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Wood in the Built Environment: The Restorative Benefits of Wood on Student Health and Well-being

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Abstract

Reaching Canadian shores in March of 2020, the COVID-19 pandemic relentlessly continues to impact life on a global scale. Post-secondary students have been especially hard hit throughout the pandemic, with the doors of many institutions still closed 20 months after the initial lockdowns. They have had to self-navigate the difficulties of remote learning while grappling with several negative health concerns associated with extended periods of time spent in artificial environments, such as social isolation, mental fatigue, increased stress, and low levels of motivation. This study seeks to determine how interior applications of wood can be used to improve the health and well-being of post-secondary students impacted by the pandemic. To do so, qualitative research was undertaken in the form of a remotely administered questionnaire. Eleven post-secondary students in the GTA were anonymously recruited to take part in the study. Analysis of the results indicates that wood in the built environment is consistently perceived by students as being beneficial for their overall mental state, in the recovery of mental fatigue, and in regulation of stress and motivation levels. Based on the results of the study, the following 5 recommendations for interior designers have been developed: 1) Less is more, 2) Experiment with various wood stains and species, 3) Use organic curves to promote restoration, 4) Provide a healthy balance of private and public spaces, and 5) Design with multisensory stimulation in mind. These recommendations will inform the design of a physical restorative space for students to recover from mental fatigue and psychological stress.

Introduction

In March of 2020, our world was turned upside down when the first wave of COVID-19 reached Canadian shores. Businesses and schools alike abruptly closed their doors in an attempt to keep their employees and students safe, while doing their part to stop the spread of the virus. Nobody knew how long the restrictions would be in place for, or for how long we would be working alone in the confides of our homes. Now, 20 months since the initial lockdowns, we are sitting on the cusp of a potential fifth wave if restrictions are lifted too quickly as COVID numbers begin to ease. Although corporate offices and retail spaces have slowly begun re-opening their doors, students have largely been left behind. Pandemic restrictions have kept the doors of their post-secondary institutions closed, forcing students to work and study from home in often less than ideal situations, both ergonomically and mentally (Mastroianni, 2021). While staying home is imperative to stopping the spread of the virus, there are several negative health concerns associated with extended periods of time spent in artificial, urbanized environments. These include, but are not limited to, psychophysiological stress, social isolation, low motivation, and mental fatigue (also referred to as directed attentional fatigue or DAF).

To prepare for the post-COVID world, interior designers must start re-imagining the spaces where we live, work, study, and play, with a focus on restoration and recovery. Through experimental research in the early 90s, Ulrich et al. (1991) presented evidence that correlated our exposure to natural environments with our recovery from psychophysiological stress and mental fatigue. To combat the negative health effects

associated with time spent in urban environments, designers can use principles of biophilic design to create restorative indoor environments. Wilson (1984) explained that it is our innate need to interact with nature that explains why surrounding ourselves with natural elements has such a profound effect on our health and well-being. The application of natural materials, such as wood, is a facet of biophilic design that often gets overlooked. Preliminary research on the subject has indicated that interior applications of wood are beneficial in reducing stress and have an overall positive effect on occupants' mental and physiological health (Nyrud & Bringslimark, 2010).

This study will seek to illustrate the restorative benefits of wood in the built environment from the perspective of post-secondary students studying remotely through the pandemic. Ultimately, the data collected from this study can be used by interior designers to aid in the design of restorative indoor environments as we prepare to enter the post-pandemic era.

Literature Review

This review synthesizes literature from 12 articles and one PhD dissertation on the restorative properties of wood in the built environment, published from 1995 to 2020. Articles were sorted by their findings into three themes: Psychophysiological Responses to Wood in the Built Environment, The Restorative Effects of Wood on Cognitive Capacity, and Perceptions and Preferences of Wood Used in Interior Applications. To develop adequate foundational knowledge for this review, a study by Ulrich et al. (1991) and a book on biophilic design by Wilson (1984) were consulted.

Psychophysiological Responses to Wood in the Built Environment

Much of the research to date investigating the positive psychophysiological benefits of nature has been focused solely on plants and their potential to relieve stress (Rice et al., 2006). Research exploring the connection between a building's design and the ways in which occupants experience stress in interior environments is still being developed. This includes how stress is perceived, our psychophysiological responses to it, and how we recover from it (Burnard & Kutnar, 2020). The following studies explored participants' psychophysiological responses to wood applications in the built environment using visual, tactile, and olfactory stimulation. The findings of these sensory studies can give designers valuable insights into how wood can be used in stress reduction and recovery in the built environment.

Sakuragawa et al. (2005) examined how visual preferences for certain materials can impact blood pressure. In the study, 14 participants viewed wall panels made of wood, white steel, or a white curtain (control) in a random order for 90 seconds. Blood pressure was monitored throughout the experiment. Participants who reported liking steel retained stable blood pressure readings when viewing the steel panel, while those who reported disliking steel saw their blood pressure increase when viewing the steel panel. Meanwhile, the blood pressure of participants who reported liking wood decreased when viewing the wood panel, but neither increased nor decreased in those who reported disliking wood. Sakuragawa and colleagues (2005) concluded that visual preferences for certain materials could impact psychophysiological responses to various interior environments.

In a subsequent study, Sakuragawa et al. (2008) monitored participants' blood pressure during physical contact with wood. No increases in blood pressure were measured when participants touched the wood samples (both room temperature and cold wood samples). However, contact with room temperature aluminium and cold acrylic samples caused blood pressure to rise significantly. Sakuragawa et al. (2008) concluded that the lower and/ or stable blood pressure measurements imply physical contact with wood surfaces does not induce physiological stress, unlike contact with artificial materials. This is useful information for designers when selecting material finishes for surfaces that occupants will experience tactilely.

Tsunetsugu et al. (2007) investigated the psychophysiological responses to varying ratios of wood in actual sized living room environments. Three rooms were designed to replicate traditional Japanese-style living rooms, with a total wood coverage of 0%, 45%, and 90%. Brain activity, heart rate and blood pressure were evaluated as the physiological indicators of stress. Subjective evaluation of participants' feelings within each room was also conducted using a semantic differential (SD) rating test with three sets of adjectives (comfortable–uncomfortable, relaxed–awakening, and natural–artificial) on 13-point scales. 15 male Japanese participants aged 19-28 spent 90 seconds in each room. When asked to rank the rooms in order of preference, the room with 45% wood coverage was rated as the most favourable. Participants had lower blood pressure in this room, but heart rate was measured higher than in the room with no wood coverage. Interestingly, the living room with 90% wood coverage produced the lowest blood pressure readings, but heart rate increased. Despite the small sample size, the lack of correlation between participant preference and physiological response

effectively contradicts conclusions on preference discovered by Sakuragawa and colleagues (2005).

