3
111 PC	On	On	3
113 PC	On	On	3
115 PC	On	On	3
117 PC	On	On	3
119 PC	On	On	3
121 PC	On	On	3
123 PC	On	On	3

Table 7.4 Monday, March 16th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 12pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	Asleep	1
6 Mac	NA	On	2

8 Mac	NA	Asleep	1
10 Mac	NA	On	2
12 Mac	NA	On	2
14 PC	On	On	3
16 PC	On	On	3
18 PC	On	On	3
20 PC	On	On	3
22 PC	On	On	3
24 PC	On	On	3
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	On	On	3
36 PC	On	On	3
38 PC	On	On	3
40 PC	On	On	3
42 PC	On	On	3
44 PC	On	On	3
46 PC	On	On	3
48 PC	On	On	3
50 PC	On	On	3
52 PC	On	On	3
54 PC	On	On	3
56 PC	On	On	3
58 PC	Asleep	On	2
60 PC	On	On	3
62 PC	Asleep	On	2
64 PC	On	On	3
66 PC	On	On	3
68 PC	On	On	3
70 PC	On	On	3
72 PC	On	On	3
74 PC	On	On	3
76 PC	On	On	3
78 PC	On	On	3
80 PC	On	On	3
82 PC	On	On	3
84 PC	On	On	3
86 PC	On	On	3
88 PC	On	On	3

90 PC	Asleep	On	2
92 PC	Asleep	On	2
94 PC	On	On	3
96 PC	On	On	3
98 PC	On	On	3
100 PC	On	On	3
102 PC	On	On	3
104 PC	On	On	3
106 PC	On	On	3
108 PC	On	On	3
110 PC	On	On	3
112 PC	On	On	3
114 PC	On	On	3
116 PC	On	On	3
118 PC	On	On	3
120 PC	Asleep	On	2
122 PC	On	On	3

Table 7.8 Monday, March 16th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 5pm.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	On	2
5 Mac	NA	On	2
7 Mac	NA	On	2
9 Mac	NA	On	2
11 Mac	NA	On	2
13 Mac	NA	On	2
15 Mac	NA	On	2
17 PC	Asleep	On	2
19 PC	On	On	3
21 PC	On	On	3
23 PC	Off	On	1
25 PC	On	On	3
27 PC	On	On	3
29 PC	On	On	3
31 PC	On	On	3
33 PC	On	On	3
35 PC	On	On	3
37 PC	On	On	3
39 PC	On	On	3

41 PC	On	On	3
43 PC	On	On	3
45 PC	On	On	3
47 PC	On	On	3
49 PC	On	On	3
51 PC	On	On	3
53 PC	On	On	3
55 PC	On	On	3
57 PC	On	On	3
59 PC	Asleep	On	2
61 PC	On	On	3
63 PC	On	On	3
65 PC	On	On	3
67 PC	On	On	3
69 PC	On	On	3
71 PC	On	On	3
73 PC	On	On	3
75 PC	On	On	3
77 PC	On	On	3
79 PC	On	On	3
81 PC	On	On	3
83 PC	On	On	3
85 PC	On	On	3
87 PC	On	On	3
89 PC	On	On	3
91 PC	On	On	3
93 PC	On	On	3
95 PC	On	On	3
97 PC	On	On	3
99 PC	On	On	3
101 PC	On	On	3
103 PC	On	On	3
105 PC	On	On	3
107 PC	On	On	3
109 PC	On	On	3
111 PC	On	On	3
113 PC	On	On	3
115 PC	On	On	3
117 PC	On	On	3
119 PC	On	On	3
121 PC	On	On	3

123 PC	On	On	3
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Table 7.9 Monday, March 16th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 6pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	On	2
6 Mac	NA	On	2
8 Mac	NA	On	2
10 Mac	NA	On	2
12 Mac	NA	On	2
14 PC	On	On	3
16 PC	On	On	3
18 PC	On	On	3
20 PC	Off	On	2
22 PC	On	On	3
24 PC	On	On	3
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	On	On	3
36 PC	On	On	3
38 PC	On	On	3
40 PC	On	On	3
42 PC	On	On	3
44 PC	On	On	3
46 PC	On	On	3
48 PC	On	On	3
50 PC	On	On	3
52 PC	Asleep	On	2
54 PC	On	On	3
56 PC	On	On	3
58 PC	On	On	3
60 PC	On	On	3
62 PC	On	On	3
64 PC	On	On	3
66 PC	On	On	3
68 PC	On	On	3
70 PC	On	On	3
72 PC	On	On	3

74 PC	On	On	3
76 PC	On	On	3
78 PC	On	On	3
80 PC	On	On	3
82 PC	On	On	3
84 PC	On	On	3
86 PC	On	On	3
88 PC	On	On	3
90 PC	On	On	3
92 PC	On	On	3
94 PC	On	On	3
96 PC	On	On	3
98 PC	On	On	3
100 PC	On	On	3
102 PC	Asleep	On	2
104 PC	On	On	3
106 PC	On	On	3
108 PC	On	On	3
110 PC	On	On	3
112 PC	On	On	3
114 PC	On	On	3
116 PC	On	On	3
118 PC	On	On	3
120 PC	On	On	3
122 PC	On	On	3

Table 7.10 Monday, March 16th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 7pm.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	On	2
5 Mac	NA	On	2
7 Mac	NA	On	2
9 Mac	NA	On	2
11 Mac	NA	On	2
13 Mac	NA	Asleep	1
15 Mac	NA	On	2
17 PC	On	On	3
19 PC	Asleep	On	2
21 PC	On	On	3
23 PC	On	On	3

25 PC	On	On	3
27 PC	Off	On	2
29 PC	On	On	3
31 PC	On	On	3
33 PC	On	On	3
35 PC	On	On	3
37 PC	On	On	3
39 PC	Asleep	On	2
41 PC	On	On	3
43 PC	On	On	3
45 PC	On	On	3
47 PC	On	On	3
49 PC	Asleep	On	2
51 PC	On	On	3
53 PC	On	On	3
55 PC	On	On	3
57 PC	On	On	3
59 PC	On	On	3
61 PC	On	On	3
63 PC	On	On	3
65 PC	On	On	3
67 PC	On	On	3
69 PC	On	On	3
71 PC	Asleep	On	2
73 PC	On	On	3
75 PC	On	On	3
77 PC	Asleep	On	2
79 PC	On	On	3
81 PC	On	On	3
83 PC	On	On	3
85 PC	On	On	3
87 PC	Asleep	On	2
89 PC	On	On	3
91 PC	On	On	3
93 PC	On	On	3
95 PC	On	On	3
97 PC	On	On	3
99 PC	On	On	3
101 PC	On	On	3
103 PC	Asleep	On	2
105 PC	On	On	3

107 PC	On	On	3
109 PC	On	On	3
111 PC	On	On	3
113 PC	On	On	3
115 PC	On	On	3
117 PC	On	On	3
119 PC	On	On	3
121 PC	On	On	3
123 PC	Asleep	On	2

Table 7.11 Monday, March 16th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 8pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	On	2
6 Mac	NA	On	2
8 Mac	NA	On	2
10 Mac	NA	On	2
12 Mac	NA	On	2
14 PC	On	On	3
16 PC	On	On	3
18 PC	On	On	3
20 PC	On	On	3
22 PC	On	On	3
24 PC	On	On	3
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	On	On	3
36 PC	On	On	3
38 PC	On	On	3
40 PC	Off	On	2
42 PC	On	On	3
44 PC	On	On	3
46 PC	On	On	3
48 PC	On	On	3
50 PC	On	On	3
52 PC	Asleep	On	2
54 PC	Asleep	On	2
56 PC	On	On	3

58 PC	Asleep	On	2
60 PC	On	On	3
62 PC	On	On	3
64 PC	On	On	3
66 PC	Asleep	On	2
68 PC	On	On	3
70 PC	On	On	3
72 PC	On	On	3
74 PC	On	On	3
76 PC	On	On	3
78 PC	On	On	3
80 PC	On	On	3
82 PC	On	On	3
84 PC	On	On	3
86 PC	On	On	3
88 PC	On	On	3
90 PC	On	On	3
92 PC	On	On	3
94 PC	On	On	3
96 PC	On	On	3
98 PC	Asleep	On	2
100 PC	On	On	3
102 PC	On	On	3
104 PC	On	On	3
106 PC	On	On	3
108 PC	Asleep	On	2
110 PC	Asleep	On	2
112 PC	On	On	3
114 PC	On	On	3
116 PC	On	On	3
118 PC	On	On	3
120 PC	On	On	3
122 PC	On	On	3

Table 7.12 Monday, March 16th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 9am.

	Monitor	Computer	Ranking
1 Mac	NA	Asleep	1
3 Mac	NA	On	2
5 Mac	NA	On	2
7 PC	Asleep	On	2

9 PC	On	On	3
11 PC	Asleep	On	2
13 PC	Asleep	On	2
15 PC	Asleep	On	2
17 PC	On	On	3
19 PC	Asleep	On	2
21 PC	On	On	3
23 PC	Asleep	On	2
25 PC	Asleep	On	2
27 PC	Asleep	On	2
29 PC	Asleep	On	2
31 PC	Asleep	On	2
33 PC	On	On	3
35 PC	Asleep	On	2
37 PC	Asleep	On	2
39 PC	Asleep	On	2
41 PC	On	On	3
43 PC	On	On	3
45 PC	On	On	3

Table 7.13 Monday, March 16th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 10am.

	Monitor	Computer	Ranking
2 Mac	NA	Asleep	1
4 Mac	NA	Asleep	1
6 PC	On	On	3
8 PC	Asleep	On	2
10 PC	On	On	3
12 PC	Asleep	On	2
14 PC	On	On	3
16 PC	On	On	3
18 PC	Asleep	On	2
20 PC	On	On	3
22 PC	On	On	3
24 PC	On	On	3
26 PC	On	On	3
28 PC	Asleep	On	2
30 PC	Asleep	On	2
32 PC	On	On	3
34 PC	Asleep	On	2
36 PC	On	On	3

38 PC	Asleep	On	2
40 PC	On	On	3
42 PC	Asleep	On	2
44 PC	On	On	3

Table 7.14 Monday, March 16th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 11am.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	Off	0
5 Mac	NA	Asleep	1
7 PC	On	On	3
9 PC	On	On	3
11 PC	On	On	3
13 PC	Asleep	On	2
15 PC	On	On	3
17 PC	On	On	3
19 PC	Asleep	On	2
21 PC	Asleep	On	2
23 PC	On	On	3
25 PC	On	On	3
27 PC	Asleep	On	2
29 PC	Asleep	On	2
31 PC	On	On	3
33 PC	On	On	3
35 PC	Asleep	On	2
37 PC	Asleep	On	2
39 PC	On	On	3
41 PC	Asleep	On	2
43 PC	On	On	3
45 PC	Asleep	On	2

Table 7.15 Monday, March 16th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 12pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	On	2
6 PC	On	On	3
8 PC	On	On	3
10 PC	On	On	3
12 PC	Asleep	On	2

14 PC	On	On	3
16 PC	On	On	3
18 PC	On	On	3
20 PC	On	On	3
22 PC	On	On	3
24 PC	On	On	3
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	Asleep	On	2
36 PC	Asleep	On	2
38 PC	On	On	3
40 PC	Asleep	On	2
42 PC	On	On	3
44 PC	On	On	3

Table 7.16 Monday, March 16th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 5pm.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	On	2
5 Mac	NA	On	2
7 PC	On	On	3
9 PC	On	On	3
11 PC	On	On	3
13 PC	On	On	3
15 PC	On	On	3
17 PC	On	On	3
19 PC	On	On	3
21 PC	On	On	3
23 PC	On	On	3
25 PC	On	On	3
27 PC	On	On	3
29 PC	On	On	3
31 PC	On	On	3
33 PC	On	On	3
35 PC	On	On	3
37 PC	On	On	3
39 PC	On	On	3
41 PC	On	On	3

43 PC	On	On	3
45 PC	On	On	3

Table 7.17 Monday, March 16th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 6pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	On	2
6 PC	Asleep	On	2
8 PC	On	On	3
10 PC	On	On	3
12 PC	On	On	3
14 PC	On	On	3
16 PC	On	On	3
18 PC	On	On	3
20 PC	On	On	3
22 PC	On	On	3
24 PC	On	On	3
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	On	On	3
36 PC	Asleep	On	2
38 PC	On	On	3
40 PC	On	On	3
42 PC	On	On	3
44 PC	On	On	3

Table 7.18 Monday, March 16th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 7pm.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	On	2
5 Mac	NA	On	2
7 PC	On	On	3
9 PC	On	On	3
11 PC	On	On	3
13 PC	On	On	3
15 PC	On	On	3
17 PC	Asleep	On	2

19 PC	On	On	3
21 PC	On	On	3
23 PC	On	On	3
25 PC	On	On	3
27 PC	On	On	3
29 PC	On	On	3
31 PC	On	On	3
33 PC	On	On	3
35 PC	On	On	3
37 PC	On	On	3
39 PC	On	On	3
41 PC	On	On	3
43 PC	Asleep	On	2
45 PC	On	On	3

Table 7.19 Monday, March 16th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 8pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	On	2
6 PC	On	On	3
8 PC	Asleep	On	2
10 PC	On	On	3
12 PC	On	On	3
14 PC	On	On	3
16 PC	On	On	3
18 PC	On	On	3
20 PC	On	On	3
22 PC	Asleep	On	2
24 PC	On	On	3
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	On	On	3
36 PC	On	On	3
38 PC	On	On	3
40 PC	Asleep	On	2
42 PC	On	On	3
44 PC	On	On	3

Table 7.20 Friday, March 20th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 9am.

