The Good, The Bad, and The Study Space: A Quantitative Analysis of Dalhousie University's Studley Campus

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1.0 Executive Summary

Using a non-probabilistic sampling method, classrooms in the Sir James Dunn and Mona Campbell buildings were examined in order to determine the viability of using these classrooms as a study space. Eighteen criteria were developed using the literature review and quartiles were used to determine how usable the classrooms would be as study spaces. We found that the majority of classrooms studied fell into the second quartile range of 13.5-9 (somewhat easy to convert). Two classrooms fell into the highest quartile range of 18-13.5 (easiest to convert), both of which were located in the Sir James Dunn building. This research suggests that Dalhousie should further examine these two rooms in order to better assess the viability of these rooms to be used as study spaces. The environmental purpose of our research is to reduce infrastructure expansion and save resources at Dalhousie University, through examining if current space could be utilized more, thereby saving the need to construct new spaces.

2.0 Introduction

2.1 The Broader Problem

The broader problem of this research project is to demonstrate to Dalhousie University that there is suitable study space for students already existing on campus. Looking at it from an environmental perspective, we are hoping to show Dalhousie University that it is not necessary to spend resources in constructing new facilities when available study space already exists on campus.

2.2 Project Definition

The object of this research project is to provide Dalhousie University with a list of all classrooms in the Sir James Dunn building and the Mona Campbell building ranked for suitability as both classrooms and as student study spaces. We have chosen these buildings as to represent both an old building and a new building on Dalhousie's Studley campus. Using criteria developed through research on the subject, we developed a checklist of elements that a study space should have (**Appendix A**). Using the results from using this checklist, we were able to rank all classrooms studied to determine which are more suitable to be study spaces and which are less suitable. The purpose of this study is to determine if existing spaces at Dalhousie University can be used as study spaces. If existing spaces are utilizable as study spaces this could provide an alternative to spending resources on new buildings, decreasing the cost to the university, and the environmental impact.

2.3 Research Question

The research question for this project is:

Which classrooms in the Sir James Dunn and Mona Campbell buildings are suitable to be study spaces as well as classrooms?

Suitability of classrooms will be determined by how many of the criteria are satisfied. In order to better understand what criteria makes good study spaces the following question will also be investigated. This question is researched in the background section of the paper.

What characteristics do classrooms need to make them study spaces?

3.0 Background

3.1 Defining Good Classroom/Study Space

> "Once freed from the classroom, students gravitate to the spaces most appealing to them. Comfortable and customizable spaces quickly become candidates for frequent use between classes. The informal learning that takes place outside classes occurs in libraries, information commons […] and any other locations where students can gather" (Lomas et al., 2006).

There are many assumptions that exist about learning. These include: learning has to be done at certain times, learning is done individually, classrooms have a structure, are always forward facing, and there should be limited items in a study space to prevent distractions (Brown, 2005). However, students today favour active, participatory learning (Oblinger, 2006). Bolted down single study carrels or massive lecture halls with fixed, cramped seating do not match these preferences. Today's students rely heavily on media and the internet, and their study environment needs to incorporate elements that cater towards these needs; including power outlets for all students, Wi-Fi, access to computers, and other media and technological tools (MacWhinnie, 2003). Students also rely heavily on connections to one another, whether it be face to face or via social media (Kolb et al., 2005).

Social constructivists observe that social setting greatly influences learning in a positive way (Van Note Chism, 2006). Current classroom types can be unstimulating; seating arrangements and auditorium design limit interaction among peers, and technology is either outdated or does not foster individual access (Beatty et al., 2005). The current generation of students prefers "small group work spaces, table space for a variety of tools, Information Technology highly integrated into all aspects of learning spaces, availability of labs and equipment, shared screens and marker boards, and smaller places for […] project work and discussion" (Brown, 2005). In addition to these aspects, good classroom/study space also consists of access to primary resources, printer availability (Brown, 2005), movable rolling chairs and tables, sufficient and comfortable seating (Van Note Chism, 2006), a level floor, a lack of fixed central lecture stand to limit structure, flat desk surfaces rather than slanted, and small tables (Bickford et al., 2003). As a final note, the current generation of students enjoys aesthetically pleasing atmosphere with patterned walls with bright and lively designs, as well as plenty of windows (Lippincott, 2006).

From the experience of the researchers, many Dalhousie University classrooms do not contain all of these features, and the ones that do may not be utilized to full potential of both a classroom and a study space. Many students attend classes in conventional style lecture halls, with tiny, forward facing seats, little room for movement to facilitate discussions or use laptops, and an overhead projector at the front of the room. Dalhousie is starting to acknowledge that, in order to facilitate better learning, new classrooms and study spaces should be made to meet students' various learning

styles. This shift is observed in Dalhousie's new collaborative health building (Morse, 2015).

We hope to demonstrate that as an alternative to constructing these spaces in new buildings, Dalhousie can use existing classrooms that are already suitable as study space as well. The LINC (Learning Incubator Networking Centre) in the Killam Library serves as a model of how Dalhousie can use existing space as both a classroom and a study area. Many other universities have had great success in transforming their facilities into classroom-study commons, such as the Vanderbilt University Peabody Library[1] and the University of Georgia Student Learning Center[2] (Lippincott, 2006).

The LINC classroom in the Killam Library serves as a "model for engagement and interaction, team teaching, and interdisciplinary themes" (Dittoe, 2006) and is an example of integrated classroom/study space already on Dalhousie's Studley campus. As previously stated, there is a strong link between the built environment and effective learning. The LINC is a classroom and study space that features the newest technology in an interactive work space. The LINC classroom possesses many elements of a good classroom/study space as mentioned earlier. The classroom can be rearranged in many different formats and has 19 'pods' that have flat screen televisions which can be connected to laptops, share videos and images between students, or used for lecture by a professor (Smulders, 2011). There are plenty of white boards, projectors, and speakers along with other technology. All tables and chairs are on wheels and can be rearranged to foster social settings or individual learning. The LINC classroom holds up to 115 students, and the space switches between a study common room and classroom several times throughout the day (Smulders, 2011). This classroom study space is more effective than other study spaces, because as mentioned above, it meets the criteria of current generational learning styles and needs. This type of classroom/study space would be practical for the ENVS 3502 class, for example, as the class is regularly engaging in interactive group work and exercises that require movement and media. If the class was held in one of these spaces, rearranging the furniture depending on interactivity easily facilitates the switch from lecturing to group work, while remaining in the same room. Were this the case, students could use the space after class is finished to study or for further group work. Students would not need to move from space to space in order to complete assignments or access different media, nor walk to another building on campus in order to have a group meeting.