Wood applications in interior environments can contribute not only to the visual and tactile experience of the space but can also produce olfactory responses to the scents released by different types of wood. The physiological effects of olfactory stimulation have been previously researched. Matsubara and Kawai (2014) evaluated physiological responses to violate organic compounds (VOCs) released from wall panels made of Japanese cedar. A total of 16 male Japanese participants (with a mean age of 23.5 years) completed arithmetic questions in cycles of 15 minutes with a 5-minute rest in a room containing the Japanese cedar wall panels. As a control, they also completed similar tasks with the same amount of rest time in a room containing no wood. The study found that after completing the tasks in the control room, participants produced more salivary chromogranin A (a known indicator of stress) than when they completed the arithmetic tasks in the wood panel room. No significant changes in salivatory secretion between pre- and post-work measurements were reported in the wood room. These results indicate that the VOCs emitted by Japanese cedar can induce physiological relaxation and help to keep people calm in stressful situations.

In another study, Ikei et al. (2015) compared the effects of olfactory stimulation from air-dried and high-temperature dried wood chips (Japanese cypress) on human physiology. Air-drying wood chips allows them to retain their natural odor while high-temperature drying may alter their scent. In a soundproof, artificial climatic chamber, 19 female Japanese participants (with a mean age 22.5 of years) were exposed to the two VOCs in random order using a smell supply device for 90 seconds each. 10 participants

received the olfactory stimulation first, followed by a control setting, while the other nine participants received the opposite. Followed by the exposure to the VOCs, participants underwent an SD rating test using the same set of adjectives and 13-point scales as Tsunetsugu and colleagues (2007) (comfortable–uncomfortable, relaxed–awakening, and natural–artificial), to assess the emotional impact of both scents. Based on the results, participants perceived the air-dried wood chips as being considerably more natural, more comfortable, and more relaxing than high-temperature-dried wood chips. In addition, the oxyhemoglobin (oxy-Hb) concentration in the prefrontal cortex was significantly reduced after the olfactory stimulation by air-dried wood chips, which is linked to physiological relaxation.

The Restorative Effects of Wood on Cognitive Capacity

Wood's restorative effect on our cognitive capacity can be explained using Kaplan's (1995) Attention Restoration Theory (ART), which suggests that recovery from mental fatigue can occur by spending time in nature or by viewing it from a window. The theory states that any prolonged or intense mental effort leads to mental fatigue. Kaplan (1995) differentiates between directed attention and fascination; the former requires a great deal of effort and is mentally tiring, while the latter is an effortless form of attention which allows our attentional capacity to rest and recovery. Kaplan (1995) refers to the attention-drawing condition of natural environments as "soft-fascination". Thus, exposure to natural environments (and by extension, natural materials like wood) can restore our capacity to direct attention because they are intrinsically fascinating (Kaplan, 1995). To date, few studies have successfully examined the restorative effects of wood

on cognitive performance. Of the three studies that were reviewed, two failed to detect any restoration of cognitive performance or attentional capabilities after exposure to the wood but gave plausible explanations as to why their results did not align with their hypotheses. The third study by Berto (2005) did not use wood in the experiment but produced promising results for recovery from cognitive fatigue after viewing photographs of restorative environments. This study could be replicated using wood.

In the study (Berto, 2005), images of restorative environments were used to assess how exposure to natural scenes can facilitate mental fatigue recovery. A total of 32 participants (with a mean age of 23) were mentally fatigued by performing a sustained attention test prior to viewing the photographs. Half the participants viewed photographs containing restorative environments, while the other half viewed non-restorative environments or geometric patterns. After viewing the images, participants completed a second sustained attention test. Between the two groups, only participants who had viewed the restorative environments saw an improvement in their performance. These findings are in accordance with ART (Kaplan, 1995), as viewing natural environments has been proven to restore our directed attention capacity.

In a study by Fell (2010), 119 participants spent 40 minutes in one of four rooms: 1) wooden interior with plants, 2) wooden interior without plants, 3) non-wooden interior with plants, or 4) non-wooden interior without plants. After the first 10 minutes, participants were asked to complete a 20-minute cognitive task in the form of a Paced Auditory Serial Addition Test (PASAT). The last 10 minutes in the rooms were used as a recovery period. Throughout the experiment, participant's electrodermal activity (EDA) and heart rate were continuously monitored. No differences in cognitive performance

were observed between those who spent time in the wooden rooms versus the non-wooden rooms. Fell (2010) noted that the results can be explained by the lack of stress-inducing or attention-depleting activity prior to the cognitive task. According to ART (Kaplan, 1995), to experience restoration from attentional fatigue, the attention-depleting task must take place prior to the exposure to the natural environment. Therefore, even if the wooden interiors were capable of restoring depleted attention levels, the study's design did not allow the environmental settings to demonstrate their full potential.

Lipovac and colleagues (2020) concentrated on the visual and tactile properties of desk surface materials and how they affected participants' emotional and cognitive functioning. 16 participants took part in the study; a much smaller sample size than with Fell (2010). In total, 10 materials were included in the study: untreated spruce, oiled spruce, lacquered spruce, untreated oak, oiled oak, lacquered oak, untreated oak veneer, imitation wood laminate, glass, and a mineral-filled thermoplastic composite (MFTC). A cognitive performance task and affective state assessment (CTAS) was administered before and after the time spent at the desk. Participants started with a baseline period at a control desk for one minute before completing the first round of CTAS. After being moved to their randomized desk with one of the 10 surface materials, participants rested another minute before completing another round of CTAS. Then, participants were asked to rest their bare arms flat on the desk and keep their gaze directly at the surface material for 15 minutes. To end, participants completed a third and final CTAS. Results revealed no difference between the cognitive performance and affective states of participants between the various desk surfaces. Lipovac et al. (2020)

suggested a few possible reasons to explain the results. First, it was acknowledged that attentional fatigue may not have been adequately induced. The authors noted that future studies should prepare more demanding tasks for participants, to ensure attentional fatigue is adequately induced. Secondly, they speculated that the dimensions of the desk surfaces (80cm x 80cm) played a roll in the results. It was concluded that exposure to such a small area of wood is not able to radically influence cognitive and affective outcomes. Future studies should increase the amount of wood coverage.

Perceptions and Preferences of Wood Used in Interior Applications

When it comes to the selection of interior materials, the personal preferences of building occupants in large scale non-residential projects are not able to be considered. Instead, designers focus on the established health benefits associated with biophilic design and select materials accordingly. However, the way we perceive and interact with interior spaces can affect our stress levels and overall health and well-being (Rice et al., 2006). People's perceptions and impressions of various wood products used in interior environments is still a relatively uncharted area of study. However, the aesthetic appeal of wood has the potential to contribute to our sense of well-being when viewed in the built environment. The following studies observed the emotional impact of interior wood products, the tactile and visual warmth of interior wood wall treatments, and the positive perceptions of wood in interior spaces. Across all three studies, wood was consistently perceived to be a warm, relaxing material when used in interior applications.