	Monitor	Computer	Ranking
1 Mac	NA	Asleep	1
3 Mac	NA	Asleep	1
5 Mac	NA	Asleep	1
7 Mac	NA	Asleep	1
9 Mac	NA	On	2
11 Mac	NA	On	2
13 Mac	NA	Asleep	1
15 Mac	NA	On	2
17 PC	On	On	3
19 PC	On	On	3
21 PC	On	On	3
23 PC	On	On	3
25 PC	On	On	3
27 PC	On	On	3
29 PC	On	On	3
31 PC	On	On	3
33 PC	On	On	3
35 PC	Asleep	On	2
37 PC	Asleep	On	2
39 PC	On	On	3
41 PC	Off	Off	0
43 PC	On	On	3
45 PC	Off	Off	0
47 PC	On	On	3
49 PC	On	On	3
51 PC	On	On	3
53 PC	On	On	3
55 PC	On	On	3
57 PC	On	On	3
59 PC	On	On	3
61 PC	On	On	3
63 PC	On	On	3
65 PC	On	On	3
67 PC	On	On	3
69 PC	On	On	3
71 PC	On	On	3
73 PC	On	On	3
75 PC	On	On	3

77 PC	On	On	3
79 PC	On	On	3
81 PC	On	On	3
83 PC	On	On	3
85 PC	On	On	3
87 PC	On	On	3
89 PC	On	On	3
91 PC	Asleep	On	2
93 PC	Asleep	On	2
95 PC	Asleep	On	2
97 PC	Asleep	On	2
99 PC	Asleep	On	2
101 PC	Asleep	On	2
103 PC	Asleep	On	2
105 PC	On	On	3
107 PC	Asleep	On	2
109 PC	On	On	3
111 PC	Asleep	On	2
113 PC	On	On	3
115 PC	On	On	3
117 PC	Asleep	On	2
119 PC	On	On	3
121 PC	Off	Off	0
123 PC	On	On	3

Table 7.21 Friday, March 20th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 10am.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	On	2
6 Mac	NA	On	2
8 Mac	NA	Asleep	1
10 Mac	NA	Asleep	1
12 Mac	NA	On	2
14 PC	Asleep	On	2
16 PC	Asleep	On	2
18 PC	Asleep	On	2
20 PC	On	On	3
22 PC	On	On	3
24 PC	On	On	3
26 PC	On	On	3

28 PC	Asleep	On	2
30 PC	On	On	3
32 PC	Asleep	On	2
34 PC	On	On	3
36 PC	On	On	3
38 PC	On	On	3
40 PC	On	On	3
42 PC	On	On	3
44 PC	On	On	3
46 PC	On	On	3
48 PC	On	On	3
50 PC	On	On	3
52 PC	On	On	3
54 PC	On	On	3
56 PC	On	On	3
58 PC	On	On	3
60 PC	On	On	3
62 PC	On	On	3
64 PC	On	On	3
66 PC	On	On	3
68 PC	On	On	3
70 PC	On	On	3
72 PC	On	On	3
74 PC	On	On	3
76 PC	On	On	3
78 PC	On	On	3
80 PC	On	On	3
82 PC	On	On	3
84 PC	On	On	3
86 PC	On	On	3
88 PC	Asleep	On	2
90 PC	On	On	3
92 PC	On	On	3
94 PC	On	On	3
96 PC	On	On	3
98 PC	On	On	3
100 PC	On	On	3
102 PC	On	On	3
104 PC	On	On	3
106 PC	On	On	3
108 PC	On	On	3

110 PC	Asleep	On	2
112 PC	On	On	3
114 PC	On	On	3
116 PC	On	On	3
118 PC	On	On	3
120 PC	On	On	3
122 PC	Asleep	On	2

Table 7.22 Friday, March 20th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 11am.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	Asleep	1
5 Mac	NA	On	2
7 Mac	NA	Asleep	1
9 Mac	NA	On	2
11 Mac	NA	On	2
13 Mac	NA	On	2
15 Mac	NA	On	2
17 PC	On	On	3
19 PC	On	On	3
21 PC	On	On	3
23 PC	On	On	3
25 PC	On	On	3
27 PC	On	On	3
29 PC	On	On	3
31 PC	On	On	3
33 PC	On	On	3
35 PC	On	On	3
37 PC	Off	Off	0
39 PC	On	On	3
41 PC	On	On	3
43 PC	On	On	3
45 PC	On	On	3
47 PC	On	On	3
49 PC	On	On	3
51 PC	On	On	3
53 PC	On	On	3
55 PC	On	On	3
57 PC	On	On	3
59 PC	On	On	3

61 PC	Off	On	2
63 PC	On	On	3
65 PC	Off	On	2
67 PC	On	On	3
69 PC	On	On	3
71 PC	On	On	3
73 PC	On	On	3
75 PC	On	On	3
77 PC	On	On	3
79 PC	On	On	3
81 PC	On	On	3
83 PC	On	On	3
85 PC	On	On	3
87 PC	On	On	3
89 PC	On	On	3
91 PC	On	On	3
93 PC	On	On	3
95 PC	On	On	3
97 PC	On	On	3
99 PC	On	On	3
101 PC	On	On	3
103 PC	On	On	3
105 PC	On	On	3
107 PC	On	On	3
109 PC	Off	Off	0
111 PC	On	On	3
113 PC	Off	Off	0
115 PC	On	On	3
117 PC	On	On	3
119 PC	On	On	3
121 PC	On	On	3
123 PC	On	On	3

Table 7.23 Friday, March 20th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 12pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	On	2
6 Mac	NA	Asleep	1
8 Mac	NA	On	2
10 Mac	NA	On	2

12 Mac	NA	On	2
14 PC	On	On	3
16 PC	On	On	3
18 PC	On	On	3
20 PC	On	On	3
22 PC	On	On	3
24 PC	On	On	3
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	On	On	3
36 PC	On	On	3
38 PC	On	On	3
40 PC	On	On	3
42 PC	On	On	3
44 PC	On	On	3
46 PC	On	On	3
48 PC	On	On	3
50 PC	On	On	3
52 PC	On	On	3
54 PC	On	On	3
56 PC	On	On	3
58 PC	On	On	3
60 PC	On	On	3
62 PC	On	On	3
64 PC	On	On	3
66 PC	On	On	3
68 PC	On	On	3
70 PC	On	On	3
72 PC	On	On	3
74 PC	On	On	3
76 PC	On	On	3
78 PC	On	On	3
80 PC	On	On	3
82 PC	Asleep	On	2
84 PC	On	On	3
86 PC	On	On	3
88 PC	On	On	3
90 PC	On	On	3
92 PC	Asleep	On	2

94 PC	On	On	3
96 PC	On	On	3
98 PC	On	On	3
100 PC	On	On	3
102 PC	On	On	3
104 PC	On	On	3
106 PC	On	On	3
108 PC	On	On	3
110 PC	Off	Off	0
112 PC	On	On	3
114 PC	On	On	3
116 PC	On	On	3
118 PC	On	On	3
120 PC	On	On	3
122 PC	On	On	3

Table 7.24 Friday, March 20th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 5pm.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	Asleep	1
5 Mac	NA	On	2
7 Mac	NA	Asleep	1
9 Mac	NA	Asleep	1
11 Mac	NA	On	2
13 Mac	NA	Asleep	1
15 Mac	NA	On	2
17 PC	On	On	3
19 PC	On	On	3
21 PC	On	On	3
23 PC	Asleep	On	2
25 PC	On	On	3
27 PC	On	On	3
29 PC	On	On	3
31 PC	On	On	3
33 PC	On	On	3
35 PC	On	On	3
37 PC	On	On	3
39 PC	On	On	3
41 PC	Asleep	On	2
43 PC	On	On	3

45 PC	On	On	3
47 PC	On	On	3
49 PC	On	On	3
51 PC	On	On	3
53 PC	On	On	3
55 PC	On	On	3
57 PC	On	On	3
59 PC	On	On	3
61 PC	On	On	3
63 PC	On	On	3
65 PC	On	On	3
67 PC	On	On	3
69 PC	On	On	3
71 PC	Asleep	On	2
73 PC	Asleep	On	2
75 PC	Asleep	On	2
77 PC	Asleep	On	2
79 PC	Asleep	On	2
81 PC	Asleep	On	3
83 PC	On	On	3
85 PC	Asleep	On	2
87 PC	Asleep	On	2
89 PC	On	On	3
91 PC	On	On	3
93 PC	Asleep	On	2
95 PC	On	On	3
97 PC	On	On	3
99 PC	Asleep	On	2
101 PC	On	On	3
103 PC	On	On	3
105 PC	On	On	3
107 PC	Asleep	On	2
109 PC	Asleep	On	2
111 PC	On	On	3
113 PC	On	On	3
115 PC	On	On	3
117 PC	Asleep	On	2
119 PC	On	On	3
121 PC	Asleep	On	2
123 PC	Asleep	On	2

Table 7.25 Friday, March 20th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 6pm.

	Monitor	Computer	Ranking
2 Mac	NA	Off	0
4 Mac	NA	Asleep	1
6 Mac	NA	On	2
8 Mac	NA	On	2
10 Mac	NA	On	2
12 Mac	NA	On	2
14 PC	Asleep	On	2
16 PC	On	On	3
18 PC	On	On	3
20 PC	Asleep	On	2
22 PC	Asleep	On	2
24 PC	On	On	3
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	Asleep	On	2
36 PC	Asleep	On	2
38 PC	On	On	3
40 PC	On	On	3
42 PC	On	On	3
44 PC	On	On	3
46 PC	Asleep	On	2
48 PC	On	On	3
50 PC	On	On	3
52 PC	On	On	3
54 PC	On	On	3
56 PC	On	On	3
58 PC	Asleep	On	2
60 PC	Asleep	On	2
62 PC	On	On	3
64 PC	Asleep	On	2
66 PC	On	On	3
68 PC	Asleep	On	2
70 PC	On	On	3
72 PC	On	On	3
74 PC	On	On	3
76 PC	Asleep	On	2

78 PC	Asleep	On	2
80 PC	On	On	3
82 PC	On	On	3
84 PC	On	On	3
86 PC	On	On	3
88 PC	On	On	3
90 PC	On	On	3
92 PC	On	On	3
94 PC	Asleep	On	2
96 PC	Asleep	On	2
98 PC	On	On	3
100 PC	On	On	3
102 PC	On	On	3
104 PC	Asleep	On	2
106 PC	Asleep	On	2
108 PC	Asleep	On	2
110 PC	Asleep	On	2
112 PC	On	On	3
114 PC	Asleep	On	2
116 PC	Asleep	On	2
118 PC	Asleep	On	2
120 PC	Asleep	On	2
122 PC	On	On	3

Table 7.26 Friday, March 20th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 7pm.