By examining several of Dalhousie's classrooms using the criteria examined earlier (listed later on in this project (**Appendix A**), we will be able to provide a list of classrooms within our study areas that are suitable to be used as both classroom and study space. In light of this information, we will examine the economic and environmental impacts of creating new buildings.

[1] For further reading go to http://www.library.vanderbilt.edu/peabody/commons/index.html
[2] For further reading go to http://www.slc.uga.edu/

3.2 Construction and the environmental costs

In Canada, new construction projects are happening on a day to day basis, and it is important to consider both the economic cost and the ecological impact of such projects. The costs of constructing a new building can be divided up in many ways, such as: the initial economic cost, the economic cost of maintaining the building post construction, and the long-term environmental cost. The environmental impact of a building can be further broken down into the construction process, the use of the building, and the inevitable retrofits or removal. Each of these has different effects on the environment and the surrounding area.

Construction of a building causes a lot of disturbance both the local environment in addition to the environment globally. The cement industry is a major contributor to the global rise of carbon dioxide (CO_2), accounting for 4.5% to 5% of all anthropogenic CO_2 emissions (Boden et al, 2010). One of the many uses for cement is a material in construction, and its production is increasing (Boden et al, 2010). Sulfate is also another harmful gas that is released during the building phase, resulting in 0.7 to 1.4 $kgSO_4/m^2$ of floor area (Coelho and Brito, 2011) (Dimoudi and Tompa, 2008). Sulphate in to the atmosphere is a driver of acid rain which has its own negative consequences on the environment. Greenhouse gasses are no simple problem; they have a wide range of effects and can cause unpredicted damages in the long run (Abrahamson, 1987). One of the first steps of Construction is the removal of any vegetation from the worksite, followed by the removal of earth. The alteration of the landscape may result in the disturbance of the local ecosystem, assuming there were no previous structures. Removal of trees and vegetation results in lower diversity, removal of flowers for bees to pollinate, additions to landfills, changes to the ground and air chemistry and less plants to provided oxygen and store carbon. The aesthetic value that the natural landscape may provide should also be considered as green spaces improve mental health and well-being (Lee and Maheswaran, 2010). Finally, the last thing that should be considered while calculating environmental damages is the transportation that is used during construction. Supplies used on site are likely brought in by trucks and the trucks likely received their load from a cargo ship or less likely an airplane. The greenhouse gases released by transportation in Canada are significant, making up 12% of Canada's total emissions (Environment and Climate Change Canada, 2013). It is clear that constructing a building will have negative environmental impacts to some degree.

The construction phase is only one part, to see the full environmental impacts buildings can have the other two stages of the life cycle must be considered: the operation of the building, and the end stage. The daily operational uses of a building cause the largest environmental impacts. This accounts for 80% to 90% of the life-cycle energy use (Khasreen et al, 2009). The main environmental effects buildings have on the environment are due largely to the use of electricity and heating. This is increased in Canada because of the cold winters requiring more heat. Buildings in Canada are responsible for 12% of total greenhouse gas emissions, widely due to this operational phase in the buildings life cycle (Environment and Climate Change Canada, 2013). It is still important to consider the final stage of construction even if it is significantly lower in

impacts, compared to the operation phase of the life cycle. The initial construction has a huge effect on the end life of a building, what materials were used and the designs ability to retrofit play a significant role. In 1996, more than 50% of U.S. concrete waste ended up in landfills and 27% of concrete from the building enters the recycling loop, these numbers are predicted to be only slightly lower in 2008 (Vieira and Horvath, 2008). The lack of reuse of materials is an issue; building waste can add a sizable amount to landfills. Again, we must also consider the transportation element and the dust that is released into the environment. The removal of a building does not ensure the site will go back to the way it was, if there is not a reclamation plan in place.

4.0 Methods

4.1 Overview

Throughout this methods section we state how we answered our research question. Firstly, we will begin with an overview of our project, highlighting key ideas. We will discuss the research tools used, and our methodology for conducting our study. From the data collected in these observations we will perform data analysis using several statistical tests. The group looked at the validity of our study and examine the delimitations and limitations of our experiment.

4.2 Research Tools

Our project design incorporates non-probabilistic sampling methods for observing characteristics of classrooms and study spaces. We created an a priori checklist of various features based on the literature that we will use to assess these classrooms. The checklist determined the suitability of each classroom for use as a study space. Refer to **Appendix A** for a copy of this checklist.
Our assumption is that the university would not need to build an entirely new building for studying if existing classrooms were converted into good study spaces. These renovations would save the school financial costs and eliminate further environmental impacts from building new facilities as explored in section 3.2.

4.3 Stepwise Methodology

On March 29th at 7 pm, the six researchers split themselves into three groups of two to observe the classrooms of the Mona Campbell and the James Dunn buildings. Using the checklist (**Appendix A**), each group observed all classrooms in the Mona Campbell and James Dunn buildings and took note of each design feature present, noting the classroom number and size of each classroom observed until all classrooms were examined. The data collected using the checklist of the classrooms in the James Dunn and Mona Campbell buildings was used for subsequent data analysis explained below.

4.4 Data Analysis

Checklist data collected from the classrooms of the two buildings were used to produce four quartiles. These were then used to determine the viability of the classrooms to be converted to study space. We ranked the quartiles from easiest to convert to most difficult to convert. Elaborating on this, the requirements were divided into four sections based on a score out of 18: easiest to convert (18-13.5), somewhat easy to convert (13.5-9), difficult to convert (9-4.5), and extremely difficult to convert (4.5-0).

4.5 Validity and Justification of Research Methods

The two classroom buildings that were analyzed - the Mona Campbell and James Dunn buildings - using non-probabilistically purposeful sampling, were chosen to be representatives of an older building on campus (James Dunn) and new building on campus (Mona Campbell). The buildings are similar in size and belong to different faculties. This will provide a better representation of all facilities at the university. To avoid any biases, the criteria were not given a weighted value based on our preferences, therefore each for the 18 criterion have equal weighting.

4.6 Delimitations and Limitations

A limitation to this study is that the availability and scheduling of classrooms for use as study space was not considered. This was excluded because of the difficulty in obtaining class schedules for the chosen rooms. A delimitation was choosing to only investigate the Mona Campbell and Sir James Dunn building classrooms, based on time constraints. The study was limited to assessing only the physical feasibility of using existing classroom space as both classroom and study space. Assessing the practicality, including issues such as scheduling, , are beyond the scope of this study and the researchers were not able to undertake such a research project due to lack of access to Dalhousie facilities, time, and money.