Rice et al. (2006) conducted an exploratory study on the appearance of wood products and the way they can influence the mood or atmosphere within a space. The aim of the study was to evaluate the emotional impact of wood products used in interior environments. In total, 119 Canadian participants above the age of 20 took part in the study, which consisted of a Q-sort experiment, personal interviews, and a self-administered survey. During the Q-sort experiment, participants were given 25 different 5 x 7 photographs of living rooms taken from recent design magazines and were told to sort them into three categories: 1) rooms they liked, 2) rooms they did not like, and 3) rooms they felt indifferent to. Next, they were asked to place the photographs on a normal distribution, with a scale ranging from -4 (least liked) to +4 (most liked). During the personal interviews, participants were asked questions in response to one of three photographs included in the Q-sort experiment. Questions sought to understand emotional reactions to the photograph, such as positive and negative elements and the feeling or atmosphere of the room. The self-administered survey was used to gain information on furniture and material preferences. When compared against other natural materials (ceramics, stone, and leather), wood was perceived as being warm, natural, homey, relaxing, and inviting. The same results were achieved when the wood was compared with two man-made materials (plastic and glass) and two wall treatments (painted surfaces and wallpaper). Results indicated that living rooms containing wood were preferred over those that did not, and were perceived to be warm, healthy, and relaxing.

Wastiels et al. (2012) analyzed participants' perceptions of the tactile and visual warmth of interior wall treatments. A material's tactile warmth was defined as how warm

or cold the material feels when touched, while visual warmth was associated with the material's colour. In total, five materials were compared in terms of their tactile and visual warmth: steel, concrete, blue stone, brickwork, and wood. Material samples were presented at eye-level and mounted in white MDF cases to ensure each material was seen on a neutral canvas. During the visual test, participants were asked to view the sample from different angles from a fixed distance. In the tactile test, samples were covered and participants could only feel the material with their hands. Lastly during the general test, participants were free to interact with the samples as they pleased. The study concluded that wood is seen as both visually and tactilely warmer than other materials. Designers can use this information on perceived tactile and visual warmth of wood to develop multisensory experiences within the built environment.

In a study by Strobel et al. (2017), qualitative data was collected by conducting eight separate focus groups with building professionals and laypersons from five European countries (Austria, Finland, France, Norway, Sweden). While participants were asked to share their opinions on various topics pertaining to the naturalness of interior building materials, the main objective of the focus groups was to gauge the various perceptions of wood use in built environment. It is important to note, that due to the small sample size (each group consisted of 5-10 participants), results should be seen as opinions of a few rather than sweeping generalizations of the populations observed in the study. Results were consistent across all focus groups, with participants having positive perceptions of wood used in interior spaces. Participants noted that wood added a warm ambiance to a space, improved perceived air quality, and generally created more enjoyable spaces to be in compared to other building materials. Wood

was viewed as a sustainable material, and many participants associated its use in interior environments with forests and experiences in nature. Strobel et al. (2017) noted that this abstract link between interior wood use and participant's personal memories of nature should be developed further. With this information, designers can use interior applications of wood to conjure more of these positive associations.

Literature Review Summary

In summary, there is still much research to be done on the restorative benefits of wood in the built environment. How can we use the tactile, olfactory, and visual perceptions of wood to design healthier interior environments? Can interior wood applications be used to help students recover faster from mental fatigue? Can wood's aesthetic appeal and positive emotional influence act as a holistic approach to health and well-being? Are people who spend more time in nature desensitized to its restorative effects, and will they need longer time in interior environments outfitted with wood to recover from psychophysical stress? Future studies should expand their sample sizes to increase the likelihood of finding statistically significant differences, increase exposure time, and diversify the types of wood species being included in studies as well as the lesser studied aspects of wood like its colour, quantity, and grain pattern.

Methods

Objective

The objective of this study is to determine how interior applications of wood can be used to improve the health and well-being of post-secondary students, by gathering

information on how post-secondary students visually, emotionally, and psychologically perceive indoor wood environments. Data collected from the study will inform the design of a physical restorative space for students to recover from mental fatigue and psychological stress.

Hypotheses

Taking into consideration the findings from Rice et all. (2006), Wastiels et al. (2012), and Strobel et al. (2017) on perceptions and preferences towards wood in interior applications, I hypothesize that participants will view wood as being relaxing and emotionally calming while diminishing feelings of anxiety, fatigue, stress and depression. I also believe lighter stains of wood will be perceived as more comforting than darker wood varieties. Overall, I believe that wood applications in the built environment will receive a positive reaction from participants.

Participants

Post-secondary students in the Greater Toronto Area will be anonymously recruited to take part in the study. As the study seeks to determine wood's restorative effect on students who have been affected by the pandemic lockdowns, only students who have been working from home since the start of the pandemic will be eligible to take part in the study. Recent graduates will be excluded from the study.

Process

Quantitative data will be collected in the form of a questionnaire, titled "Restorative Benefits of Wood on Student Health and Well-being". The questionnaire will contain 30 questions and be divided into 6 sections. The sections will be labeled:

Informed Consent, Background Information, Interior 1, Interior 2, Wood Materials, and Preferences and Perspectives. To ensure the anonymity of participants, informed consent will be built into the questionnaire and act as question 1. Questions 2 and 3 will be multiple choice, while questions 4 to 29 will use a 5-point Likert scale. Answers will range from 1 = strongly disagree/ strongly dislike/ not at all/, 2 = disagree/ dislike/ slightly, 3 = neutral/ somewhat, 4 = agree/ like/ moderately, and 5 = strongly agree/ strongly like/ extremely. Question 30 will allow participants to give a free form answer.

In Sections 3 (Interiors 1) and 4 (Interiors 2), participants will view two images (Figure 1 and 2) depicting spaces with interior applications of wood and identify how the spaces make them feel. In Section 5 (Wood Materials), participants will use 4 images of wood materials to aid them in answering the questions for that section. The images can be viewed in Figure 3. The full questionnaire can be viewed in the Appendix.

Figure 1

"Image 1" for Section 3- Interior 1

Figure 2

"Image 2" for Section 4- Interior 2

Figure 3

Images for Section 5- Wood Materials

Results

The questionnaire opened with Section 1, asking participants for their informed consent. The purpose of the study, confidentiality, potential benefits, participation and withdrawal, and the rights of research participants were explained in detail. Only participants who selected “Yes” to giving their consent were able to continue with the questionnaire. All 11 participants gave their consent.