	Monitor	Computer	Ranking
1 Mac	NA	Asleep	1
3 Mac	NA	Asleep	1
5 Mac	NA	Asleep	1
7 Mac	NA	On	2
9 Mac	NA	Asleep	1
11 Mac	NA	Asleep	1
13 Mac	NA	Asleep	1
15 Mac	NA	Asleep	1
17 PC	Asleep	On	2
19 PC	Asleep	On	2
21 PC	On	On	3
23 PC	On	On	3
25 PC	Asleep	On	2
27 PC	Asleep	On	2

29 PC	On	On	3
31 PC	On	On	3
33 PC	Off	On	2
35 PC	On	On	3
37 PC	Asleep	On	2
39 PC	On	On	3
41 PC	On	On	3
43 PC	On	On	3
45 PC	On	On	3
47 PC	Asleep	On	2
49 PC	On	On	3
51 PC	On	On	3
53 PC	On	On	3
55 PC	Asleep	On	2
57 PC	On	On	3
59 PC	Asleep	On	2
61 PC	On	On	3
63 PC	Asleep	On	2
65 PC	Asleep	On	2
67 PC	On	On	3
69 PC	Asleep	On	2
71 PC	Asleep	On	2
73 PC	Asleep	On	2
75 PC	On	On	3
77 PC	Asleep	On	2
79 PC	Asleep	On	2
81 PC	On	On	3
83 PC	On	On	3
85 PC	On	On	3
87 PC	Asleep	On	2
89 PC	Asleep	On	2
91 PC	Asleep	On	2
93 PC	Asleep	On	2
95 PC	Asleep	On	2
97 PC	Asleep	On	2
99 PC	Asleep	On	2
101 PC	Asleep	On	2
103 PC	Asleep	On	2
105 PC	Asleep	On	2
107 PC	Asleep	On	2
109 PC	Asleep	On	2

111 PC	Asleep	On	2
113 PC	Asleep	On	2
115 PC	Asleep	On	2
117 PC	Asleep	On	2
119 PC	Asleep	On	2
121 PC	Asleep	On	2
123 PC	Asleep	On	2

Table 7.27 Friday, March 20th 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 8pm.

	Monitor	Computer	Ranking
2 Mac	NA	Off	0
4 Mac	NA	Asleep	1
6 Mac	NA	On	2
8 Mac	NA	Asleep	1
10 Mac	NA	On	2
12 Mac	NA	On	2
14 PC	Asleep	On	2
16 PC	Asleep	On	2
18 PC	Asleep	On	2
20 PC	On	On	3
22 PC	Asleep	On	2
24 PC	On	On	3
26 PC	Asleep	On	2
28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	Asleep	On	2
36 PC	Asleep	On	2
38 PC	On	On	3
40 PC	On	On	3
42 PC	On	On	3
44 PC	On	On	3
46 PC	On	On	3
48 PC	On	On	3
50 PC	On	On	3
52 PC	On	On	3
54 PC	On	On	3
56 PC	Asleep	On	2
58 PC	On	On	3

60 PC	Asleep	On	2
62 PC	Asleep	On	2
64 PC	On	On	3
66 PC	Asleep	On	2
68 PC	Asleep	On	2
70 PC	On	On	3
72 PC	On	On	3
74 PC	On	On	3
76 PC	Asleep	On	2
78 PC	Asleep	On	2
80 PC	Asleep	On	2
82 PC	Asleep	On	2
84 PC	On	On	3
86 PC	Asleep	On	2
88 PC	On	On	3
90 PC	Asleep	On	2
92 PC	Asleep	On	2
94 PC	Asleep	On	2
96 PC	Asleep	On	2
98 PC	Asleep	On	2
100 PC	Asleep	On	2
102 PC	Asleep	On	2
104 PC	Asleep	On	2
106 PC	Asleep	On	2
108 PC	Asleep	On	2
110 PC	Asleep	On	2
112 PC	Asleep	On	2
114 PC	Asleep	On	2
116 PC	Asleep	On	2
118 PC	Asleep	On	2
120 PC	On	On	3
122 PC	Asleep	On	2

Table 7.28 Friday, March 20th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 9am.

	Monitor	Computer	Ranking
1 Mac	NA	Asleep	1
3 Mac	NA	Asleep	1
5 Mac	NA	Asleep	1
7 PC	On	On	3
9 PC	Asleep	On	2

11 PC	Asleep	On	2
13 PC	On	On	3
15 PC	Asleep	On	2
17 PC	Asleep	On	2
19 PC	Asleep	On	2
21 PC	On	On	3
23 PC	Asleep	On	2
25 PC	On	On	3
27 PC	Asleep	On	2
29 PC	On	On	3
31 PC	Asleep	On	2
33 PC	Asleep	On	2
35 PC	On	On	2
37 PC	On	On	3
39 PC	On	Asleep	2
41 PC	On	Asleep	2
43 PC	On	Asleep	2
45 PC	On	Asleep	2

Table 7.29 Friday, March 20th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 10am.

	Monitor	Computer	Ranking
2 Mac	NA	Asleep	1
4 Mac	NA	Asleep	1
6 PC	On	On	3
8 PC	Asleep	On	2
10 PC	On	On	3
12 PC	On	On	3
14 PC	On	On	3
16 PC	Asleep	On	2
18 PC	On	On	3
20 PC	On	On	3
22 PC	Asleep	On	2
24 PC	Asleep	On	2
26 PC	On	On	3
28 PC	Asleep	On	2
30 PC	On	On	3
32 PC	On	On	3
34 PC	Asleep	On	2
36 PC	On	On	3
38 PC	On	On	3

40 PC	On	On	3
42 PC	Asleep	On	2
44 PC	On	On	3

Table 7.30 Friday, March 20th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 11am.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	Asleep	1
5 Mac	NA	Asleep	1
7 PC	On	On	3
9 PC	On	On	3
11 PC	Asleep	On	2
13 PC	On	On	3
15 PC	Asleep	On	2
17 PC	On	On	3
19 PC	Asleep	On	2
21 PC	On	On	3
23 PC	Asleep	On	2
25 PC	On	On	3
27 PC	On	On	3
29 PC	On	On	3
31 PC	Asleep	On	2
33 PC	On	On	3
35 PC	On	On	3
37 PC	Asleep	On	2
39 PC	On	On	3
41 PC	On	On	3
43 PC	Asleep	On	2
45 PC	On	On	3

Table 7.31 Friday, March 20th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 12pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	On	2
6 PC	On	On	3
8 PC	On	On	3
10 PC	On	On	3
12 PC	On	On	3
14 PC	On	On	3

16 PC	Asleep	On	2
18 PC	On	On	3
20 PC	On	On	3
22 PC	On	On	3
24 PC	On	On	3
26 PC	Asleep	On	2
28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	On	On	3
36 PC	On	On	3
38 PC	On	On	3
40 PC	On	On	3
42 PC	On	On	3
44 PC	On	On	3

Table 7.32 Friday, March 20th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 5pm.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	On	2
5 Mac	NA	On	2
7 PC	Asleep	On	2
9 PC	On	On	3
11 PC	On	On	3
13 PC	Asleep	On	2
15 PC	On	On	3
17 PC	On	On	3
19 PC	Asleep	On	2
21 PC	On	On	3
23 PC	On	On	3
25 PC	On	On	3
27 PC	Asleep	On	2
29 PC	On	On	3
31 PC	On	On	3
33 PC	On	On	3
35 PC	Asleep	On	2
37 PC	Asleep	On	2
39 PC	On	On	3
41 PC	On	On	3
43 PC	Asleep	On	2

45 PC	On	On	3
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Table 7.33 Friday, March 20th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 6pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	On	2
6 PC	On	On	3
8 PC	On	On	3
10 PC	On	On	3
12 PC	Asleep	On	2
14 PC	On	On	3
16 PC	On	On	3
18 PC	Off	On	2
20 PC	On	On	3
22 PC	On	On	3
24 PC	On	On	3
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	Asleep	On	2
34 PC	On	On	3
36 PC	On	On	3
38 PC	Asleep	On	2
40 PC	On	On	3
42 PC	On	On	3
44 PC	On	On	3

Table 7.34 Friday, March 20th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 7pm.

	Monitor	Computer	Ranking
1 Mac	NA	Asleep	1
3 Mac	NA	Asleep	1
5 Mac	NA	Asleep	1
7 PC	Asleep	On	2
9 PC	On	On	3
11 PC	Asleep	On	2
13 PC	On	On	3
15 PC	Asleep	On	2

17 PC	On	On	3
19 PC	On	On	3
21 PC	Asleep	On	2
23 PC	On	On	3
25 PC	On	On	3
27 PC	On	On	3
29 PC	On	On	3
31 PC	On	On	3
33 PC	On	On	3
35 PC	On	On	3
37 PC	On	On	3
39 PC	On	On	3
41 PC	On	On	3
43 PC	On	On	3
45 PC	On	On	3

Table 7.35 Friday, March 20th 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 8pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	On	2
6 PC	On	On	3
8 PC	On	On	3
10 PC	On	On	3
12 PC	Asleep	On	2
14 PC	On	On	3
16 PC	On	On	3
18 PC	On	On	3
20 PC	On	On	3
22 PC	Asleep	On	2
24 PC	On	On	3
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	Asleep	On	2
36 PC	On	On	3
38 PC	Asleep	On	2
40 PC	On	On	3
42 PC	On	On	3
44 PC	Asleep	On	2

Table 7.36 Sunday, March 22nd 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 11am.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	Asleep	1
5 Mac	NA	Asleep	1
7 Mac	NA	Asleep	1
9 Mac	NA	On	2
11 Mac	NA	Asleep	1
13 Mac	NA	Asleep	1
15 Mac	NA	Asleep	1
17 PC	On	On	3
19 PC	Asleep	On	2
21 PC	On	On	3
23 PC	On	On	3
25 PC	On	On	3
27 PC	Asleep	On	2
29 PC	Asleep	On	2
31 PC	On	On	3
33 PC	On	On	3
35 PC	Asleep	On	2
37 PC	Asleep	On	2
39 PC	Asleep	On	2
41 PC	Asleep	On	2
43 PC	Asleep	On	2
45 PC	Asleep	On	2
47 PC	On	On	3
49 PC	Asleep	On	2
51 PC	Asleep	On	2
53 PC	Asleep	On	2
55 PC	On	On	3
57 PC	Asleep	On	2
59 PC	On	On	3
61 PC	On	On	3
63 PC	On	On	3
65 PC	Asleep	On	2
67 PC	Asleep	On	2
69 PC	Asleep	On	2
71 PC	Asleep	On	2
73 PC	Asleep	On	2
75 PC	Asleep	On	2

77 PC	Asleep	On	2
79 PC	On	On	3
81 PC	Asleep	On	2
83 PC	Asleep	On	2
85 PC	Asleep	On	2
87 PC	Asleep	On	2
89 PC	On	On	3
91 PC	Asleep	On	2
93 PC	Asleep	On	2
95 PC	Asleep	On	2
97 PC	Asleep	On	2
99 PC	Asleep	On	2
101 PC	Asleep	On	2
103 PC	Asleep	On	2
105 PC	Asleep	On	2
107 PC	Asleep	On	2
109 PC	Asleep	On	2
111 PC	Asleep	On	2
113 PC	Asleep	On	2
115 PC	Asleep	On	2
117 PC	Asleep	On	2
119 PC	On	On	3
121 PC	On	On	3
123 PC	On	On	3

Table 7.37 Sunday, March 22nd 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 12pm.

	Monitor	Computer	Ranking
2 Mac	NA	Asleep	1
4 Mac	NA	Asleep	1
6 Mac	NA	On	2
8 Mac	NA	On	2
10 Mac	NA	On	2
12 Mac	NA	On	2
14 PC	On	On	3
16 PC	Asleep	On	2
18 PC	Asleep	On	2
20 PC	On	On	3
22 PC	Asleep	On	2
24 PC	On	On	3
26 PC	Asleep	On	2

28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	On	On	3
36 PC	On	On	3
38 PC	On	On	3
40 PC	On	On	3
42 PC	On	On	3
44 PC	On	On	3
46 PC	On	On	3
48 PC	On	On	3
50 PC	On	On	3
52 PC	On	On	3
54 PC	On	On	3
56 PC	Asleep	On	2
58 PC	On	On	3
60 PC	On	On	3
62 PC	On	On	3
64 PC	Asleep	On	2
66 PC	Asleep	On	2
68 PC	On	On	3
70 PC	Asleep	On	2
72 PC	On	On	3
74 PC	Asleep	On	2
76 PC	Asleep	On	2
78 PC	On	On	3
80 PC	On	On	3
82 PC	Asleep	On	2
84 PC	Asleep	On	2
86 PC	Asleep	On	2
88 PC	On	On	3
90 PC	Asleep	On	2
92 PC	Asleep	On	2
94 PC	Asleep	On	2
96 PC	On	On	3
98 PC	Asleep	On	2
100 PC	Asleep	On	2
102 PC	Asleep	On	2
104 PC	Asleep	On	2
106 PC	Asleep	On	2
108 PC	Asleep	On	2

110 PC	On	On	3
112 PC	Asleep	On	2
114 PC	On	On	3
116 PC	On	On	3
118 PC	Asleep	On	2
120 PC	Asleep	On	2
122 PC	Asleep	On	2

Table 3.38 Sunday, March 22nd 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 1pm.