5.0 Results

Table 1. Sir James Dunn Building Classroom Criteria Met

	Classroom Number									# Classrooms	% Classrooms
Criteria	135	101	117	221C	301B	301A	302	304	208	met criteria	met criteria
1	n	n	y	y	y	y	y	y	y	7	78
2	n	n	n	n	y	y	y	y	y	5	56
3	n	n	n	n	y	y	n	n	y	3	33
4	n	n	n	n	n	n	n	n	n	0	0
5	y	y	y	y	y	y	n	n	y	7	78
6	n	n	n	n	y	y	n	n	y	3	33
7	y	y	y	y	y	y	y	y	y	9	100
8	y	y	y	y	y	y	y	y	y	9	100
9	n	n	n	y	y	y	y	y	n	5	56
10	n	n	n	y	y	y	y	n	y	5	56
11	n	n	n	y	y	y	n	n	y	4	44
12	n	n	n	y	n	n	y	n	n	2	22
13	n	n	n	y	n	n	y	n	n	2	22
14	y	y	n	n	n	y	n	n	n	3	33
15	y	n	n	y	y	y	n	n	y	4	44
16	y	y	y	y	y	y	y	y	y	9	100
17	n	n	y	y	y	y	y	y	n	6	67
18	y	y	n	y	y	y	y	y	y	8	89
Number of Seats	72	85	237	34	70	64	35	60	25		

(y=yes meets criteria, n=no does not meet criteria)

Table 2. Mona Campbell Building Classroom Criteria Met

	Classroom Number											# Classrooms
Criteria	3107	3110	1107	1108	1110	1111	2109	2108	2107	2111	2010	met criteria
1	y	y	y	y	y	y	y	y	y	y	y	11
2	n	n	n	n	n	n	n	n	n	n	n	0
3	n	n	n	n	n	n	y	y	n	n	n	2
4	n	n	n	n	n	n	n	n	n	n	n	0
5	y	y	n	n	n	n	n	n	n	n	n	2
6	n	n	n	n	n	n	n	n	n	n	n	0
7	y	y	y	y	y	y	y	y	y	y	y	11
8	y	y	y	y	y	y	y	y	y	y	y	11
9	y	y	y	y	y	y	y	y	y	y	y	11
10	y	y	y	y	y	y	y	y	y	y	y	11
11	n	n	y	y	y	y	n	n	y	y	y	7
12	y	y	y	y	y	y	n	n	y	y	y	9
13	y	y	y	y	y	y	y	y	n	y	y	10
14	y	y	n	n	n	n	n	n	n	n	n	2
15	y	y	y	y	n	n	y	y	y	n	y	1
16	y	y	y	y	y	y	y	y	y	y	y	11
17	y	y	y	y	y	y	y	y	y	y	y	11
18	y	y	y	y	n	y	y	y	y	y	y	10
Number of Seats	45	15	35	75	24	25	23	15	37	31	17	

(y=yes, meets criteria, n=no, does not meet criteria)

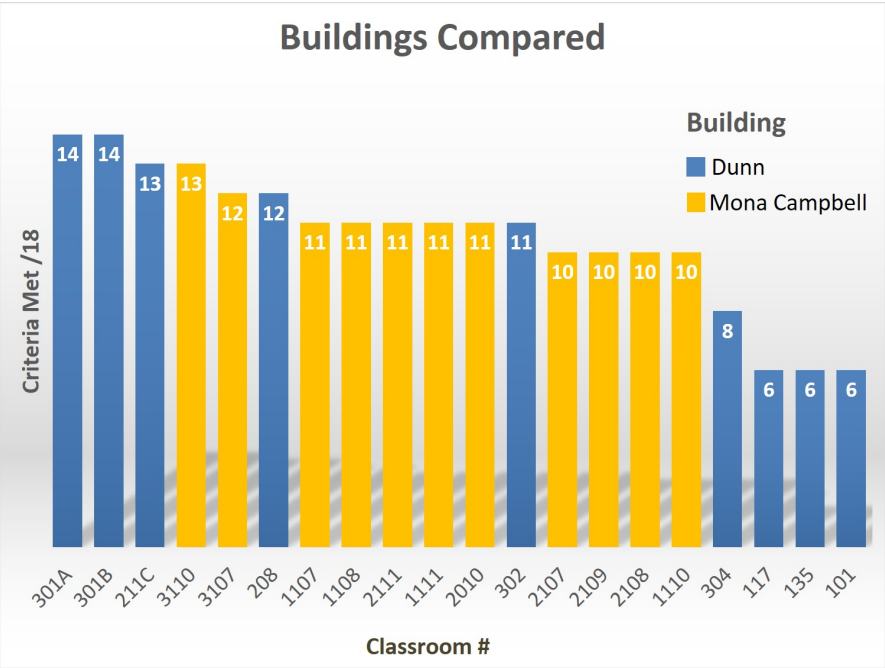

Figure 1. Comparing Buildings: Number of Criteria Met by Classroom

Data Distribution of All Classrooms
Median = 11
Q1 = 10
Q3 = 12
IQR = 2

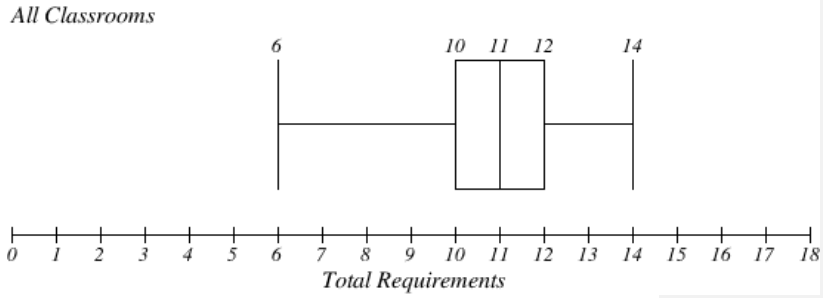

Figure 2. Box and Whisker Plot of All Classrooms with Detailed Data Distribution

Data Distribution of Sir James Dunn
Median = 11
Q1 = 6
Q3 = 13
IQR = 7

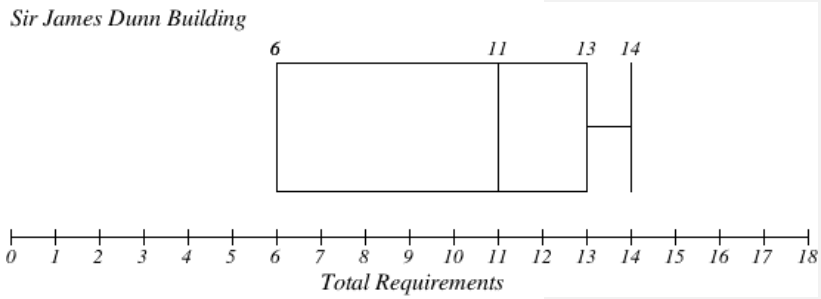

Figure 3. Box and Whisker Plot of Sir James Dunn Building with Detailed Data Distribution