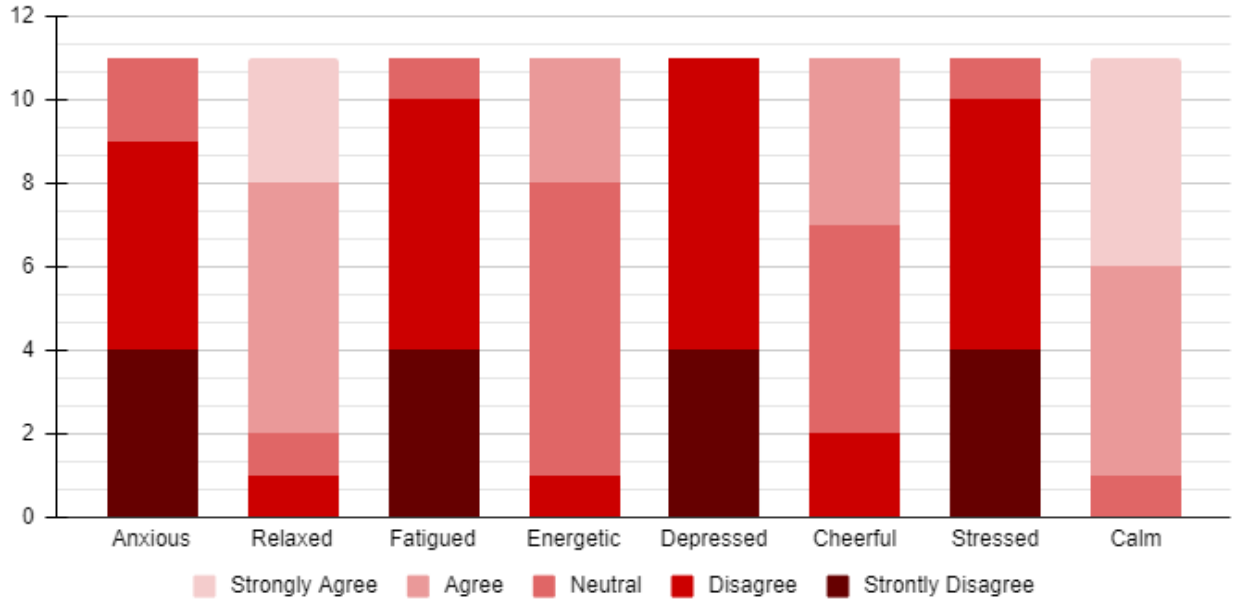
Section 2 asked participants the approximate number of months they had been working remotely in incremental ranges of 6 months, starting from 0 months. All 11 participants indicated that they had been working remotely for at least 7 months, with the majority (82%, 9/11) answering 13 months or longer. As a follow up question, participants were asked how working and studying remotely over the course of the pandemic has made them feel, based on the following 5 psychophysiological conditions: stressed, mentally exhausted, physically exhausted, socially isolated, and unmotivated. 56% (6/11) of participants responded that they felt moderately to extremely stressed, while 64% (7/11) of participants said working remotely has made them feel moderately to extremely socially isolated. All 11 participants indicated that studying and working remotely over the course of the pandemic has made them feel slightly to extremely unmotivated.

Sections 3 and 4 invited participants to view two images (see Figures 1 and 2) depicting spaces with interior applications of wood and identify how the spaces made them feel. Participants were asked the same 8 questions for both images. The first question asked, “*How would you describe the effect this space has on you in terms of*

the following emotions?". When asked if the space in Figure 1 made them feel anxious, 46% (5/11) of participants selected 'disagree' while 36% (4/11) selected 'strongly disagree'. In contrast, 91% (10/11) of participants chose 'agree' or higher when asked if Figure 1 made them feel calm. All 11 participants disagreed or strongly disagreed that the space in Figure 1 made them feel depressed, while 91% (10/11) disagreed when asked if it made them feel stressed. An in-dept look at all the responses to the first question for Figure 1 can be viewed in Figure 4.

Figure 4

How would you describe the effect this space has on you in terms of the following emotions?

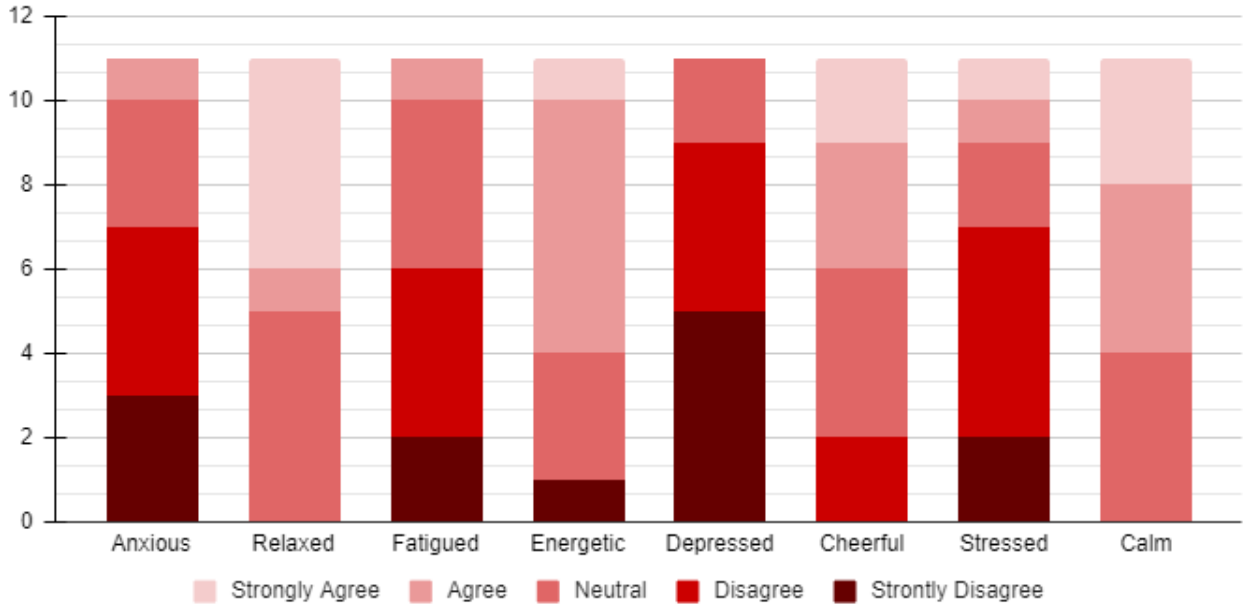


In response to Figure 2, 64% (7/11) of participants selected 'agree' or higher when asked if the space made them feel energetic, compared to 27% (3/11) for Figure 1. In contrast, 46% (5/11) of participants answered 'agree' or higher when asked if Figure 2 made them feel fatigued, while only 9% (1/11) participants reacted the same

way for Figure 1. A detailed look at all the responses to the first question for Figure 2 can be viewed in Figure 5.

Figure 5

How would you describe the effect this space has on you in terms of the following emotions?



Participants were then asked if they believed their mental health would benefit from spending time in the spaces depicted in Figure 1 and 2. In response to Figure 1, 82% (9/11) of participants agreed or strongly agreed, while 73% (8/11) of participants felt the same way about Figure 2. When asked if they felt motivated to study in either space, 55% (6/11) of participants selected ‘agree’ or higher after viewing Figure 1, compared to 82% (9/11) for Figure 2.

Section 5 provided participants with an image containing two light wood materials and two dark wood materials (see Figure 3). In response to the question which asked their preferences for spending time in indoor environments containing light wood materials like white oak or pine, 91% (10/11) of participants agreed or strongly agreed.

In comparison, when asked the same question about interiors containing dark wood materials like chestnut or walnut, 64% (7/11) of participants agreed or strongly agreed.