	Monitor	Computer	Ranking
1 Mac	NA	Asleep	1
3 Mac	NA	Asleep	1
5 Mac	NA	On	2
7 Mac	NA	On	2
9 Mac	NA	On	2
11 Mac	NA	Asleep	1
13 Mac	NA	Asleep	1
15 Mac	NA	On	2
17 PC	On	On	3
19 PC	Asleep	On	2
21 PC	Asleep	On	2
23 PC	On	On	3
25 PC	Asleep	On	2
27 PC	Asleep	On	2
29 PC	Asleep	On	2
31 PC	Asleep	On	2
33 PC	Asleep	On	2
35 PC	On	On	3
37 PC	Asleep	On	2
39 PC	On	On	3
41 PC	Asleep	On	2
43 PC	Asleep	On	2
45 PC	On	On	3
47 PC	Asleep	On	2
49 PC	Asleep	On	2
51 PC	On	On	3
53 PC	On	On	3
55 PC	On	On	3
57 PC	On	On	3
59 PC	Asleep	On	2

61 PC	Asleep	On	2
63 PC	Asleep	On	2
65 PC	On	On	3
67 PC	On	On	3
69 PC	On	On	3
71 PC	On	On	3
73 PC	Asleep	On	2
75 PC	On	On	3
77 PC	On	On	3
79 PC	On	On	3
81 PC	Asleep	On	2
83 PC	On	On	3
85 PC	On	On	3
87 PC	On	On	3
89 PC	Asleep	On	2
91 PC	On	On	3
93 PC	On	On	3
95 PC	Asleep	On	2
97 PC	Asleep	On	2
99 PC	On	On	3
101 PC	Asleep	On	2
103 PC	Asleep	On	2
105 PC	On	On	3
107 PC	On	On	3
109 PC	Asleep	On	2
111 PC	On	On	3
113 PC	On	On	3
115 PC	On	On	3
117 PC	Asleep	On	2
119 PC	Asleep	On	2
121 PC	On	On	3
123 PC	Asleep	On	2

Table 7.39 Sunday, March 22nd 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 2pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	Asleep	1
6 Mac	NA	On	2
8 Mac	NA	On	2
10 Mac	NA	Asleep	1

12 Mac	NA	On	2
14 PC	On	On	3
16 PC	Asleep	On	2
18 PC	On	On	3
20 PC	On	On	3
22 PC	On	On	3
24 PC	On	On	3
26 PC	Asleep	On	2
28 PC	On	On	3
30 PC	On	On	3
32 PC	Asleep	On	2
34 PC	On	On	3
36 PC	On	On	3
38 PC	On	On	3
40 PC	On	On	3
42 PC	On	On	3
44 PC	Asleep	On	2
46 PC	On	On	3
48 PC	On	On	3
50 PC	On	On	3
52 PC	Asleep	On	2
54 PC	On	On	3
56 PC	On	On	3
58 PC	On	On	3
60 PC	On	On	3
62 PC	On	On	3
64 PC	On	On	3
66 PC	On	On	3
68 PC	Asleep	On	2
70 PC	On	On	3
72 PC	On	On	3
74 PC	On	On	3
76 PC	Asleep	On	2
78 PC	On	On	3
80 PC	On	On	3
82 PC	Asleep	On	2
84 PC	On	On	3
86 PC	On	On	3
88 PC	On	On	3
90 PC	On	On	3
92 PC	On	On	3

94 PC	Asleep	On	2
96 PC	Asleep	On	2
98 PC	On	On	3
100 PC	On	On	3
102 PC	On	On	3
104 PC	On	On	3
106 PC	Asleep	On	2
108 PC	On	On	3
110 PC	On	On	3
112 PC	Asleep	On	2
114 PC	On	On	3
116 PC	On	On	3
118 PC	On	On	3
120 PC	On	On	3
122 PC	Asleep	On	2

Table 7.40 Sunday, March 22nd 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 7pm.

	Monitor	Computer	Ranking
1 Mac	NA	Asleep	1
3 Mac	NA	Asleep	1
5 Mac	NA	On	2
7 Mac	NA	Asleep	1
9 Mac	NA	On	2
11 Mac	NA	Asleep	1
13 Mac	NA	On	2
15 Mac	NA	On	2
17 PC	On	On	3
19 PC	On	On	3
21 PC	Asleep	On	2
23 PC	Asleep	On	2
25 PC	On	On	3
27 PC	On	On	3
29 PC	Asleep	On	2
31 PC	On	On	3
33 PC	On	On	3
35 PC	On	On	3
37 PC	On	On	3
39 PC	Off	Off	0
41 PC	On	On	3
43 PC	On	On	3

45 PC	Asleep	On	2
47 PC	Asleep	On	2
49 PC	On	On	3
51 PC	Asleep	On	2
53 PC	On	On	3
55 PC	Asleep	On	2
57 PC	On	On	3
59 PC	On	On	3
61 PC	Asleep	On	2
63 PC	On	On	3
65 PC	On	On	3
67 PC	On	On	3
69 PC	Asleep	On	2
71 PC	On	On	3
73 PC	On	On	3
75 PC	On	On	3
77 PC	On	On	3
79 PC	On	On	3
81 PC	Off	On	2
83 PC	On	On	3
85 PC	On	On	3
87 PC	Asleep	On	2
89 PC	On	On	3
91 PC	On	On	3
93 PC	Asleep	On	2
95 PC	On	On	3
97 PC	On	On	3
99 PC	On	On	3
101 PC	Asleep	On	2
103 PC	Asleep	On	2
105 PC	On	On	3
107 PC	On	On	3
109 PC	On	On	3
111 PC	Asleep	On	2
113 PC	On	On	3
115 PC	Asleep	On	2
117 PC	On	On	3
119 PC	Asleep	On	2
121 PC	On	On	3
123 PC	On	On	3

Table 7.41 Sunday, March 22nd 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 8pm.

	Monitor	Computer	Ranking
2 Mac	NA	Off	0
4 Mac	NA	On	2
6 Mac	NA	On	2
8 Mac	NA	Asleep	1
10 Mac	NA	Asleep	1
12 Mac	NA	On	2
14 PC	On	On	3
16 PC	On	On	3
18 PC	Asleep	On	2
20 PC	On	On	3
22 PC	Asleep	On	2
24 PC	Asleep	On	2
26 PC	On	On	3
28 PC	Asleep	On	2
30 PC	On	On	3
32 PC	On	On	3
34 PC	On	On	3
36 PC	On	On	3
38 PC	On	On	3
40 PC	On	On	3
42 PC	On	On	3
44 PC	On	On	3
46 PC	On	On	3
48 PC	On	On	3
50 PC	On	On	3
52 PC	On	On	3
54 PC	Asleep	On	2
56 PC	Asleep	On	2
58 PC	On	On	3
60 PC	On	On	3
62 PC	On	On	3
64 PC	Asleep	On	2
66 PC	On	On	3
68 PC	Asleep	On	2
70 PC	Asleep	On	2
72 PC	On	On	3
74 PC	Asleep	On	2
76 PC	On	On	3

78 PC	Asleep	On	2
80 PC	Asleep	On	2
82 PC	Asleep	On	2
84 PC	On	On	3
86 PC	Asleep	On	2
88 PC	Asleep	On	2
90 PC	On	On	3
92 PC	On	On	3
94 PC	Asleep	On	2
96 PC	On	On	3
98 PC	On	On	3
100 PC	On	On	3
102 PC	Asleep	On	2
104 PC	On	On	3
106 PC	On	On	3
108 PC	On	On	3
110 PC	On	On	3
112 PC	On	On	3
114 PC	Asleep	On	2
116 PC	On	On	3
118 PC	Asleep	On	2
120 PC	On	On	3
122 PC	On	On	3

Table 7.42 Sunday, March 22nd 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 9pm.

	Monitor	Computer	Ranking
1 Mac	NA	Asleep	1
3 Mac	NA	Asleep	1
5 Mac	NA	Asleep	1
7 Mac	NA	On	2
9 Mac	NA	On	2
11 Mac	NA	Asleep	1
13 Mac	NA	On	2
15 Mac	NA	Asleep	1
17 PC	On	On	3
19 PC	On	On	3
21 PC	On	On	3
23 PC	Asleep	On	2
25 PC	On	On	3
27 PC	Asleep	On	2

29 PC	Asleep	On	2
31 PC	Asleep	On	2
33 PC	Asleep	On	2
35 PC	Asleep	On	2
37 PC	On	On	3
39 PC	Asleep	On	2
41 PC	Off	Off	0
43 PC	On	On	3
45 PC	On	On	3
47 PC	On	On	3
49 PC	On	On	3
51 PC	On	On	3
53 PC	On	On	3
55 PC	On	On	3
57 PC	Asleep	On	2
59 PC	Asleep	On	2
61 PC	Asleep	On	2
63 PC	Asleep	On	2
65 PC	On	On	3
67 PC	On	On	3
69 PC	On	On	3
71 PC	On	On	3
73 PC	On	On	3
75 PC	Asleep	On	2
77 PC	Asleep	On	2
79 PC	Asleep	On	2
81 PC	Asleep	On	2
83 PC	Asleep	On	2
85 PC	Asleep	On	2
87 PC	Asleep	On	2
89 PC	Off	Off	0
91 PC	Asleep	On	2
93 PC	On	On	3
95 PC	Asleep	On	2
97 PC	On	On	3
99 PC	On	On	3
101 PC	Asleep	On	2
103 PC	On	On	3
105 PC	On	On	3
107 PC	Asleep	On	2
109 PC	On	On	3

111 PC	On	On	3
113 PC	On	On	3
115 PC	Asleep	On	2
117 PC	Asleep	On	2
119 PC	On	On	3
121 PC	On	On	3
123 PC	Asleep	On	2

Table 7.43 Sunday, March 22nd 2015 raw data collection on the first floor Learning Commons of the Killam Memorial Library for 10pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	Off	0
6 Mac	NA	Asleep	1
8 Mac	NA	Asleep	1
10 Mac	NA	On	2
12 Mac	NA	On	2
14 PC	Asleep	On	2
16 PC	Asleep	On	2
18 PC	Asleep	On	2
20 PC	On	On	3
22 PC	Asleep	On	2
24 PC	Asleep	On	2
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	On	On	3
34 PC	On	On	3
36 PC	On	On	3
38 PC	On	Off	2
40 PC	Off	On	2
42 PC	On	On	3
44 PC	On	On	3
46 PC	On	On	3
48 PC	Asleep	On	2
50 PC	Asleep	On	2
52 PC	On	On	3
54 PC	On	On	3
56 PC	On	On	3
58 PC	On	On	3
60 PC	On	On	3

62 PC	On	On	3
64 PC	On	On	3
66 PC	On	On	3
68 PC	Asleep	On	2
70 PC	Asleep	On	2
72 PC	On	On	3
74 PC	On	On	3
76 PC	On	On	3
78 PC	On	On	3
80 PC	On	On	3
82 PC	On	On	3
84 PC	Asleep	On	2
86 PC	Asleep	Off	1
88 PC	On	On	3
90 PC	On	On	3
92 PC	Asleep	On	2
94 PC	Asleep	On	2
96 PC	Asleep	On	2
98 PC	Asleep	On	2
100 PC	Asleep	On	2
102 PC	Asleep	On	2
104 PC	Asleep	On	2
106 PC	Asleep	On	2
108 PC	Asleep	On	2
110 PC	On	On	3
112 PC	Asleep	On	2
114 PC	On	On	3
116 PC	On	On	3
118 PC	Asleep	On	2
120 PC	On	On	3
122 PC	Asleep	On	2