Data Distribution of Mona Campbell
Median = 11
Q1 = 10
Q3 = 11
IQR = 1

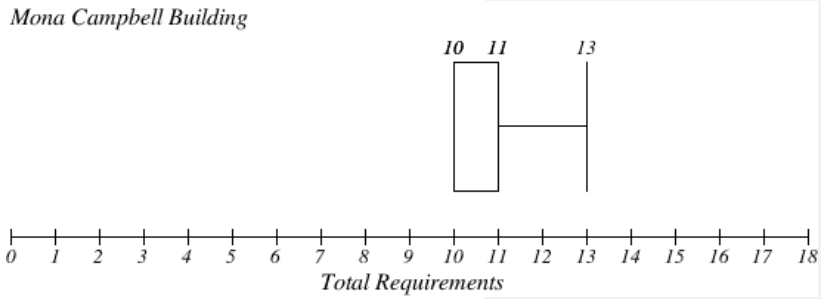

Figure 4. Box and Whisker Plot of Mona Campbell Building with Detailed Data Distribution

6.0 Discussion

6.1 Summary of Research Question

As previously stated in the introduction our research question is: “Which classrooms in the Sir James Dunn and Mona Campbell buildings are suitable to be study spaces as well as classrooms?” In order to determine which classrooms were suitable to be classified as study spaces, a separate research question needed to be answered: “What characteristics need be observed in classrooms to make the good candidates for study spaces?”

When focusing on our primary research question, the Sir James Dunn and Mona Campbell buildings were chosen to show a representation of a new and old building on Dalhousie campus. Both buildings are located on the main Studley campus. The Mona Campbell building has 11 classrooms and the James Dunn building has 9. Therefore, the starting sample sizes were relatively equal.

When defining the term “study space” in our secondary research question, we created a checklist of elements a study space should have based on background research. Using the checklist, we ranked the classrooms based on the number of criteria met to discover which classrooms are suitable to be used as study spaces. Classrooms were tested from a list of 18 characteristics, and the number out of 18 was then recorded in our analysis.

Dalhousie is constantly consuming resources daily and expanding. From an environmental perspective we want to emphasize that there are currently spaces on Dalhousie campus that are not being utilized to their full potential and can be used for scheduled classes as well as studying. Therefore, reducing the need for new spaces to be constructed by the university

6.2 Overview of Significant Findings

As seen in **Figures 1-4** above (pgs.11-12), the majority of classrooms fell in the second highest quartile. Out of 20 classrooms examined, 14 of them fell under the ‘somewhat easy to convert’ category within the score range of 13.5-9 out of 18 criteria. Two classrooms fell within the highest quartile range of 18-13.5 ‘easiest to convert’, and four classrooms fell in the third quartile range of 9-4.5, ‘difficult to convert’. The James Dunn building had classrooms with both the highest and lowest scores and a large deviation between classrooms. The Mona Campbell building’s classrooms all scored within the second quartile range, ‘somewhat easy to convert’.

The results gathered from the two buildings have a significantly different range of the amount of criteria met. **Figure 1** (pg. 11) shows that the Mona Campbell building has a range from 10 to 13, whereas the James Dunn building yielded a 6 to 14 range. The larger range of classroom scores in the James Dunn building is a result of the variety of different classroom layouts present in the building, these include: auditoriums,

traditional classes rooms, as well as smaller work areas. This variation is evident by comparing the number of seats present in the array of different studied rooms seen in **Tables 1 and 2** (pg. 10). The Mona Campbell has a much lower diversity when it comes to the number of seats available. The Mona Campbell is much newer than the Sir James Dunn; this may explain the homogeneity of the classrooms sizes in the Mona Campbell. When the Sir James Dunn was constructed, there may have been a greater demand for different classroom styles than more modern buildings like the Mona Campbell. The implications of this means that it is easier to see which classrooms are more appropriate to convert into study spaces in the Sir James Dunn building compared to the less diverse Mona Campbell building.

Investigating **Tables 1 and 2** (pg. 10) there are a few trends present in the criteria met or not met. Out of the 18 criteria examined in this study there were three that all classrooms studied met: white and/or chalk boards present, wireless access and flat desk surfaces. On the other hand, only one room observed met the access to primary resources (books) criteria. These trends lead to a discussion of how vital each criterion is to the conversion ability of each classroom. Some are inevitably going to hold a higher weight when they are all compared to one another. Primary resources were only present in one classroom but this is not as important to a study area, because students are able to bring these themselves, whereas study space users are not able to simply supply their own wireless access or white boards. The study did not include a weighting system associated with each criterion chosen, but in post analysis this can be performed. Weighting would require making assumptions as to which are more important than others. Doing so would allow biases to manifest themselves in the study, depending on what type of study criteria the researcher prefers over the alternatives. For example, some students may enjoy windows and aesthetics, while others prefer not to have such things present. This being the case, weighing each value has not been performed in post due to the unknowns associated with the population's preferences.

6.3 Consideration of findings in light of existing research

There are a number of studies that highlight student preferences in terms of their studying habits and environment. The most apparent aspect of studying for students is their reliance on technology and media. As previously stated in the background, today's students rely heavily on media and the internet, and their study environment needs to incorporate elements that cater towards these needs; including power outlets for all students, being networked (Wi-Fi access), access to computers, and other media and technological tools (MacWhinnie, 2003). This excerpt can be related to our findings in that every room that we examined had wireless access; displaying students' reliability on the internet and rapid access to information.

7.0 Recommendations

The results of this exploratory study provides Dalhousie University with a solid basis to further investigate the possibility of creating study spaces on the Studley campus using existing classrooms. With the inclusion of classroom schedules, a better idea of which classrooms are currently under-used can be compared to the criteria met as per the checklist used in this study. Further, Dalhousie University should consider the accessibility to the rooms, as well as the traffic level outside the considered classrooms, as this will allow a better understanding of which areas would be most likely to be used by the student body. Through this case study, a better understanding of the current options available for new study spaces will be achieved, and implementation can easily follow suit. To minimize the amount of time and resources needed to put into supplementary work, Dalhousie should focus only on the classrooms that yielded the highest scores in this study's sample frame.

With this being said, we present two Recommendations to Dalhousie:

Recommendation A: Dalhousie University compares the results from this study with detailed classroom schedules. This would determine if high-scoring classrooms are already being used to their full-potential, or if there are time periods when no classes are scheduled in which the room can be available as a study space.