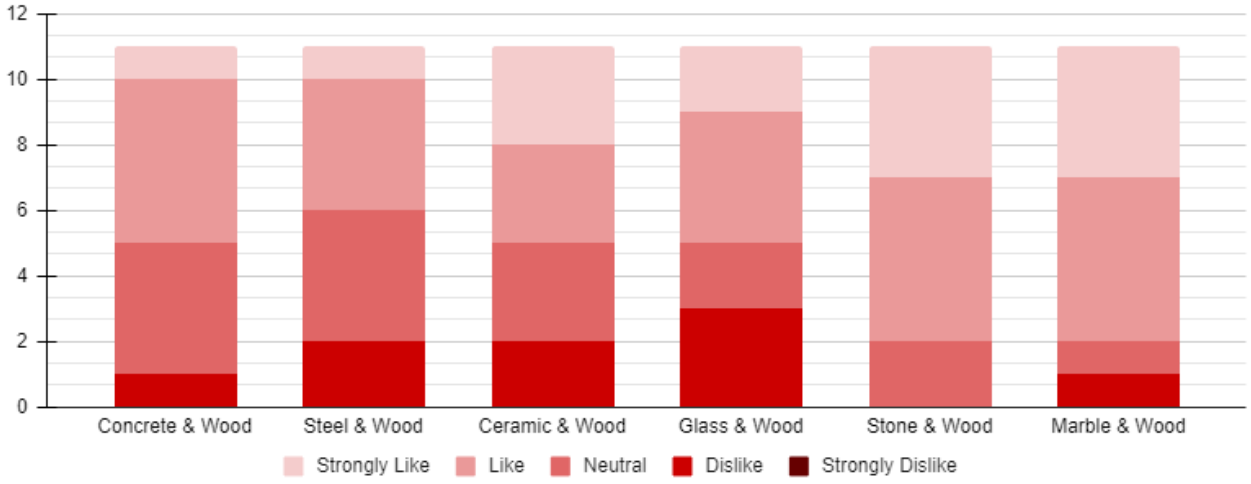
Section 6 asked participants specific questions about their preferences and perspectives on different applications of wood in interior environments. First, participants were asked if they found wood aesthetically pleasing when used on floors, walls, ceilings, furniture, and countertops. All 11 participants agreed or strongly agreed that wood was aesthetically pleasing on floors, while 91% (10/11) reacted the same way for wood used on furniture. Wood used on ceilings and countertops received an equal division of answers. For both applications of wood, 46% (5/11) of participants selected 'agree' or higher, 36% (4/11) selected 'neutral', and 18% (2/11) answered 'disagree' or lower.

A subsequent question asked participants to indicate their visual preference for certain material combinations when used in interior applications. 82% (9/11) of participants selected 'like' or higher for the combinations of marble and wood and stone and wood, 55% (6/11) selected 'like' or 'strongly like' for concrete and wood and glass and wood, and 46% (5/11) selected 'like' or higher for the combinations of steel and wood and ceramic and wood. While no material combinations received any 'strongly dislike' answers, stone and wood was the only combination that received no 'dislike' responses. An in-dept look at all the responses for this question can be viewed in Figure 6. When asked about their preference for organic (soft curves) wood patterns, all 11 participants answered 'like' or higher, with 73% (8/11) choosing 'strongly like'. For their

preference towards geometric wood patterns, 91% (10/11) of participants chose ‘like’ or higher.

Figure 6

Please indicate your visual preference for the following material combinations when used in interior applications:



Finally, participants were asked to rate how important certain spaces within a student centre were to them. All 11 participants regarded a quiet study area and a meditation room as being ‘important’ or ‘very important’, while kitchen facilities were seen by 55% (6/11) of participants to be ‘moderately important’. 82% (9/11) of participants selected ‘important’ or higher for each of the following spaces: communal work area, group study rooms, fitness room, and counseling offices. The last question asked participants to freely describe spaces they deemed to be beneficial that had not been mentioned in the previous question. The input has been summarized in Table 1.

Table 1

Interior spaces for student centre suggested by participants

Participant	Input
A	"A 'create room' where students can do arts & crafts style work for fun. There is something therapeutic about making art, whether it's 2D or 3D, or digital"
B	"Maybe some type of Arts & Crafts or Games/Board Games room for students to just hang out. Also depending on the type of courses, maybe bookable specialty rooms for woodworking or studio spaces?"
C	"Maybe a quiet room with calming music in the background. Maybe a place for tutoring or asking questions/maybe library?"

Discussion

Summary of Key Finding

This study seeks to illustrate the restorative benefits of wood in the built environment and how the application of wood in interior spaces can improve the health and well-being of post-secondary students. The results indicate that wood interiors are consistently perceived by students as being beneficial for their overall mental state, in the recovery of mental fatigue, and in regulation of stress and motivation levels.

Interpretation of Results

The study results are significant as they provide insight on the restorative benefits of interior applications of wood on student health and well-being. As the health benefits of wood in the built environment is still a relatively uncharted area of study, the data accumulated from this research adds to the overall field of study by raising questions for future research to develop further. In general, the results of the study were expected. In line with the first hypothesis, the two images (Figures 1 and 2) of wood interiors used in the study produced overall feelings of agreement ("This space makes me feel…") in response to the positive emotions (relaxed, energetic, cheerful, and calm), while overwhelming feelings of disagreement ("This space does not make me feel…") were produced in response to the negative emotions (anxious, fatigued, depressed, and stressed). Figure 2 did however produce some degree of agreement in the negative emotions, which was unexpected but can be explained with an analysis of the image. It was far busier than Figure 1, depicting a library full of books with plenty of interesting wood features. The negative emotions evoked by Figure 2 suggest that busy environments may be perceived by participants as being less beneficial to their overall health and inadvertently more stressful, despite the ample applications of wood. These results create an opportunity for future research to determine the extent to which wood affects various emotional states and how that knowledge can be used to positively impact student well-being. Previous studies (Sakuragawa et al., 2005, 2008; Tsunetsugu et al., 2007; Matsubara & Kawai, 2014; Ikei et al., 2015) have focused primarily on wood's ability to reduce stress.

In support of the second hypothesis, an overwhelming majority of participants indicated their preference for interiors containing light wood materials. However, it is interesting to note that interiors containing dark wood materials were also well received, with over half of participants having a positive opinion of dark wood. This is an unexpected result but provides new insight into the relationship between visual preferences of wood and interior spaces. This data builds on the existing evidence discovered by Sakuragawa et al. in 2005, which concluded that visual preferences for certain materials may impact psychophysiological responses to various interior environments. In this study, both light and dark wood were seen by participants as being suitable for use in interior environments. It appears the strong visual preference for wood as a material produces a positive psychophysiological response in participants, which may outweigh the need to be selective about its colour.