Table 7.44 Sunday, March 22nd 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 11am.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	On	2
5 Mac	NA	On	2
7 PC	Asleep	On	2
9 PC	On	On	3
11 PC	Asleep	On	2

13 PC	Asleep	On	2
15 PC	Asleep	On	2
17 PC	On	On	3
19 PC	Asleep	On	2
21 PC	On	On	3
23 PC	Asleep	On	2
25 PC	On	On	3
27 PC	On	On	3
29 PC	On	On	3
31 PC	On	On	3
33 PC	Asleep	On	2
35 PC	Asleep	On	2
37 PC	On	On	3
39 PC	Asleep	On	2
41 PC	On	On	3
43 PC	Asleep	On	2
45 PC	On	On	3

Table 7.45 Sunday, March 22nd 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 12pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	Asleep	1
6 PC	On	On	3
8 PC	Asleep	On	2
10 PC	On	On	3
12 PC	Asleep	On	2
14 PC	On	On	3
16 PC	Asleep	On	2
18 PC	Asleep	On	2
20 PC	On	On	3
22 PC	On	On	3
24 PC	Asleep	On	2
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	Asleep	On	2
34 PC	On	On	3
36 PC	Asleep	On	2
38 PC	On	On	3
40 PC	On	On	3

42 PC	Asleep	On	2
44 PC	Asleep	On	2

Table 7.46 Sunday, March 22nd 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 1pm.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	Asleep	1
5 Mac	NA	Asleep	1
7 PC	On	On	3
9 PC	On	On	3
11 PC	Asleep	On	2
13 PC	On	On	3
15 PC	Asleep	On	2
17 PC	On	On	3
19 PC	On	On	3
21 PC	On	On	3
23 PC	On	On	3
25 PC	On	On	3
27 PC	Asleep	On	2
29 PC	On	On	3
31 PC	On	On	3
33 PC	Asleep	On	2
35 PC	On	On	3
37 PC	On	On	3
39 PC	Asleep	On	2
41 PC	Asleep	On	2
43 PC	On	On	3
45 PC	On	On	3

Table 7.47 Sunday, March 22nd 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 2pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	Asleep	1
6 PC	On	On	3
8 PC	Asleep	On	2
10 PC	On	On	3
12 PC	On	On	3
14 PC	On	On	3
16 PC	Asleep	On	2

18 PC	On	On	3
20 PC	On	On	3
22 PC	Asleep	On	2
24 PC	Asleep	On	2
26 PC	Asleep	On	2
28 PC	Asleep	On	2
30 PC	Asleep	On	2
32 PC	Asleep	On	2
34 PC	Asleep	On	2
36 PC	On	On	3
38 PC	On	On	3
40 PC	On	On	3
42 PC	Asleep	On	2
44 PC	On	On	3

Table 7.48 Sunday, March 22nd 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 7pm.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	Asleep	1
5 Mac	NA	On	2
7 PC	Asleep	On	2
9 PC	Asleep	On	2
11 PC	On	On	3
13 PC	Asleep	On	2
15 PC	On	On	3
17 PC	On	On	3
19 PC	On	On	3
21 PC	On	On	3
23 PC	Asleep	On	2
25 PC	On	On	3
27 PC	Asleep	On	2
29 PC	On	On	3
31 PC	Asleep	On	2
33 PC	Asleep	On	2
35 PC	On	On	3
37 PC	Asleep	On	2
39 PC	On	On	3
41 PC	On	On	3
43 PC	On	On	3
45 PC	On	On	3

Table 7.49 Sunday, March 22nd 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 8pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	On	2
6 PC	On	On	3
8 PC	On	On	3
10 PC	Asleep	On	2
12 PC	On	On	3
14 PC	On	On	3
16 PC	On	On	3
18 PC	On	On	3
20 PC	On	On	3
22 PC	On	On	3
24 PC	Asleep	On	2
26 PC	On	On	3
28 PC	On	On	3
30 PC	On	On	3
32 PC	Asleep	On	2
34 PC	Asleep	On	2
36 PC	On	On	3
38 PC	Asleep	On	2
40 PC	On	On	3
42 PC	On	On	3
44 PC	Asleep	On	2

Table 7.50 Sunday, March 22nd 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 9pm.

	Monitor	Computer	Ranking
1 Mac	NA	On	2
3 Mac	NA	On	2
5 Mac	NA	On	2
7 PC	Asleep	On	2
9 PC	Asleep	On	2
11 PC	On	On	3
13 PC	Asleep	On	2
15 PC	On	On	3
17 PC	On	On	3
19 PC	On	On	3

21 PC	On	On	3
23 PC	On	On	3
25 PC	On	On	3
27 PC	Asleep	On	2
29 PC	On	On	3
31 PC	Asleep	Off	1
33 PC	On	On	3
35 PC	On	On	3
37 PC	On	On	3
39 PC	On	On	3
41 PC	On	On	3
43 PC	On	On	3
45 PC	On	On	3

Table 7.51 Sunday, March 22nd 2015 raw data collection on the second floor Learning Commons of the Killam Memorial Library for 10pm.

	Monitor	Computer	Ranking
2 Mac	NA	On	2
4 Mac	NA	Asleep	1
6 PC	On	On	3
8 PC	On	On	3
10 PC	Asleep	On	2
12 PC	On	On	3
14 PC	On	On	3
16 PC	On	On	3
18 PC	On	On	3
20 PC	Asleep	On	2
22 PC	On	On	3
24 PC	On	On	3
26 PC	On	On	3
28 PC	On	On	3
30 PC	Asleep	On	2
32 PC	On	On	3
34 PC	Asleep	On	2
36 PC	On	On	3
38 PC	On	On	3
40 PC	Asleep	On	2
42 PC	On	On	3
44 PC	On	On	3

Appendix 8

**ENVIRONMENTAL PROGRAMMES
FACULTY OF SCIENCE
DALHOUSIE UNIVERSITY
APPLICATION FOR ETHICS REVIEW OF RESEARCH INVOLVING HUMAN PARTICIPANTS
UNDERGRADUATE THESES AND IN NON-THESIS COURSE PROJECTS**

GENERAL INFORMATION

1. Title of Project: Dalhousie University, Studley Campus Energy Audit
Killam Computer Labs: Are they an energy waste?

2. Faculty Supervisor(s)	Department	Ext:	E-mail:
Tarah Wright	Environmental Science	902-494-3683	Tarah.Wright@dal.ca
Eliza Jackson	Planning	N/A	Eliza.Jackson@dal.ca

3. Student Investigator(s)	Department	e-mail:	Telephone Number
Christina Martin	Planning	ch567696@dal.ca	905-933-8583
Sarah Colley	IDS	sr326648@dal.ca	902-452-7493
Katie Bartlett	Science	kt950511@dal.ca	902-237-5647
Darlynton Nonju	Earth Science	dr49690@dal.ca	N/A

4. Level of Project:
Non-thesis Course Project Undergraduate [] Graduate Specify
course and number: ENVS/SUST 3502: Campus as a Living Laboratory

5. a. Indicate the anticipated commencement date for this project: Thursday, February 26th, 2015

b. Indicate the anticipated completion date for this project: Friday, April 17th, 2015

SUMMARY OF PROPOSED RESEARCH

1. Purpose and Rationale for Proposed Research

Briefly describe the purpose (objectives) and rationale of the proposed project and include any hypothesis(es)/research questions to be investigated.

The purpose of this proposed research project is to address the energy consumption of computer labs located in the Killam Library on Dalhousie University's campus. The findings of this research will aid in making future recommendations to reduce the energy use on campus associated with the computer labs located in the Killam Library. The research question that will be investigated is as follows:

- What are the energy inefficiencies in the Killam computer labs and what measures could be taken in order to reduce these inefficiencies?

Dalhousie University has started commitments related to sustainability in 1990 when the university signed the Talloires Declaration. Sustainability Tracking, Assessment and Rating System also referred to, as STARS is a credit rating system. Dalhousie recently went from silver to a gold rating based on this system. However, the energy section rated 0, as Dalhousie University did not meet the threshold under this category. Although the campus has made significant improvements to sustainability accomplishments, energy usage is an area that can still be improved. Thus, the topic of this research project relates to the campus sustainability issue of energy.

2. Methodology/Procedures

a. Which of the following procedures will be used? Provide a copy of all materials to be used in this study..

- Survey(s) or questionnaire(s) (mail-back)
 - Survey(s) or questionnaire(s) (in person)
 - Computer-administered task(s) or survey(s)]
 - Interview(s) (in person)
 - Interview(s) (by telephone)
 - Focus group(s)
 - Audio taping
 - Videotaping
 - Analysis of secondary data (no involvement with human participants)
 - Unobtrusive observations
 - Other, specify
-

b. Provide a brief, sequential description of the procedures to be used in this study. For studies involving multiple procedures or sessions, the use of a flow chart is recommended.

On a Monday and Friday of the same week, two members of the team will walk around the Learning Commons in the Killam Library together at 9am, 10am, 11am, 12pm, 5pm, 6pm, 7pm, and 8pm. Each person will be looking to see if the computers and monitors are turned on, off, or asleep.

3. Participants Involved in the Study

a. Indicate who will be recruited as potential participants in this study.

Dalhousie Participants: Undergraduate students

Graduate students

Faculty and/or staff

Non-Dal Participants: Children

Adolescents

Adults

Seniors

Persons in Institutional Settings (e.g. Nursing Homes, Correctional Facilities)

Other (specify) _____

b. Describe the potential participants in this study including group affiliation, gender, age range and any other special characteristics. If only one gender is to be recruited, provide a justification for this.

The participants in this study will include both male and females. The group affiliation of potential participants are Dalhousie University students, faculty, staff and anyone else who has a Net ID and password which allows these individuals access to log in to the computers located in the Killam Library computer labs.

c. How many participants are expected to be involved in this study? This number is dependent on the number of computer users in the library during the times of observation for this research project. However, the maximum number of participants that could be involved in this study is 169, which is the total number of desktop computers (both Mac and PC) that are located in the computer labs at this particular library.

4. Recruitment Process and Study Location

a. From what source(s) will the potential participants be recruited?

- Dalhousie University undergraduate and/or graduate classes
 Other Dalhousie sources (specify) Computer Users in the Killam Library ie) Dalhousie University undergraduate and graduate students, faculty, staff, and anyone with a Dalhousie Net ID who can access the computer labs in this specific location.
 Local School Boards
 Halifax Community
 Agencies
 Businesses, Industries, Professions
 Health care settings, nursing homes, correctional facilities, etc.
 Other, specify (e.g. mailing lists)
-

b. **Identify who will recruit potential participants and describe the recruitment process.**

Provide a copy of any materials to be used for recruitment (e.g. posters(s), flyers, advertisement(s), letter(s), telephone and other verbal scripts).

- N/A, participants will be selected based on the locational context of this research project of energy consumption and usage in the computer labs at the Killam Memorial Library.

5. Compensation of Participants

Will participants receive compensation (financial or otherwise) for participation? Yes No

If **Yes**, provide details:

6. Feedback to Participants

Briefly describe the plans for provision of feedback and attach a copy of the feedback letter to be used. Wherever possible, written feedback should be provided to study participants including a statement of appreciation, details about the

purpose and predictions of the study, contact information for the researchers, and the ethics review and clearance statement.

Note: When available, a copy of an executive summary of the study outcomes also should be provided to participants.

- N/A as this research project is based on unobtrusive observations and the participant's names and/or identity is not known or necessary for the purpose of this research project.

POTENTIAL BENEFITS FROM THE STUDY

1. Identify and describe any known or anticipated direct benefits to the participants from their involvement in the project.

There are no known benefits to the participants from their involvement in the research project, as the identity of the participants is not required to undertake this research. However, the findings of the research can benefit Dalhousie University computer users at the Killam Library as the results may provoke new measures to reduce energy use from computer labs in the library located on Studley campus.

2. Identify and describe any known or anticipated benefits to society from this study.

The anticipated benefits to society as a whole from this research is to conserve energy associated with the use of computers. The research study will highlight the main energy inefficiencies associated with computer use. By recommending new measures to reduce energy use from computer labs in the Killam Library, Dalhousie can reduce its overall carbon footprint. These recommended measures to reduce the energy use associated with computer labs can trigger additional studies on this topic and some of the findings from this study may be able to be translated to other computer labs on campus or at different Universities locally, nationally or even internationally.