Recommendation B: Dalhousie University considers converting high and moderate scoring classrooms, as determined through this research study, to classroom/study spaces. High scoring classrooms are most suitable for such uses, and would be most likely to be successful as a flexible space.

8.0 Conclusion

Using a non-probabilistic sampling method, classrooms in the Sir James Dunn and Mona Campbell buildings were examined in order to determine the viability of using the classrooms as a study space. Eighteen criteria were chosen based off literature review to form an a priori checklist which was used to determine a classroom's physical suitability to be a study space. Four quartiles were used to display the research results. It was found that the majority of classrooms studied fell into the second quartile range of 13.5-9 (somewhat easy to use). Two classrooms fell into the highest quartile range of 18-13.5 (easiest to use), both of which were located in the Sir James Dunn building. This research suggests that Dalhousie should further examine these two rooms in order to better assess their viability to be used as study spaces. The environmental purpose of our research question would be achieved, which is to reduce infrastructure expansion and save resources at Dalhousie University.

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Appendices

Appendix A: Classroom Criteria Checklist

1. Table space sufficient for use of multiple tools – (Van Note Chism, 2006)
2. Access to labs and lab resources – (Brown, 2005)
3. Access to computers – (MacWhinnie, 2003)
4. Access to primary resources – (Brown, 2005)
5. Shared screens including: projectors, LCD TV's, display monitors – (Brown, 2005)
6. Availability of a printer – (Brown, 2005)
7. Marker and chalk boards – (Brown, 2005)
8. Wi-Fi access – (MacWhinnie, 2003)
9. Rolling chairs – (Van Note Chism, 2006)
10. Level, flat floor – (Bickford et al., 2003)
11. A lack of fixed central lecture stand or table – (Bickford et al., 2003)
12. Moveable tables, ability to re-arrange tables – (Van Note Chism, 2006)
13. Four-five sided tables for group work – (Brown, 2005)
14. Brightly coloured or patterned walls – (Lippincott, 2006)
15. Windows – (Lippincott, 2006)
16. Power outlet accessible to all students – (MacWhinnie, 2003)
17. Flat desk surface – (Bickford et al., 2003)
18. Comfortable and sizeable chair – (Van Note Chism, 2006)
19. Number of chairs, sufficient seating available – (Van Note Chism, 2006)

Appendix B: Research Proposal with Comments (Following Pages)

Dalhousie University Multi-Use Classroom/Study Space Feasibility Project Proposal

Team Mowat Research Group Members:

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Erik Fraser

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Table of Contents

1.0 Introduction

1.1 The Broader Problem

The two broader issues the group is concerned with are the environmental costs of building new buildings and the inefficient use of existing space at Dalhousie University. New spaces require new materials, additional heating costs and transportation costs. In addition, many of the classrooms at Dalhousie are only used for a couple hours each weekday, but are inaccessible to students at other times. Our project aims to determine the feasibility of retrofitting existing classrooms as additional study spaces when they are not being used for instructional purposes.

1.2 Project Definition

The object of this research project is to determine the feasibility of turning existing classrooms into multi-use spaces for studying purposes outside of class time. Our model multi-use space is the LINC in the Killam Library. The research group will be looking into the classrooms in the Mona Campbell and James Dunn buildings to determine if they can be used as multi-use spaces. For the purposes of this project, multi-use space is defined as a room or space that can be used for lectures and tutorials as well as studying and homework. Feasibility will be determined by a set of criteria outlining what is found in the existing classroom, based on conditions found in existing multi-use spaces at the university. Classrooms that meet more of the determined criteria are therefore more easily converted.

The purpose of the project is to encourage suitable multi-use study/classroom space in existing buildings on campus to avoid having to build new buildings. In doing so the group is trying principally to communicate that the environmental and monetary costs associated with building a new building on campus can be avoided.

1.3 Research Question

The research question for this project is:

- How feasible is it to convert existing classrooms at Dalhousie University into multi-use study space?

In order to develop a better understanding of multi-use spaces, the research group will additionally look at this sub question:

- What are the characteristics of a study space that need to be included in a multi-use space?

Comment [TW1]: this is a HUGE claim, and I suspect that the Registrar's Office might differ with you. You should make sure that you get evidence to support this claim or else tone it down or pose as a question. You cannot make this type of statement without citation associated with it in a scholarly piece of writing.

Comment [TW2]: says who? why? are they locked? please explain.

Comment [E3]: May instead be better to examine what spaces can be used as is and distinguish from ones that could be improved as study space with some adjustments

Comment [TW4]: why would one need to retrofit. This is making the assumption that the classroom could not be currently used as a study space when classes are not being held in them. You have not provided me with sufficient argument to say that retrofit would be needed. Please elaborate.

Comment [TW5]: there are costs (economic and environmental) associated with this too if you are suggesting retrofitting.

Comment [E6]: You had mentioned you were just going to be highlighting which existing spaces are currently prime candidates for multi-use space. You have not mentioned this here? Perhaps that would be a good first step before needing to renovate.

Comment [TW7]: what does this have to do with the project? are you saying you want all classroom space to look like the LINC in Killam? Why? How is this relevant to the question of efficient use of space. Also, you still haven't established that retrofit is needed.

Comment [E8]: Introduce the space before stating your use of it in your study. What is it? What makes it great?

Comment [E9]: Or they don't need to be converted at all.

Comment [TW10]: hmmm…there is a lot of jumping to conclusions in this first section. Who said that the building of new buildings on campus is necessarily for creating student study space? Or classrooms (and you haven't yet established that there isn't a need for more classroom space because you haven't done the research yet to show that there is an underutilization of classroom). Many new buildings are associated with research centres. I am quite worried about the blanket statements you are offering here. Please substantiate OR change your wording (my preference is for the former)

Comment [TW11]: MUST define feasibility

Comment [TW12]: these questions are just fine, but I don't think they follow what you have written above. I would argue instead something around the need for multi-use spaces based on environmental criteria (and common sense) but DO NOT talk about new buildings at all unless you change your language.

2.0 Background

2.1 Changing Classrooms

There are many assumptions about learning that exist. These include: learning has to be done at certain times, learning is done individually, classrooms have a structure, are always forward facing, and there should be limited items in a study space to prevent distractions (Brown, 2005). However, students today favour active, participatory learning (Oblinger, 2006). Bolted down single study carrels or massive lecture halls with fixed, cramped seating do not match these preferences. Today's students rely heavily on media and the internet, and their study environment needs to incorporate elements that cater towards these needs; including power outlets, being networked, and other media and technological tools (MacWhinnie, 2003). Students also rely heavily on connections to one another, whether it be face to face or via social media (Kolb et al., 2005).