Another interesting result that should be discussed is the participants' high degree of agreement in the relaxation properties of wood scents. This interpretation is consistent with research done by Tsunetsugu et al. (2007). The authors discovered the oxyhemoglobin (oxy-Hb) concentration in the prefrontal cortex was significantly reduced after olfactory stimulation by air-dried wood chips. The reduction of oxy-Hb concentration is linked to physiological relaxation. Additionally, over half of the participants agreed that wood is comforting to the touch. Unfortunately, no wood samples were available to touch due to the remote nature of the study. Interestingly, participants used their sensory memory of wood to answer the question. The data supports previous research by Strobel et al. (2017), which recognizes that the abstract link between interior wood use and participant's personal memories needs to be

developed further. By unlocking future study participants' key memories in relation to wood, interior designers will be able to use design to conjure positive associations between wood applications and interior spaces for occupants. This may be beneficial in the recovery process. The tactile comfort of wood is also in line with research done by Sakuragawa et al. (2008). The authors determined through consistently lower blood pressure measurements that physical contact with wood surfaces does not induce stress, unlike contact with artificial materials.

Limitations

This study has a few limitations that should be acknowledged. Firstly, the generalizability of the results is limited by the small sample size. Participants were recruited on a volunteer basis from a single Interior Design program at Sheridan College, further limiting generalizability beyond this study population. Stemming from this limitation, a sampling bias may have been introduced. Interior design students are more cognizant of interior spaces and the effects biophilia has on human health and well-being. Therefore, the results of this study should be interpreted with such bias in mind. Future studies should validate the results in more diverse study populations. Another limitation of this study is the method of administration. Due to continued pandemic restrictions, the questionnaire was administered remotely. This prevented participants from having access to wood samples while answering questions pertaining to their visual and tactile perceptions and preferences of wood. Study results may have been impacted by the inability to touch or view real samples of wood. Lastly, it was beyond the scope of this study to examine the physiological and psychological restoration effects of various wood scents. Future studies could investigate the effects

of olfactory stimulation by wood scents on students' ability to recovery from mental fatigue and low motivation levels. Despite these limitations, the results of the study are nonetheless valid in answering the research question.

Recommendations For Designers

Less is more; don't overload interior spaces

When it comes to designing for restoration, less is more. Overloading a space with too much furniture or too many different applications of wood is counterproductive and can inadvertently affect occupant health and well-being in a negative way. Based on data collected in this survey, priority should be given to wood floors and wood furniture as they are viewed by participants as the most aesthetically pleasing applications of wood.

Experiment with wood stain and species

As this study suggests, participants' visual preference for wood appears to be stronger than the need to differentiate between wood colours. This is good news for interior designers, as it allows for more experimentation with various wood stains and species.

Use organic curves to promote restoration

Find ways to incorporate soft, organic curves in interior spaces to promote enhanced restoration. This does not mean every wall needs to be curved; finding small yet meaningful ways to incorporate curved lines will lead to a more fascinating design. For example, a curved sofa snaking around the lobby or organic wayfinding lines

winding across the floor. Kaplan (1998) states that natural environments (and by extension, organic curves and lines) have a “soft fascination” as they are attention-drawing. Exposure to natural environments and curves, which are intrinsically fascinating, allow us to restore our cognitive performance or attentional capabilities.

Provide a healthy balance of private and public spaces

The COVID-19 pandemic has changed the way we interact with our built environments and therefore must change the way interior designers design it. As we move slowly into the post-pandemic era and return to in-person activities, it is important to consider all comfort levels and design accordingly. Small nooks and open airy communal spaces will allow occupants with different comfort levels to occupy the same space.

Design with multisensory stimulation in mind

Sensory stimulation promotes restoration and should be treated as a conscious design decision. By incorporating any combination of visual, tactile, or olfactory stimulation into the built environment, interior designers can create multisensory experiences to help building occupants recover from mental fatigue and stress. Olfactory stimulation can be achieved with wood scent diffusers, while tactile stimulation can be as simple as ensuring wood is used in applications that can be touched (such as furniture). The use of natural wood products with over engineered wood will further promote tactile stimulation. Visual stimulation is the easiest to incorporate into a design, as it includes any wood product that is visible. Using natural wood products with visible wood grains is preferable.

Conclusion

The chaotic social landscape of the last 20 months has impacted all aspects of society and has made the topic of stress recovery and mental fatigue restoration more relevant than ever. As the months tick by, our stress levels continue to increase while our ability to recover our attentional capacity decreases. Since March 2020, post-secondary students have had to self-navigate the difficulties of remote learning while grappling with social isolation, mental fatigue, increased stress, and low motivation (Wong, 2021). Based on preliminary research by Nyrud & Bringslimark (2010), there is sufficient evidence to indicate wood's positive effect of human health and well-being. The restorative benefits of wood in the built environment is still a young field of study and further research is needed on aspects such as the effects of visual, tactile and olfactory stimulation of wood products on post-secondary students, and the correlation between visual preference and degrees of recovery. Results from this study have added to existing literature by highlighting students' preferences and perceptions of wood in the built environment and the emotional impact of wood in interior spaces. With the data collected through this study, a restorative student-centred space will be designed to help post-students recover from stress and mental fatigue induced by the pandemic. With careful consideration of wood's health benefits, this space will be a communal place for students to rest, study, work, and play. Although the road ahead is still long and arduous, one day it will all be behind us. Interior designers must start now, designing the places we live, work, study, and play with occupant health and recovery at the forefront. Let's make 'wood' the new buzzword in the design world.

Annotated Bibliography

Berto, R. (2005). Exposure To Restorative Environments Helps Restore Attentional Capacity. *Journal of Environmental Psychology, 25*(3), 249-259. https://doi.org/10.1016/j.jenvp.2005.07.001

This source supports my claim that exposure to restorative environments helps restore our capacity to direct attention and recover from mental fatigue. The research method employed was the inspiration behind the methodology for my own study.

Burnard, M., & Kutnar, A. (2020). Human Stress Responses In Office-Like Environments With Wood Furniture. *Building Research and Information, 48*(3), 316–330. https://doi.org/10.1080/09613218.2019.1660609

This article discusses human stress response and the negative health effects associated with prolonged time spent indoors. It is one of the only studies to look at wood furniture and its affect on stress recovery.

Fell, D. R. (2010). *Wood In The Human Environment: Restorative Properties Of Wood In The Built Indoor Environment*. [Unpublished Doctoral Dissertation]. University British Columbia. https://doi.org/10.14288/1.0071305

This dissertation supports my claim that the visual and tactile properties of wood can positively affect people's emotional and cognitive functioning. When compared to non-wood products, the wood was found the reduce the stress

response in those who viewed it. This will be helpful information to design a space that seeks to lower occupant stress levels.

Ikei, H., Song, C., Lee, J., & Miyazaki, Y. (2015). Comparison Of The Effects Of Olfactory Stimulation By Air-Dried And High-Temperature-Dried Wood Chips Of Hinoki Cypress (Chamaecyparis Obtusa) On Prefrontal Cortex Activity. *Journal of Wood Science, 61*(5), 537–540. https://doi.org/10.1007/s10086-015-1495-6

This article provides insight on the effects of olfactory stimulation from air-dried and high-temperature dried wood chips.