POTENTIAL RISKS TO PARTICIPANTS FROM THE STUDY

1. For each procedure used in this study, provide a description of any known or anticipated risks/stressors to the participants. Consider physiological, psychological, emotional, social, economic, legal, etc. risks/stressors

No known or anticipated risks

Explain why no risks are anticipated: There is no anticipated risk for participants involved in this study as the study focuses on unobtrusive observation. The observation does to relate to what the participants are doing, but relates to the number of computers in the computer labs that are in use. Therefore, no personal information is required. Thus participants will not be involved in any type of risk or stressor.

Minimal risk

Description of risks:

Greater than minimal risk

Description of risks:

2. Describe the procedures or safeguards in place to protect the physical and psychological health of the participants in light of the risks/stresses identified in Question 1.

As there are no known or anticipated risks to participants involved in the study, no procedures or safeguards are necessary to protect the physical and psychological health of the participants in light of the risks/stresses identified in Question 1.

INFORMED CONSENT PROCESS

Refer to: <http://pre.ethics.gc.ca/english/policystatement/section2.cfm>

1. What process will be used to inform the potential participants about the study details and to obtain their consent for participation?

Information letter with written consent form; provide a copy

Information letter with verbal consent; provide a copy

Information/cover letter; provide a copy

Other (specify) Potential participant consent for participation is not required for this research, as the data collected does not relate to the participants themselves, but the energy and usage of computers in the Killam Library. In these circumstances and because these participants are in a public place, no formal informed consent is necessary.

2. If written consent cannot be obtained from the potential participants, provide a justification.

Written consent does not need to be obtained from the potential participants due to the fact that the research project does not pose any potential risks to the participants involved in the study. The unobtrusive observation that is used is based on the use of computers and does not require any personal information. As the Killam Memorial Library is a public place, the observations that are taking place do not disrupt the participants. The data that is being collected for this research is strictly based on the computer usage, not the information about the individuals who are using the computers.

ANONYMITY OF PARTICIPANTS AND CONFIDENTIALITY OF DATA

1. Explain the procedures to be used to ensure anonymity of participants and confidentiality of data both during the research and in the release of the findings.

As the participants observed in this study are not identified, since it is not crucial to the type of data collection required for this research project, the participants will remain anonymous both during the research and in the release of the findings. The findings in this case are the number of computer users. A number will be assigned in general, but specific participants will not be distinguished or identified.

2. Describe the procedures for securing written records, questionnaires, video/audio tapes and electronic data, etc.

The procedures for securing electronic data will be saved on the researcher's computers in an Excel spread sheet. This information will be sent via e-mail to our professor, Tarah Wright, and our mentor, Eliza Jackson. After the completion of this course all raw data (i.e. the numbers related to computer usage in the Killam computer labs will be deleted and erased permanently). The only electronic data that will be stored permanently is the data used for the final report, which will be posted on the Dalhousie University website under the Environmental Science Research page of past projects.

3. Indicate how long the data will be securely stored, the storage location, and the method to be used for final disposition of the data.

- Paper Records
 - Confidential shredding after _____ years
 - Data will be retained indefinitely in a secure location
 - Data will be retained until completion of specific course.

- Audio/Video Recordings
 - Erasing of audio/video tapes after _____ years
 - Data will be retained indefinitely in a secure location
 - Data will be retained until completion of specific course.

Electronic Data

- Erasing of electronic data after _____ years
- Data will be retained indefinitely in a secure location
- Data will be retained until completion of specific course.

Other

(Provide details on type, retention period and final disposition, if applicable)

Specify storage location: Excel Spreadsheet on the researcher's computers. This raw data will also be sent via e-mail to the professor of this course, Tarah Wright, and our mentor, Eliza Jackson for grading purposes.

ATTACHMENTS

Please **check** below all appendices that are attached as part of your application package:

- Recruitment Materials:** A copy of any poster(s), flyer(s), advertisement(s), letter(s), telephone or other verbal script(s) used to recruit/gain access to participants.
- Information Letter and Consent Form(s).** Used in studies involving interaction with participants (e.g. interviews, testing, etc.)
- Information/Cover Letter(s).** Used in studies involving surveys or questionnaires.

- [] Parent Information Letter and Permission Form for studies involving minors.
- [] **Materials:** A copy of all survey(s), questionnaire(s), interview questions, interview themes/sample questions for open-ended interviews, focus group questions, or any standardized tests used to collect data.

SIGNATURES OF RESEARCHERS

<u>Christina Martin</u> Signature of Student Investigator(s)	<u>Tuesday, February 24th, 2015</u> Date
<u>Sarah Colley</u> Signature of Student Investigator(s)	<u>Tuesday, February 24th, 2015</u> Date
<u>Katie Bartlett</u> Signature of Student Investigator(s)	<u>Tuesday, February 24th, 2015</u> Date
<u>Darlynton Nonju</u> Signature of Student Investigator(s)	<u>Tuesday, February 24th, 2015</u> Date

FOR ENVIRONMENTAL PROGRAMMES USE ONLY:

Ethics proposal been checked for eligibility according to the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans

Signature	Date
-----------	------

Appendix 9
Copy of Proposal

Dalhousie University, Studley Campus Energy Audit
Killam Computer Labs: Are they a waste of energy?

Preliminary Research Proposal
Thursday, February 26th, 2015

ENVS/SUST 3502: Campus as a Living Laboratory
Professor: Tarah Wright
Mentor: Eliza Jackson

Writers: Christina Martin, Sarah Colley, Darlynton Nonju, and Katie Bartlett

(Team Young)

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Project Definition

Research Team

The researchers involved in this project come from a variety of different backgrounds. The research team consists of a third year student, Christina Martin, who is majoring in Urban Planning and Environmental Sustainability. Sarah Colley is a fourth year student researcher who is studying Environment, Society & Sustainability and International Development. Katie Bartlett is completing a Bachelor's of Science in Biology and Environmental Studies. Darlynton Nonju is a researcher who is passionate about Earth and Environmental Sciences. This diversity will be beneficial as sustainability issues are often complex and require a multidisciplinary approach. The different educational backgrounds of this research team will collaborate in order to effectively undertake this research project for ENV5/SUST 3502: Campus as a Living Laboratory. All researchers share a common goal of promoting sustainability on their university campus.

Study Location

The location of this research project will take place on Dalhousie University's Studley campus, which is also the main campus (see Appendix 1). The Killam Memorial Library is the largest library on campus (Fraser-Brace Maritimes Limited, n.d.). The library is located on University Avenue. The construction of the Killam Library started in 1965 when Dorothy Killam donated \$30 million dollars (Fraser-Brace Maritimes Limited, n.d.). The library was officially completed in 1971 and has been renovated twice since (Fraser-Brace Maritimes Limited, n.d.).

Research Purpose and Question

Dalhousie University has started commitments related to sustainability in 1990 when the university signed the Talloires Declaration (University Leaders For A Sustainable Future, 2001). Globally, over 350 university and college President's have signed this Declaration (University Leaders For A Sustainable Future, 2001). The commitment of universities to create a sustainable future is extremely important as campus research can initiate sustainable change at a global scale. As highlighted in the 1990 Report and Declaration of the President's Conference: "Universities educate most of the people who develop and manage society's institutions. For this reason, universities bear profound responsibilities to increase the awareness, knowledge, technologies, and tools to create an environmentally sustainable future" (University Leaders For A Sustainable Future, 2001).

The Office of Sustainability at Dalhousie University formed in January 2008 (Owen, 2015). The Office is composed of a variety of different groups on campus such as administrative, college, student office, and research groups (Owen, 2015). Sustainability Tracking, Assessment and Rating System also referred to, as STARS is a credit rating system (Owen, 2015). Dalhousie recently improved from silver to a gold rating based on this system (Owen, 2015). However, the energy section rated 0, as Dalhousie University did not meet the threshold under this category (Owen, 2015). The energy category of the STARS rating system is based on both building energy consumption and clean and renewable energy (AASHE, 2015). The building energy consumption includes lab and energy intensive spaces such as computer labs on campus (AASHE, 2015). Although the campus has made significant improvements and a variety of sustainability accomplishments, energy usage is an area that still needs to be improved. Thus, the topic of this research project relates to the campus sustainability issue of energy.

The purpose of this research project is to address the energy usage and consumption of computer labs located in the Killam Library. The research project is an energy audit that uses a quantitative methodological approach. The findings of this research will aid in making future recommendations to reduce the energy use on campus associated with the computer labs located in the Killam Library. The research question of this project is stated below:

- What are the energy inefficiencies in the Killam computer labs and what measures could be taken in order to reduce these inefficiencies?

Research Scope

The scope of this research project focuses on the computer labs in the Killam Library, which is located on Studley campus. Individuals who use the computers in this library are Dalhousie University students, faculty, and staff. Essentially the computers located in this building are accessible to anyone who has a Net ID and password. The computer labs that will be observed for data collection include the learning commons on the main floor and on the second floor of the library. The learning commons on the main floor is referred to as the South Learning Commons (see Appendix 2). The South Learning Commons has a total of 123 desktop computers. This includes 14 Mac's and 109 PC's. The computer lab on the second floor quiet room is referred to as the Learning Commons (see Appendix 3). This computer lab has a total of 46 desktop computers. This includes 5 Mac's and 41 PC's. The energy audit for this research study focuses strictly on the energy consumption associated with the desktop computers in the labs identified above. This does not include the energy associated

with the printers or scanners that are sometimes used in conjunction with these desktop computers.

As this research project is using quantitative measures rather than qualitative measures, there are not any significant limitations surrounding the populations that are under study. However, the scope of the data collection process is limited due to the time constraints of this course and the availability of the research team. If more time were allotted for data collection, the results of this research would contain a higher level of validity. Another limitation to this research project is the time of year the data is being collected. To ensure greater validity, the research conducted in this project would have to take place in both the fall and winter terms, as well as off-peak library times such as the summer and vacations such as Christmas Break and Reading Week. However, the results of energy use from this project can be used as a general template for future research studies.

Due to the observational nature of the scope of our research and recommendations, a budget is not required at this time.

Background and Literature Review

There is an emerging need for energy efficiency and environmental initiatives on university and college campuses. Institutions of higher education (HE) such as universities and colleges are molding the world's future leaders and are key places to begin engaging with issues related to sustainability (Finlay & Massey, 2012). The concern for environmental sustainability has been growing since the 1970s, and institutions of HE are viewed as having the ability to become leaders in global sustainability (Finlay & Massey, 2012). Jessica Finlay and Jennifer Massey (2012) state that university and college campuses have a variety of environmental impacts, which range from air and water pollution and waste, to the vast energy sources they consume. In 1990, the Talloires Declaration was composed, in which universities worldwide signed this declaration in their commitment to environmental sustainability, as of July 2014; there are 472 signatories, including Dalhousie University (ULSF, 2001). Universities and colleges are being held accountable to environmental sustainability by their students, and more commonly the offices and centers being established on campuses that are specifically focused on environmental responsibility (Finlay & Massey, 2012). Institutions of HE have been identified as some of the most computer-dense settings, and with this comes the need for energy efficiency and monitoring (Hirst, Kaplan, Miller & Reed (2013).

In order to commit to environmental sustainability, institutions of HE need to focus on the largest energy consuming aspects of their campuses. For the purpose of this research project, we will look into the energy inefficiencies of computer labs on Dalhousie campus, namely in the Killam Memorial Library, as computer and IT technology account for a large amount of energy consumption in these settings (Hirst et al., 2013).

There is a substantial amount of literature that touches on the issue of power-management within the computing and IT industry. Other similar research projects in this field have: investigated the benefits of default energy-saving settings in computers, the connection of Energy Star criteria development with desktop computers' energy efficiency, the development of tools to estimate the energy consumption of computer software, and examined university campus buildings' energy consumption in the computer and IT technology sector.

There is a fair amount of literature that discusses the default or built-in energy-saving settings on computers, and their impacts on energy consumption (Hirst et al., 2013). Hirst et al., (2013) discuss the nature of humans in choosing the option that requires the least amount of effort; therefore proving that having energy-saving settings on computers, such as the initiation of sleep-mode, or powering-down after a specific amount of idle time, are viable methods of energy conservation. This research demonstrated significant cost and energy savings when explored across university computer labs on campus (Hirst et al., 2013).