Social constructivists observe that social setting greatly influences learning in a positive way (Van Note Chism, 2006). Standard classrooms and study carrels can greatly limit learning experiences. Current classroom types are unstimulating; seating arrangements and auditorium design limit interaction among peers, and technology is either outdated or does not foster individual access (Beatty et al., 2005). The current generation of students prefers "small group work spaces, table space for a variety of tools, Information Technology highly integrated into all aspects of learning spaces, availability of labs and equipment, shared screens, and smaller places for […] project work and discussion" (Brown, 2005).

At Dalhousie University, many of these features do not exist in the majority of buildings. Dalhousie is an old university with many aging buildings and classrooms. Many students attend classes in conventional style lecture halls, with tiny, forward facing seats, little room for movement to discuss or use laptops, and an overhead projector at the front of the room. Dalhousie is starting to acknowledge that in order to facilitate better learning, new classrooms and study spaces should be made to meet students' various learning styles. This shift is observed in Dalhousie's new collaborative health building (Morse, 2015).

> "Once freed from the classroom, students gravitate to the spaces most appealing to them. Comfortable and customizable spaces quickly become candidates for frequent use between classes. The informal learning that takes place outside classes occurs in libraries, information commons […] and any other locations where students can gather" (Lomas et al., 2006).

This project aims to examine the extent to which there is a need and desire for multi-use classrooms from a student's perspective. We argue that as an alternative to constructing these spaces in new buildings, Dalhousie should retrofit existing classrooms and buildings to include multi-use space. The research group proposes that the LINC (Learning Incubator Networking Centre) multi-use classroom in the Killam Library serves as an excellent model of how Dalhousie can implement successful multi-

Comment [E13]: Very well-researched and presented effectively.

Comment [TW14]: this is the good stuff that you should be drawing on for the beginning of this proposal! MUCH better arguments can be found here.

Comment [TW15]: evidence to back up claim please.

Comment [E16]: A great quote, but I would like to see a bit more context around it.

Comment [TW17]: DO NOT decide what your results are going to be before you do the research.

Comment [TW18]: This is a VERY different focus from what you said in your research questions above. Tehre is a difference between examining need and desire from a student's perspective with your questions in 1.3 which focus on feasibility. You need to focus yourself on what EXACTLY you are doing, ok?

use classrooms that are heavily utilized by students. Many other universities have had great success in transforming their facilities into multi-use commons, such as the Vanderbilt University Peabody Library[3] and the University of Georgia Student Learning Center[4] (Lippincott, 2006).

The LINC classroom in the Killam Library serves as a "model for engagement and interaction, team teaching, and interdisciplinary themes" (Dittoe, 2006). As previously stated, there is a strong link between the built environment and effective learning. The LINC is a fully-loaded classroom that has the newest technology and features an interactive work space. The classroom can be rearranged in many different formats and has 19 'pods' that have flat screen televisions which can be connected to laptops, share videos and images between students, or used for lecture by a professor (Smulders, 2011). There are plenty of white boards, projectors, and speakers along with other technology. All tables and chairs are on wheels and can be rearranged to foster social settings or individual learning. The LINC classroom holds up to 115 students, and the space switches between a study common room and classroom several times throughout the day (Smulders, 2011). This type of multi-use space would be practical for the ENVS 3502 class, for example, as the class is regularly engaging in interactive group work and exercises that require movement and media. If the class was held in a multi-use classroom, rearranging the furniture depending on interactivity easily facilitates the switch from lecturing to group work, while remaining in the same room. Were this the case, students could use the space after class is finished to study or for further group work. Students would not need to move from space to space in order to complete assignments or access different media, nor walk to another building on campus in order to have a group meeting.

Since this project is suggesting that Dalhousie retrofit existing classrooms instead of construct new buildings, we suggest that the finances of space are considered. "Many campuses, for example, have no base funding allocations for furniture replacement. Furniture is generally funded with the construction of a new building…but routing replacement of furniture depends on […] little end-of-the-year cash" (Van Note Chism, 2006). As seen in many buildings at Dalhousie, such as the Life Sciences Centre or Henry Hicks Building, it is fairly common to see classroom chairs and tables in need of replacement or updating. In order to retrofit classrooms, Dalhousie needs to redirect funding from new buildings to allocations for renovations to existing space, including new classroom designs and incorporating technological access.

2.2 Building Impacts

In Canada, new construction projects are happening on a day to day basis, and it is important to consider both the economic costs and the ecological impacts of such projects. The costs of constructing a new building can be divided up in many ways, such

Comment [TW19]: based on what? who says it is an excellent model? Why would you use this? Why wouldn't you rather go to the literature and review the criteria for good multi-use classrooms and use THAT as a model.

AND – if you are looking at students perceptiosn for need and desire, why do you need a model at all?

I'm asking these questions because you seem to be going in 3 different directions with this proposal and you really need to focus on one

Comment [E20]: What makes this more effective than other spaces?

Comment [E21]: May want to focus your research more as an exploratory of options for space sthat can be used as multi-use, grounding in your literature section above. The jump to the retrofit needs a stronger backing if you want to pursue it.

[3] For further reading go to http://www.library.vanderbilt.edu/peabody/commons/index.html
[4] For further reading go to http://www.slc.uga.edu/

as: the initial cost, the cost of maintaining the building post construction, and the environmental cost. Any sensible enterprise will consider the former two costs to a microscopic degree, but the environmental price of construction is often ignored. Breaking it down even further you can consider the life cycle of the building: the construction process, the use of the building, and the inevitable retrofits or removal. Each of these stages has different effects on the environment.

Construction of a building causes much disturbance to the environment locally, as well as globally. The cement industry is a major contributor to the global rise of carbon dioxide (CO_2), accounting for 4.5% to 5% of all anthropogenic CO_2 emissions (Boden et al, 2012). One of the many uses for cement is as a material in construction, and it is increasing on a yearly basis. Sulfate is another harmful gas that is released during the construction phase, resulting in 0.7 to 1.4 $kgC0_2/m^2$ of floor area (Coelho and Brito, 2011; Dimoudi & Tompa, 2008). Releasing sulphate into the atmosphere is a cause of acid rain which has its own negative environmental consequences. Greenhouse gases are no simple problem; they have a wide range of effects and can cause long-term unpredicted damage.