Kaplan, S. (1995). The Restorative Benefits Of Nature: Toward An Integrative Framework. *Journal of Environmental Psychology, 15*(3), 169–182. https://doi.org/10.1016/0272-4944(95)90001-2

This source supports my claim that recovery from attentional fatigue can occur through visual contact with nature. It uses Attention Restoration Theory to explain the role of restorative environments in the recovery process.

Lipovac, D., Podrekar, N., Burnard, M., & Šarabon, N. (2020). Effect Of Desk Materials On Affective States And Cognitive Performance. *Journal of Wood Science, 66*(1), 43-54. https://doi.org/10.1186/s10086-020-01890-3

This source affirms the effect that visual exposure to wood has on our cognitive performance. It supports my claim that having direct views of wood boosts our overall cognitive capacity.

Matsubara, E., & Kawai, S. (2014). VOCs Emitted From Japanese Cedar (Cryptomeria Japonica) Interior Walls Induce Physiological Relaxation. *Building and Environment, 72*, 125–130. https://doi.org/10.1016/j.buildenv.2013.10.023

This article provides a detailed overview of physiological relaxation induced by VOCs emitted from wood products. The study findings support my claim that the physiological effect of stressful activities can be reduced if the activity is performed in a room with wood applications.

Rice, J., Kozak, R. A., Meitner, M. J., & Cohen, D. H. (2006). Appearance Wood Products and Psychological Well-Being. *Wood and Fiber Science, 38*(4), 644-659.

This study supports my claim that the visual appearance of wood products has a positive effect on our psychological well-being, and that spaces with interior wood applications are viewed as more relaxing and inviting compared to rooms constructed with only artificial materials.

Sakuragawa, S., Kaneko, T., & Miyazaki, Y. (2008). Effects Of Contact With Wood On Blood Pressure And Subjective Evaluation. *Journal of Wood Science, 54*(2), 107–113. https://doi.org/10.1007/s10086-007-0915-7

This article concluded that contact with artificial materials produces a physiological state of stress, whereas contact with wood products produces a safe and comfortable feeling. This is especially helpful information for designing spaces that will be tactilely felt by the students, like tables and chairs.

Sakuragawa, S., Miyazaki, Y., Kaneko, T., & Makita, T. (2005). Influence Of Wood Wall Panels On Physiological And Psychological Responses. *Journal of Wood Science, 51*(2), 136–140. https://doi.org/10.1007/s10086-004-0643-1

This source examines the effects of visual stimulation of wood products on the body, through use of wall panels. It supports my claim that wood is perceived as being comforting and warm to those who view it. My idea to use the semantic differential (SD) method of evaluating participants mood in relation to wood products was acquired through this study.

Strobel, K., Nyrud, A., & Bysheim, K. (2017). Interior Wood Use: Linking User Perceptions To Physical Properties. *Scandinavian Journal of Forest Research, 32*(8), 798–806. https://doi.org/10.1080/02827581.2017.1287299

This study was interesting as it included building professionals, like architects, in their focus groups. Often, the participants in these studies are ordinary people with no connection to the industry. It supports my claim that wood adds a warm ambiance to a space.

Ulrich, R. S., Simons, R., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress Recovery During Exposure To Natural And Urban Environments. *Journal of Environmental Psychology, 11*, 201–230. https://doi.org/10.1016/S0272-4944(05)80184-7

This article was one of the initial starting points for my study. It provides an excellent in depth explanation at how exposure to natural environments aids in our recovery from psychophysiological stress and directed attention fatigue.

Wastiels, L., Schifferstein, H. N. J., Heylighen, A., & Wouters, I. (2012). Relating material experience to technical parameters: a case study on visual and tactile warmth perception of indoor wall materials. *Building and Environment, 49*, 359–367. https://doi.org/10.1016/j.buildenv.2011.08.009

This source supports my claim that wood is perceived to have a visual warmth when applied as an interior wall material. This warmth allows the space in which the wood is located to exude a calming atmosphere.

Wilson, E. O. (1984). *Biophilia: The Human Bond With Other Species*. Harvard University Press.

This book was the basis for many of my initial thoughts on this topic. Wood as a restorative material is a facet of biophilic design, so I cannot begin to think deeply about wood without first understanding the ground principles of biophilia.

References

Berto, R. (2005). Exposure To Restorative Environments Helps Restore Attentional Capacity. *Journal of Environmental Psychology, 25*(3), 249-259. https://doi.org/10.1016/j.jenvp.2005.07.001

Burnard, M., & Kutnar, A. (2020). Human Stress Responses In Office-Like Environments With Wood Furniture. *Building Research and Information, 48*(3), 316–330. https://doi.org/10.1080/09613218.2019.1660609

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Nyrud, A. Q., & Bringslimark, T. (2010). Is Interior Wood Use Psychologically Beneficial? A Review of Psychological Responses Toward Wood. *Wood and Fiber SCI, 42*(2), 202-218.

Matsubara, E., & Kawai, S. (2014). VOCs Emitted From Japanese Cedar (Cryptomeria Japonica) Interior Walls Induce Physiological Relaxation. *Building and Environment, 72*, 125–130. https://doi.org/10.1016/j.buildenv.2013.10.023

Mastroianni, J. (2021). *The pandemic has made post-secondary students' mental health even worse*. Now Toronto. https://nowtoronto.com/covid-19-pandemic-post-secondary-students-mental-health

Rice, J., Kozak, R. A., Meitner, M. J., & Cohen, D. H. (2006). Appearance Wood Products and Psychological Well-Being. *Wood and Fiber Science, 38*(4), 644-659.

Sakuragawa, S., Kaneko, T., & Miyazaki, Y. (2008). Effects Of Contact With Wood On Blood Pressure And Subjective Evaluation. *Journal of Wood Science, 54*(2), 107–113. https://doi.org/10.1007/s10086-007-0915-7

Sakuragawa, S., Miyazaki, Y., Kaneko, T., & Makita, T. (2005). Influence Of Wood Wall Panels On Physiological And Psychological Responses. *Journal of Wood Science, 51*(2), 136–140. https://doi.org/10.1007/s10086-004-0643-1

Strobel, K., Nyrud, A., & Bysheim, K. (2017). Interior Wood Use: Linking User Perceptions To Physical Properties. *Scandinavian Journal of Forest Research, 32*(8), 798–806. https://doi.org/10.1080/02827581.2017.1287299

Ulrich, R. S., Simons, R., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress Recovery During Exposure To Natural And Urban Environments. *Journal of Environmental Psychology, 11*, 201–230. https://doi.org/10.1016/S0272-4944(05)80184-7

Wastiels, L., Schifferstein, H. N. J., Heylighen, A., & Wouters, I. (2012). Relating material experience to technical parameters: a case study on visual and tactile warmth perception of indoor wall materials. *Building and Environment, 49*, 359–367. https://doi.org/10.1016/j.buildenv.2011.08.009

Wilson, E. O. (1984). *Biophilia: The Human Bond With Other Species*. Harvard University Press.