Energy Star is a criteria developed to provide consumers with information regarding the energy performance of products such as computers, refrigerators, and other technologies (Lim & Schoenung, 2011). This program undertook a study of desktop computers' energy efficiencies in relation to the required standards by Energy Star (Lim & Schoenung, 2011). The study demonstrated that computer manufacturers do in fact have a focus on reducing the energy consumption of their machines, rather than an aim to attain the Energy Star's program label (Lim & Schoenung, 2011).

Green Tracker, A tool being developed by Nadine Amsel and Bill Tomlinson (2010), has been created to determine the amount of energy different computer software's consume, and to provide awareness regarding these software systems to consumers. Amsel and Tomlinson (2010), outline the environmental issue of computers' energy consumption in relation to CO2 emissions. They discuss the environmental and fiscal importance of proper power-management of computers (Amsel & Tomlinson, 2010). For example, CO2 emissions could be avoided, and money could be saved in electricity costs (Amsel & Tomlinson, 2010). Though our study does not focus on

individual software energy usage within the Killam Memorial Library computers, it is important to note that proper power-management of computer labs on Dalhousie campus could reduce electricity costs to the University while also reducing campus CO2 emissions.

In 2009, the University of San Diego conducted research regarding the energy consumption of buildings on their campus, with a focus on the energy consumption of computer and IT equipment (Agarwal, Gupta & Weng, 2009). Agarwal et al., (2009) stated that, "...a good fraction of energy use in mixed-use buildings is in fact by the IT and communications/networking equipment, accounting for approximately 20% of the total energy use, second only to lighting" (p.55). This study is valuable to our research, as we will be investigating the energy usage in computer labs in the Killam Memorial Library, a mixed-use building similar to the buildings involved in the University of San Diego's research.

Universities, colleges and other educational institutions have many computers on their campuses for students and faculty members to use (Hirst et al., 2013). The computers and IT equipment on HE campuses consume a vast amount of electricity and contribute to the total CO2 emissions of that campus. The research on energy inefficiencies of the Killam Memorial Library computer labs is important because Dalhousie has committed to environmental sustainability, and a large focus of environmental sustainability is reducing electricity usage. Other universities such as the University of San Diego, Northwestern University, the University of British Columbia, the University of Calgary, and many more have made commitments to sustainable power-management of computer and IT equipment on their campuses (Agarwal et al., 2009, Allford, 2013, Northwestern University, 2009, Tufts University, n.d., University of Waterloo, n.d.). There is no lack of literature stating that proper power-management of computer labs on HE campuses is necessary. Dalhousie University could benefit substantially from the environmental and economic implications of enhanced power-management of computers on campus.

Research Methods

Description of Sample

This project will audit the energy usage of the computers found on first and second floor Learning Commons of the Killam Memorial Library. The only computers that will be used in the study are ones that require a valid Net ID and password. An inventory of both Learning Commons will be completed, which will allow for general energy usage calculations to be performed. Then, using non-probabilistic observation, the energy usage of the current state of the computer will be estimated. Finally, different

methods for energy saving will be produced.

Description of Procedure

On a Monday and Friday of the same week, two members of the team will walk around the Learning Commons in the Killam Library together at 9am, 10am, 11am, 12pm, 5pm, 6pm, 7pm, and 8pm. Using Appendix 4: Table One, each person will take note, independently, on whether the monitor is on, off, or asleep. If there is no display on the monitor, one of two will shake the mouse to determine if the monitor was in sleep mode or actually turned off. Then, still using Appendix 4: Table One, each person will take note on whether the computer is on, off, or in sleep mode. It will be assumed that if the monitor was in sleep mode that the computer itself was in sleep as well. It will also be assumed that if the monitor is on with a display that the computer itself will also be on.

After data collection has been completed, the energy usage will be estimated using the method found on Green Education Foundation: Computer Lab Energy Audit. All PCs will be assumed to consume the same amount of energy as each other, just as all Macs will be assumed to consume the same amount of energy as each other.

Data Analysis

The data collected from the non-probabilistic observation will be entered into Excel. Then, basic statistics and energy calculations shall be performed to estimate the general energy usage of the computers.

Delimitations and Limitations

There are a few limitations found with the study. Firstly, the study is only looking at some of the computers that are found in one building, which is on one campus. Secondly, there is a very small window of time for data collection. The small time frame can cause a lot of variation in the data collection because not every hour of the day, day of the week, and day of the year are covered. If the research team consisted of more students, it would allow for more data collection, and thus more validity in the results found in this research study.

A few recommendations for further studies would be to allow for more time for overall data collection, to use different rooms, buildings, and/or campuses, and to go at different times of the day and week.

Schedule

Below is a detailed schedule for the research team to follow for the remainder of the course, from March 1st, 2015 to April 17th, 2015. The schedule has been developed based on each of the researcher's personal schedules (taking into consideration both school, work and other extracurricular activities). These established dates and deadlines are created in order to prepare and to complete the tasks required for this research project in a timely manner. As the research project progresses throughout the term, more detailed tasks will be assigned to specific members of the research team. On going communication between researchers will occur on the team's private Facebook Page.

March 2015						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3 Feedback on Proposals with Mentor in class (E)	4	5	6 Make Corrections Based on Feedback (E)	7 Make Corrections Based on Feedback (E)
8 Meet in Partners and Prepare for Data Collection (E)	9 Data Collection Day 1 Morning:(S)+(C) from 9-12 Evening:(S)+(K) from 5-8	10 Check in with Mentor in class (E)	11	12	13 Data Collection Day 2 Morning:(S)+(K) from 9-12 Evening:(C)+(S) from 5-8	14
15 Compiling and Analyzing Data (E)	16 Analyzing Data (C)	17 Intensive Group Meeting with Mentor and Time to do Research and Analysis (E)	18 Analyzing Data (D)	19 Analyzing Data (S)	20 Analyzing Data (K)	21 Writing Final Report (E)
22 Writing Final Report (E)	23 Writing Final Report and Dividing Report into Sections (E)	24 Intensive Group Meeting with Mentor and Time to do Research and Analysis (E)	25 Writing Final Report and Prep for Presentation (E)	26 Presentation Prep (K) + (D)	27 Presentation Prep (C) + (S)	28 Presentation Prep and Edit Final Copy of Presentation Slides (E)
29 Presentation Slides Due on BBL at midnight (E)	30 Group Meeting to Practice for Presentation	31 Becha Kucha Presentation in class at the Graywood (E)				

**Note this is a tentative schedule, in the event that something comes up this schedule is subject to change

(C) = Christina Martin (S) = Sarah Colley
(K) = Katie ~~Barrett~~ (D) = Darlynton Nonju (E) = Everyone

April

2015

**Note this is a tentative schedule, in the event that something comes up this schedule is subject to change

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1 Presentation Prep (E)	2 Presentation Prep (E)	3 Presentation Prep (E)	4 Presentation Prep and Edit Slides as a Group (E)
5 Presentation Slides Due on BBL at midnight (E)	6	7 Pecha Kucha Presentations in class at the Grawood (E)	8 Writing Final Report (E)	9 Writing Final Report (E)	10 Writing Final Report (E)	11 Writing Final Report (E)
12 Writing Final Report (E)	13 Edit Final Report (C) + (K)	14 Edit Final Report (S) + (C)	15 Edit Final Report (K) + (D)	16 Finishing Touches and Formatting for Final Report (E)	17 Final Report Due at midnight (E) Peer Assessment Due at midnight (E)	18 Team Young Celebration!

(C) = Christina Martin (S) = Sarah Colley
(K) = Katie Bartlett (D) = Darlynton Nonju (E) = Everyone

Deliverables and Communication Plan

The primary deliverables for this research project are the final written report and the Pecha Kucha presentation. The final report will be posted on Dalhousie University's website under the Environmental Sciences Program page. The Pecha Kucha presentation will take place in the Grawood at the end of the term. This presentation is an opportunity for the research team to share the final findings of the research study with our peers, mentors, and professor.

In addition, a summary of the project's findings will be sent to the Director of the Office of Sustainability, Rochelle Owens, and the energy manager of the Office of Sustainability, Glen MacDougall. Hopefully the research team will be given a formal chance to meet and go over the final findings of the research study with both Rochelle Owen and Glen MacDougall. This would allow for an individual with the ability to make changes on campus to consider the recommendations that will be proposed from the conclusions of this research.

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Appendices

Appendix 1

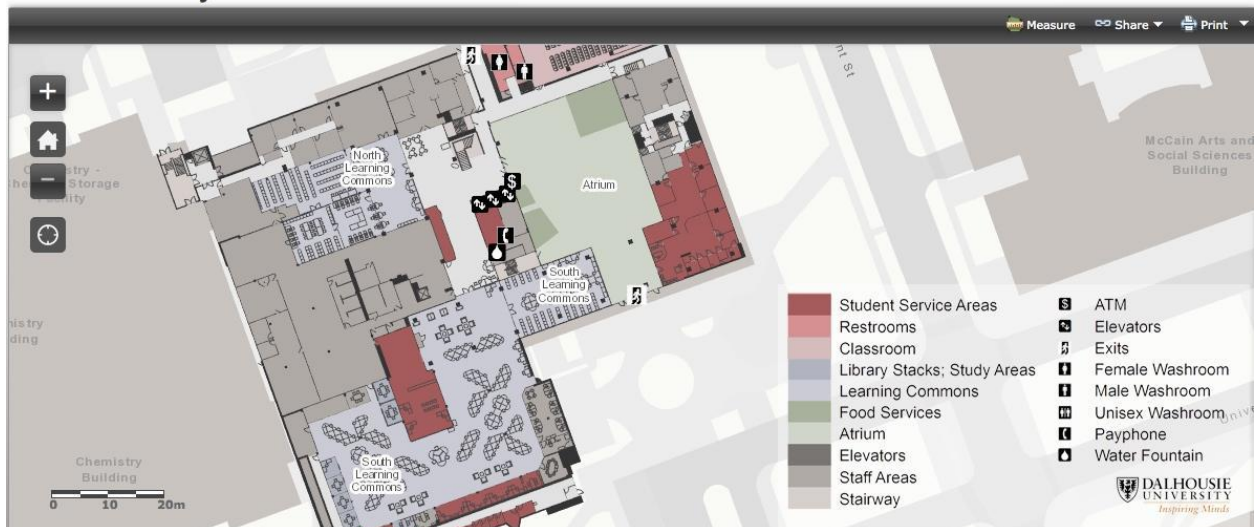
Dalhousie University: Halifax Campuses



Map Source: (Dalhousie GIS Centre, n.d.)

Appendix 2

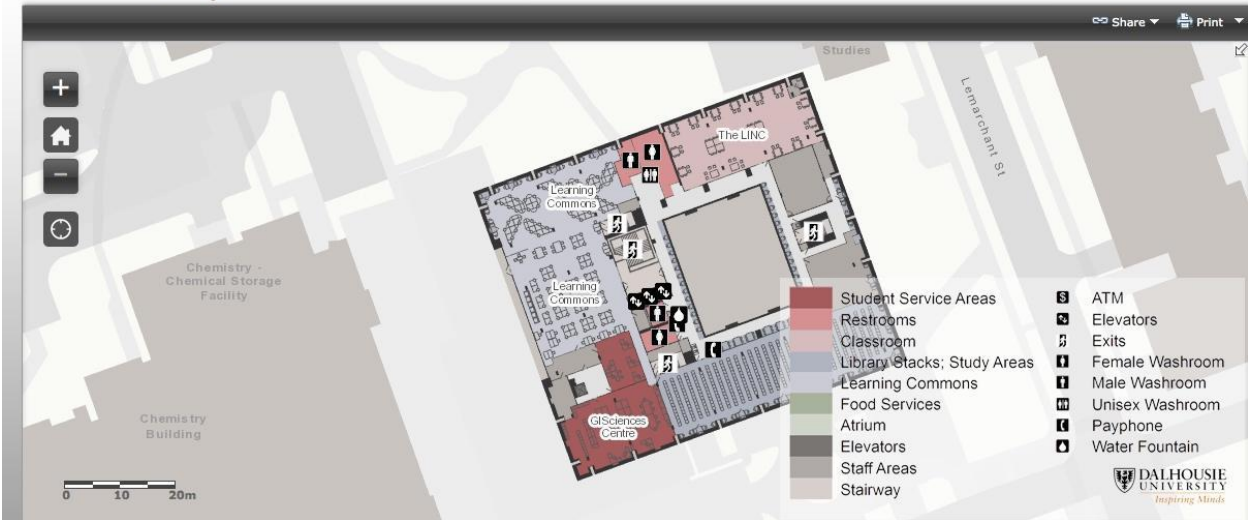
Killam Library: First Floor



Map Source: (Killam Memorial Library, n.d.)