One of the first steps of construction is the removal of any vegetation from the worksite, followed by the removal of earth. The alteration of the landscape may result in the disturbance of the local ecosystem. A loss of trees and vegetation results in lower biodiversity, removal of flowers for bees to pollinate, large additions to landfills, changes to the ground and air chemistry, and less plants to provide oxygen and store carbon. The aesthetic value that the natural landscape provides should also be considered as a loss in this life cycle phase, as green spaces have been proven to help elevate mental health and well-being (Lee & Maheswaran, 2010). The final impact that should be considered while calculating environmental damages is the transportation that is used during this life cycle phase. Supplies used on site are likely brought in by trucks, and those trucks likely received their load from a cargo ship, train, or airplane. The greenhouse gases released by transportation in Canada are significant, making up 12% of Canada's total emissions (Environment and Climate Change Canada, 2016). It is clear that constructing a new building has environmental effects no matter how "green" the process is.

The construction phase is only one part of the lifecycle, to understand the full environmental impact buildings have, the other two stages must be considered: the operation of the building and the demolition stage. The longest stage, in which the building is occupied, also makes up the largest environmental impacts, accounting for a total of 80% to 90% of the energy used in the life cycle (Khasreen et al, 2009). The main effect buildings have is due largely to the use of electricity and heating. Energy use is high in Canada because of the cold temperatures in winter, which requires more interior heating. Buildings in Canada are responsible for another 12% of total greenhouse gas emissions, again widely due to the operational phase in a building's life cycle (Environment and Climate Change Canada, 2016).

It is remains important to consider the final stage of a building's life cycle, even if it is significantly lower in impacts compared to the operational phase. The initial construction has a huge effect on the demolition impacts of a building; what materials were used and the building design's adaptability to retrofitting both play a significant role. In 1996, more than 50% of U.S. concrete waste ended up in landfills, while 27% of concrete from a building entered the recycling loop: these numbers were predicted to be only slightly lower in 2008 (Vieira & Horvath, 2008). The lack of reuse of building materials is an issue, as demolition waste adds a sizable amount to landfills. Similar to the construction phase, we must also consider the transportation element in this life cycle phase, as well as the dust that is released into the air as a result of demolition. The removal of a building does not ensure the site will revert to how it was found prior to its construction, it is highly likely that a new building will be built in that location, thus starting the life cycle over again.

Comment [E22]: You've presented some strong research related to building constructions and associated impact, you just have not quite figured out the connection between the space use and the need for new buildings. The reason may be obvious to you, but it needs to be grounded in the literature. You may want to instead focus on some of the other considerations associated with not using space efficiently (Time of usage, heating and electricity costs, maybe the feasibility of shutting some buildings down over night that you deem to be not suitable as multi-use)

3.0 Methods

3.1 Overview

Throughout this methods section we state how we will answer our research question. First, we will begin with an overview of our project, highlighting key ideas. We will discuss our research tools in detail, displaying our methodology for conducting our study in two main areas; the observation of study spaces and the observation of classrooms using a checklist created from observing the study spaces. From data collected in these observations we will perform data analysis using several statistical tests. The group will look at the validity of our study and examine the delimitations and limitations of our experiment.

3.2 Research Tools

Our project design will incorporate non-probabilistic sampling methods for observing characteristics of classrooms and study spaces. From observation of various study spaces, we will create a checklist of various features that will be taken into consideration to assess feasibility of retrofitting the classrooms into multi-use rooms. Refer to Appendix A for a draft version of this checklist.

Our assumption is that the university would not need to build an entirely new building for studying if existing classrooms were retrofitted into multi-use study spaces. These renovations would save the school financial costs and eliminate further environmental impacts from building a new building.

3.3 Stepwise Methodology

- On March 13th at 11:30 am, the six researchers will split themselves into three groups of two to observe the study locations.

- Each group will observe what features exist in primary study spaces in the Killam Library and the Wallace McCain Learning Commons, noting all features on a piece of paper.
- Once completed, all groups will meet and, using the constant comparative method, develop a checklist of the key features of these study spaces.
- Using the checklist, each group will observe classrooms in the Mona Campbell and James Dunn buildings and check each feature that applies, noting the classroom number and size of each classroom observed.
- Once completed, all groups will meet to ensure that the data is consistent and coherent.
- The data collected using the checklist on the classrooms of the Dunn and Mona Campbell buildings will be used for subsequent data analysis.

Comment [TW23]: I think what would be better is to actually develop a list of criteria FROM THE LITERATURE to determine what makes a good multi-use classroom/study space.

Comment [TW24]: why these buildings? Please justify choice.

Comment [E25]: How?

3.4 Data Analysis

Observation of the study spaces in the Killam Library and the Wallace McCain Learning Commons will be used to develop the checklist, which will in turn be used in the observation of classrooms in the Mona Campbell and James Dunn buildings. As such, observation of the study spaces will use a grounded a posteriori content sensitive scheme to develop the a priori content specific checklist to be used in observing the classrooms. The observation of the study spaces will also be used to develop different categories of study spaces, such as group study space or computer study space. This is because not all study spaces are equal, and the various needs of students in study spaces can vary based upon the type of work, ownership of laptops, personal preferences and other variables, all of which influence students' requirements for a study space. Upon gathering the data from each section, the research group will come together and use a constant comparative method to compare the findings of each of the research pairs. This is to ensure findings are consistent and coherent within the group. Once all researchers have consistent and coherent data for the classroom observation, each classroom will be quantitatively analysed based on what percentage of the checklist it fulfills. Finally, the central tendency of distribution will be calculated to determine if classrooms could be used as study spaces, or if classrooms would need to be renovated first, and in what ways.

Comment [E26]: See comments above. If you are going to making conclusions and recommendations based on the checklist, it is even more important to be grounding it within the literature.

Comment [E27]: What type? This last step is not clear. Are there not environmental repercussions associated with renovations too? Perhaps you could create a list of those spaces that are currently underutilized but effective multi-use space.

3.5 Validity and Justification of Research Methods

Dalhousie University already has two buildings purposed with being study spaces - the Killam Library and the Wallace McCain Learning Commons. By using these buildings as the unit of analysis, rather than student opinions, a more reasonable response will be documented - as human wants and inconsistencies are removed as variables. Therefore, a higher degree of catalytic validity will be achieved. By focusing on university study space the sample frame will also be reduced to not include students who prefer to study off-campus, either at home or in third places, such as cafes. The two classroom buildings that will be analyzed - the Mona Campbell and James Dunn buildings - were chosen to be representatives of both older buildings on campus and

Comment [E28]: These are study-spaces, not multi-use spaces? Is being a good study space the same as being a multi-use space?

newer buildings on campus. This will provide a better representation of the entirety of facilities at the university, rather than focusing on only certain buildings. Finally, by pairing off researchers and using a constant comparative method, bias and inconsistencies will be minimized.