Wong, M. (2021). *Morale at an 'all-time low': Post-secondary students grapple with COVID-19 fatigue*. Global News. https://globalnews.ca/news/7564247/student-mental-health-pandemic/

Appendix

Restorative Benefits of Wood on Student Health and Well-being

Section 1

Informed Consent

PURPOSE OF THE STUDY
The purpose of this study is to determine how interior applications of wood can be used to improve the health and well-being of post-secondary students.

CONFIDENTIALITY
Any information that is obtained in connection with this study and that can lead to your identification will remain confidential. All questionnaire data will be kept strictly confidential.

POTENTIAL BENEFITS
There are no direct benefits to you for participating in this study. Data accumulated through the online survey will enable the student researcher to make informed decisions in the design of a student centre. The goal of the centre is to act as a restorative environment for post-secondary students to study, work, and play.

PARTICIPATION AND WITHDRAWAL
Your participation in this project is voluntary. You are under no pressure to participate in the project, and if you choose to participate you are free to stop at any time, with no penalty to yourself.

RIGHTS OF RESEARCH PARTICIPANTS
You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study.

For questions, concerns, or complaints about this research project, please contact: **Anais Deragopian** (anais.deragopian@sheridancollege.ca) or **Shelley Woods** (shelley.woods@sheridancollege.ca). If you have any questions, concerns, or complaints about your rights as a participant in a research project, you should contact (anonymously, if you wish) the Sheridan Research Ethics Board (SREB), Sheridan Research, Sheridan College, 1430 Trafalgar Road, Oakville, Ontario, L6L 2L1.

1

Please read the above information carefully before giving or retracting your consent to participate in the study. In the event you wish to discontinue your participation in the study, please skip directly to the end of the questionnaire after selecting the appropriate answer. *

- Yes, I give my consent to participate in this study
- No, I do not give my consent and wish to discontinue my participation in this study

Section 2

Background Information

2

What is your post-secondary institution's delivery mode for the fall 2021 semester?

- On-campus
- Remote
- Hybrid (On-campus and remote)

3

Please select the appropriate range which best reflects the number of months you have worked/ studied remotely:

- 0 - 6 months
- 7 - 12 months
- 13 - 18 months
- 19+ months

4

Working/ studying remotely over the course of the pandemic has made me feel:

	Not At All	Slightly	Somewhat	Moderately	Extremely
Stressed	○	○	○	○	○
Mentally Exhausted	○	○	○	○	○
Physically Exhausted	○	○	○	○	○
Socially Isolated	○	○	○	○	○
Unmotivated	○	○	○	○	○

Section 3

Interior 1

Please refer to the following image to answer questions 4 to 11. Participants should imagine themselves in this space when selecting their answers

5

How would you describe the effect this space has on you in terms of the following emotions?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Anxious	○	○	○	○	○
Relaxed	○	○	○	○	○
Fatigued	○	○	○	○	○
Energetic	○	○	○	○	○
Depressed	○	○	○	○	○
Cheerful	○	○	○	○	○
Stressed	○	○	○	○	○
Calm	○	○	○	○	○

6

This space makes me feel motivated to do work or study

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

7

This space intrigues me and I would like to explore it further

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

8

Spending time in this space would allow me to recover from mental fatigue

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

9

Spending time in this space would give me a good break from my day-to-day routine

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

10

My mental health would benefit from spending time in this space

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

11

I would feel comfortable interacting socially with other students in this space

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

12

Spending time in this space would allow me to recharge my inner battery

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	○	○	○	○	○

Section 4

Interior 2

Please refer to the following image to answer questions 12 to 19. Participants should imagine themselves in this space when selecting their answers

13

How would you describe the effect this space has on you in terms of the following emotions?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Anxious	○	○	○	○	○
Relaxed	○	○	○	○	○
Fatigued	○	○	○	○	○
Energetic	○	○	○	○	○
Depressed	○	○	○	○	○
Cheerful	○	○	○	○	○
Stressed	○	○	○	○	○
Calm	○	○	○	○	○

14

This space makes me feel motivated to do work or study

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

15

This space intrigues me and I would like to explore it further

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

16

Spending time in this space would allow me to recover from mental fatigue

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

17

Spending time in this space would give me a good break from my day-to-day routine

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

18

My mental health would benefit from spending time in this space

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

19

I would feel comfortable interacting socially with other students in this space

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

20

Spending time in this space would allow me to recharge my inner battery

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	○	○	○	○	○

Section 5

Please refer to the following 4 wood samples to answer questions 21- 22:

White Oak

Chestnut

Pine

Walnut

21

I like spending time in indoor environments that contain lighter wood materials

(for example, white oak or pine)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	○	○	○	○	○

22

I like spending time in indoor environments that contain darker wood materials

(for example, chestnut or walnut)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	○	○	○	○	○

Section 6

Preferences & Perspectives

23

Wood is aesthetically pleasing when used on the following applications:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Floors	○	○	○	○	○
Walls	○	○	○	○	○
Ceilings	○	○	○	○	○
Furniture	○	○	○	○	○
Countertops	○	○	○	○	○

24

The scent of wood makes me feel relaxed

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

25

The feel of wood is comforting to the touch

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

26

Please indicate your visual preference for following material combinations when used in interior applications:

	Strongly Dislike	Dislike	Neutral	Like	Strongly Like
Concrete & Wood	○	○	○	○	○
Steel & Wood	○	○	○	○	○
Ceramic & Wood	○	○	○	○	○
Glass & Wood	○	○	○	○	○
Stone & Wood	○	○	○	○	○
Marble & Wood	○	○	○	○	○

27

Based on visual preference, please indicate your like or dislike for organic (soft curves) or geometric (straight edges) wood patterns:

	Strongly Dislike	Dislike	Neutral	Like	Strongly Like
Organic	○	○	○	○	○
Geometric	○	○	○	○	○

28

Please indicate your preference for locally sourced (for example, maple or pine) or imported (for example, bamboo or teak) wood products:

	Strongly Dislike	Dislike	Neutral	Like	Strongly Like
Locally Sourced Wood	○	○	○	○	○
Imported Wood	○	○	○	○	○

29

Please indicate the level of importance you place on the following spaces within a student centre:

	Not Important	Slightly Important	Moderately Important	Important	Very Important
Communal Work Area	○	○	○	○	○
Quiet Study Area	○	○	○	○	○
Group Study Rooms	○	○	○	○	○
Fitness Room (bookable classes)	○	○	○	○	○
Gym (exercise equipment)	○	○	○	○	○
Sensory Room	○	○	○	○	○
Kitchen Facilities	○	○	○	○	○
Entertainment Area	○	○	○	○	○
Counselling Offices	○	○	○	○	○
Meditation Room	○	○	○	○	○

30

From a student's perspective, are there any other spaces you feel would be beneficial to include in a student centre?

Enter your answer