Appendix 3

Killam Library: Second Floor



Map Source: (Killam Memorial Library, n.d.)

Appendix 4

Number		On	Off	Asleep
1	Monitor			
	Computer			
2	Monitor			
	Computer			

Table One: The Observational Table

**ENVIRONMENTAL PROGRAMMES
FACULTY OF SCIENCE
DALHOUSIE UNIVERSITY
APPLICATION FOR ETHICS REVIEW OF RESEARCH INVOLVING HUMAN
PARTICIPANTS
UNDERGRADUATE THESES AND IN NON-THESIS COURSE PROJECTS**

GENERAL INFORMATION

1. Title of Project: Dalhousie University, Studley Campus Energy Audit
Killam Computer Labs: Are they an energy waste?

2. Faculty Supervisor(s)	Department	Ext:	E-mail:
Tarah Wright	Environmental Science	902-494-3683	Tarah.Wright@dal.ca
Eliza Jackson	Planning	N/A	Eliza.Jackson@dal.ca

3. Student Investigator(s)	Department	e-mail:	Telephone Number
Christina Martin	Planning	ch567696@dal.ca	905-933-8583
Sarah Colley	IDS	sr326648@dal.ca	902-452-7493
Katie Bartlett	Science	kt950511@dal.ca	902-237-5647
Darlynton Nonju	Earth Science	dr49690@dal.ca	N/A

4. Level of Project:
Non-thesis Course Project Undergraduate [Graduate Specify
course and number: ENVS/SUST 3502: Campus as a Living Laboratory

5. a. Indicate the anticipated commencement date for this project: Thursday, February 26th, 2015

b. Indicate the anticipated completion date for this project: Friday, April 17th, 2015

SUMMARY OF PROPOSED RESEARCH

1. Purpose and Rationale for Proposed Research
Briefly describe the purpose (objectives) and rationale of the proposed project and include any hypothesis(es)/research questions to be investigated.

The purpose of this proposed research project is to address the energy consumption of computer labs located in the Killam Library on Dalhousie University's campus. The findings of this research will aid in making future recommendations to reduce the energy use on campus associated with the computer labs located in the Killam Library. The research question that will be investigated is as follows:

- What are the energy inefficiencies in the Killam computer labs and what measures could be taken in order to reduce these inefficiencies?

Dalhousie University has started commitments related to sustainability in 1990 when the university signed the Talloires Declaration. Sustainability Tracking, Assessment and Rating System also referred to, as STARS is a credit rating system. Dalhousie recently went from silver to a gold rating based on this system. However, the energy section rated 0, as Dalhousie University did not meet the threshold under this category. Although the campus has made significant improvements to sustainability accomplishments, energy usage is an area that can still be improved. Thus, the topic of this research project relates to the campus sustainability issue of energy.

2. Methodology/Procedures

a. Which of the following procedures will be used? Provide a copy of all materials to be used in this study..

- Survey(s) or questionnaire(s) (mail-back)
 - Survey(s) or questionnaire(s) (in person)
 - Computer-administered task(s) or survey(s)]
 - Interview(s) (in person)
 - Interview(s) (by telephone)
 - Focus group(s)
 - Audio taping
 - Videotaping
 - Analysis of secondary data (no involvement with human participants)
 - Unobtrusive observations
 - Other, specify
-

b. Provide a brief, sequential description of the procedures to be used in this study. For studies involving multiple procedures or sessions, the use of a flow chart is recommended.

On a Monday and Friday of the same week, two members of the team will walk around the Learning Commons in the Killam Library together at 9am, 10am, 11am, 12pm, 5pm, 6pm, 7pm, and 8pm. Each person will be looking to see if the computers and monitors are turned on, off, or asleep.

3. Participants Involved in the Study

a. Indicate who will be recruited as potential participants in this study.

Dalhousie Participants: Undergraduate students

Graduate students

Faculty and/or staff

Non-Dal Participants: Children

Adolescents

Adults

Seniors

Persons in Institutional Settings (e.g. Nursing Homes, Correctional Facilities)

Other (specify) _____

b. Describe the potential participants in this study including group affiliation, gender, age range and any other special characteristics. If only one gender is to be recruited, provide a justification for this.

The participants in this study will include both male and females. The group affiliation of potential participants are Dalhousie University students, faculty, staff and anyone else who has a Net ID and password which allows these individuals access to log in to the computers located in the Killam Library computer labs.

c. How many participants are expected to be involved in this study? This number is dependent on the number of computer users in the library during the times of observation for this research project. However, the maximum number of participants that could be involved in this study is 169, which is the total number of desktop computers (both Mac and PC) that are located in the computer labs at this particular library.

4. Recruitment Process and Study Location

a. From what source(s) will the potential participants be recruited?

- Dalhousie University undergraduate and/or graduate classes
 Other Dalhousie sources (specify) Computer Users in the Killam Library ie) Dalhousie University undergraduate and graduate students, faculty, staff, and anyone with a Dalhousie Net ID who can access the computer labs in this specific location.
 Local School Boards
 Halifax Community
 Agencies
 Businesses, Industries, Professions
 Health care settings, nursing homes, correctional facilities, etc.
 Other, specify (e.g. mailing lists)
-

b. **Identify who will recruit potential participants and describe the recruitment process.**

Provide a copy of any materials to be used for recruitment (e.g. posters(s), flyers, advertisement(s), letter(s), telephone and other verbal scripts).

- N/A, participants will be selected based on the locational context of this research project of energy consumption and usage in the computer labs at the Killam Memorial Library.

5. Compensation of Participants

Will participants receive compensation (financial or otherwise) for participation? Yes No

If Yes, provide details:

6. Feedback to Participants

Briefly describe the plans for provision of feedback and attach a copy of the feedback letter to be used. Wherever possible, written feedback should be provided to study participants including a statement of appreciation, details about the

purpose and predictions of the study, contact information for the researchers, and the ethics review and clearance statement.

Note: When available, a copy of an executive summary of the study outcomes also should be provided to participants.

- N/A as this research project is based on unobtrusive observations and the participant's names and/or identity is not known or necessary for the purpose of this research project.

POTENTIAL BENEFITS FROM THE STUDY

1. Identify and describe any known or anticipated direct benefits to the participants from their involvement in the project.

There are no known benefits to the participants from their involvement in the research project, as the identity of the participants is not required to undertake this research. However, the findings of the research can benefit Dalhousie University computer users at the Killam Library as the results may provoke new measures to reduce energy use from computer labs in the library located on Studley campus.

2. Identify and describe any known or anticipated benefits to society from this study.

The anticipated benefits to society as a whole from this research is to conserve energy associated with the use of computers. The research study will highlight the main energy inefficiencies associated with computer use. By recommending new measures to reduce energy use from computer labs in the Killam Library, Dalhousie can reduce its overall carbon footprint. These recommended measures to reduce the energy use associated with computer labs can trigger additional studies on this topic and some of the findings from this study may be able to be translated to other computer labs on campus or at different Universities locally, nationally or even internationally.

POTENTIAL RISKS TO PARTICIPANTS FROM THE STUDY

1. For each procedure used in this study, provide a description of any known or anticipated risks/stressors to the participants. Consider physiological, psychological, emotional, social, economic, legal, etc. risks/stressors

No known or anticipated risks

Explain why no risks are anticipated: There is no anticipated risk for participants involved in this study as the study focuses on unobtrusive observation. The observation does to relate to what the participants are doing, but relates to the number of computers in the computer labs that are in use. Therefore, no personal information is required. Thus participants will not be involved in any type of risk or stressor.

Minimal risk

Description of risks:

Greater than minimal risk

Description of risks:

2. Describe the procedures or safeguards in place to protect the physical and psychological health of the participants in light of the risks/stresses identified in Question 1.

As there are no known or anticipated risks to participants involved in the study, no procedures or safeguards are necessary to protect the physical and psychological health of the participants in light of the risks/stresses identified in Question 1.

INFORMED CONSENT PROCESS

Refer to: <http://pre.ethics.gc.ca/english/policystatement/section2.cfm>

1. What process will be used to inform the potential participants about the study details and to obtain their consent for participation?

Information letter with written consent form; provide a copy

Information letter with verbal consent; provide a copy

Information/cover letter; provide a copy

Other (specify) Potential participant consent for participation is not required for this research, as the data collected does not relate to the participants themselves, but the energy and usage of computers in the Killam Library. In these circumstances and because these participants are in a public place, no formal informed consent is necessary.

2. If written consent cannot be obtained from the potential participants, provide a justification.

Written consent does not need to be obtained from the potential participants due to the fact that the research project does not pose any potential risks to the participants involved in the study. The unobtrusive observation that is used is based on the use of computers and does not require any personal information. As the Killam Memorial Library is a public place, the observations that are taking place do not disrupt the participants. The data that is being collected for this research is strictly based on the computer usage, not the information about the individuals who are using the computers.

ANONYMITY OF PARTICIPANTS AND CONFIDENTIALITY OF DATA

1. Explain the procedures to be used to ensure anonymity of participants and confidentiality of data both during the research and in the release of the findings.

As the participants observed in this study are not identified, since it is not crucial to the type of data collection required for this research project, the participants will remain anonymous both during the research and in the release of the findings. The findings in this case are the number of computer users. A number will be assigned in general, but specific participants will not be distinguished or identified.

2. Describe the procedures for securing written records, questionnaires, video/audio tapes and electronic data, etc.

The procedures for securing electronic data will be saved on the researcher's computers in an Excel spread sheet. This information will be sent via e-mail to our professor, Tarah Wright, and our mentor, Eliza Jackson. After the completion of this course all raw data (i.e. the numbers related to computer usage in the Killam computer labs will be deleted and erased permanently). The only electronic data that will be stored permanently is the data used for the final report, which will be posted on the Dalhousie University website under the Environmental Science Research page of past projects.

3. Indicate how long the data will be securely stored, the storage location, and the method to be used for final disposition of the data.

- Paper Records
 - Confidential shredding after _____ years
 - Data will be retained indefinitely in a secure location
 - Data will be retained until completion of specific course.

- Audio/Video Recordings
 - Erasing of audio/video tapes after _____ years
 - Data will be retained indefinitely in a secure location
 - Data will be retained until completion of specific course.

Electronic Data

- Erasing of electronic data after _____ years
- Data will be retained indefinitely in a secure location
- Data will be retained until completion of specific course.

Other

(Provide details on type, retention period and final disposition, if applicable)

Specify storage location: Excel Spreadsheet on the researcher's computers. This raw data will also be sent via e-mail to the professor of this course, Tarah Wright, and our mentor, Eliza Jackson for grading purposes.

ATTACHMENTS

Please **check** below all appendices that are attached as part of your application package:

- Recruitment Materials:** A copy of any poster(s), flyer(s), advertisement(s), letter(s), telephone or other verbal script(s) used to recruit/gain access to participants.
- Information Letter and Consent Form(s).** Used in studies involving interaction with participants (e.g. interviews, testing, etc.)
- Information/Cover Letter(s).** Used in studies involving surveys or questionnaires.

- [] Parent Information Letter and Permission Form for studies involving minors.
- [] **Materials:** A copy of all survey(s), questionnaire(s), interview questions, interview themes/sample questions for open-ended interviews, focus group questions, or any standardized tests used to collect data.

SIGNATURES OF RESEARCHERS

<u>Christina Martin</u>	<u>Tuesday, February 24th, 2015</u>
Signature of Student Investigator(s)	Date
 <u>Sarah Colley</u>	 <u>Tuesday, February 24th, 2015</u>
Signature of Student Investigator(s)	Date
 <u>Katie Bartlett</u>	 <u>Tuesday, February 24th, 2015</u>
Signature of Student Investigator(s)	Date
 <u>Darlynton Nonju</u>	 <u>Tuesday, February 24th, 2015</u>
Signature of Student Investigator(s)	Date

FOR ENVIRONMENTAL PROGRAMMES USE ONLY:

Ethics proposal been checked for eligibility according to the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans

Signature	Date
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