3.6 Delimitations and Limitations

What our study assumes is that the study buildings chosen have adequate study spaces in terms of their features and facilities. This is a delimitation due the difficulty, potential inconsistencies, and time commitment resulting from using students as the unit of analysis rather than study spaces already available on campus. Another delimitation to this study is not considering the availability and scheduling of classrooms for use as study space. This was excluded because of the difficulty in obtaining class schedules due to the disorganized scheduling process that Dalhousie uses, and/or the unwillingness of staff to provide schedules to the research group. The study will be limited to assessing only the feasibility of using existing classroom space as study space. Assessing the practicality, including issues such as scheduling, liability, and usability, are beyond the scope of this study and the researchers are not adequately equipped to undertake such a research project due to lack of access to Dalhousie facilities, time, and money.

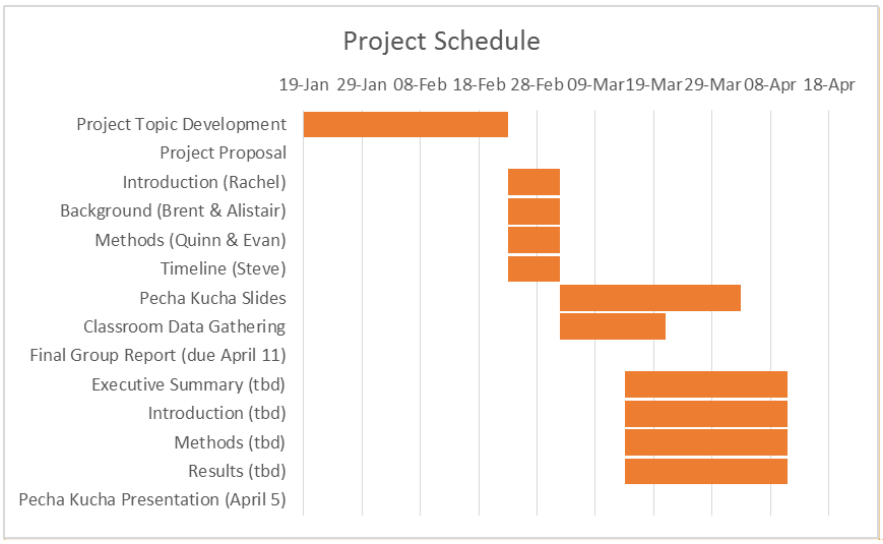
Comment [E29]: Why are these two categories important to represent?

Comment [E30]: Subjective statement

Comment [E31]: This is the focus of your study, no?

4.0 Timelines

4.1 Project Schedule



Comment [E32]: You've thought this out! Great!

4.2 Project Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
28 GROUP MEETING 10:30 KILLAM	29	March 1 GROUP MEETING IN CLASS	2	3 PROJECT PROPOSAL DUE	4	5
6 GROUP MEETING 10:30 KILLAM	7	8 GROUP MEETING IN CLASS	9	10	11	12 **WEEKLY TASK:** **CLASSROOM CHECKLIST**
13 GROUP MEETING 10:30 KILLAM **DATA COLLECTION 11:30**	14	15 GROUP MEETING IN CLASS	16	17	18	19 **WEEKLY TASK:** **STUDY SPACE/** **CLASSROOM CHECKLIST COMPLETED**
20 GROUP MEETING 10:30 KILLAM	21	22 GROUP MEETING IN CLASS	23	24	25	26 **WEEKLY GOAL:** **DATA ANALYSIS/ WORK ON REPORT SECTIONS**
27 GROUP MEETING 10:30 KILLAM	28	29 GROUP MEETING IN CLASS	30	31	April 1	2 **WEEKLY GOAL:** **REPORT NEARING COMPLETION / PECHA KUCHA SLIDES IN PROGRESS**
3	4	5	6	7	8	9

GROUP MEETING 10:30 KILLAM PECHA KUCHA SLIDES DUE		PECHA KUCHA PRESENTATION				**WEEKLY GOAL:** **ROUGH REPORT SECTIONS COMPLETED**
10	11 FINAL RESEARCH PAPER DUE	12	13	14	15	16

4.3 Budget

The research group does not anticipate any costs associated with this project, therefore no budget is required.

5.0 Deliverables

The deliverables for this project shall be:

- A final report on the project to be made available to the ENVS 3502 mentors and students, as well as the College of Sustainability;
- A Pecha Kucha style presentation of report process and findings; and
- A brief, one-page summary of report findings to be made available to the Dalhousie University community and decision-makers

Comment [E33]: You could provide more detail in this section

6.0 Communication Plan

Through the report compiling process, the group shall be in contact with mentor Erik Fraser and ENVS 3502 Professor Tarah Wright. By setting weekly goals, our team will be able to set soft due dates, ensuring work is progressing on this research project. The group has agreed to meet each Sunday morning at 10:30am, as well as Tuesday evenings after the ENVS 3502 lecture, to discuss project progress, address any concerns which have come to light, and ensure the group is on track to complete high-quality deliverables by the hard due dates.

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Appendices

Appendix A: Classroom Conversion Suitability Checklist (Draft)

Comment [E34]: You should be groundings this list in your literature review (aka draw on what you read about what makes for a good study space)

- Classifications of study spaces
  - Individual study
  - Group studying
    - Extra media (white board, projector)
  - Non-electronic studying
  - Electronic studying
- Easily accessible desk
  - Spacious – room for books and or laptop
  - Movable – arranged for group or individual
- Easily accessible chair
  - Spacious (not on top of one another)
  - Movable – to promote group or individual work
- Power outlets (ratio chairs/capacity to power outlets)
- Capacity (room size or capacity)
- White boards / chalkboards
- Computer(s) Lab

- Projector / overhead / monitor (smartboard / multimedia linkup)
- Speakers
- Proximity to services (ex. food outlets, washrooms)

Area	Score
Project Definition	**2/5**
Background and Rationale	**3.5/5**
Research Methods	**3/5**
Schedule and Budget	**5/5**
Deliverables and Communication Plan	**4/5**
The References and Appendices	**5/5**
Organization, Specifications, and Writing Style	**3/5**
TOTAL:	**25.5/35**
Convert to	**7.2/10**

You're off to a good start. It isn't entirely clear from your proposal what direction you are actually headed in, and at times it seems like the sections aren't really connecting.When you submit your final project, it is a good idea to have somebody run through and adjust any variations in language. It was sometimes easy to see when somebody stopped writing and another person began.

You also seem to be jumping the gun on the retrofit recommendations. Perhaps what you may want to do instead is develop a system based on the literature to classify spaces as either currently underutilized (great option for multiuse), opportunity for multi-use (Can be with some small adjustments), or not suitable for multi-use space. We can chat a bit more about this on Tuesday. You've done some very strong research so far, just need to put a bit more work into applying it to your proposal.