Introduction/Background

Research from multiple disciplines (e.g., environmental psychology, interior design, horticulture/landscape design) suggests that the physical environment in which an individual lives and works can impact their lifestyle, health, subjective well-being, and productivity. One interior design feature that has been studied extensively is exposure to indoor plants. Studies conducted in office and academic settings in such diverse locations as Japan (Shibata & Suzuki, 2004), the United Kingdom (Knight & Haslam, 2010), and the Netherlands (Nieuwenhuis, Knight, Postmes, & Haslam, 2014) have consistently demonstrated that indoor plants can positively impact student and worker moods, attitudes toward work, and even productivity. As noted by Nieuwenhuis et al. (2014), this may occur because (a) plants positively impact actual physical conditions such as air quality and noise pollution, (b) plants help restore attention, because they connect to our human evolutionary history (see Kaplan, 1995), and (c) enriched interior design features signal to students and workers that attempts are being made to enhance their well-being. As an example of the first explanation, NASA researchers (as described in Brethour et al., 2007) discovered that indoor plants filter air pollutants more efficiently than mechanical filters. Similar work by other researchers (Lohr & Pearson-Mims, 1996; Prescod, 1990) shows that indoor plants remove volatile organic compounds such as xylene, carbon dioxide, benzene, and formaldehyde. In terms of the second explanation, research from Tennessen and Cimprich (1995) indicated that subjects working with a view of plants had a higher ability to concentrate on their work. Similar findings regarding concentration were reported by Nieuwenhuis et al. (2014). In support of the third explanation, Nieuwenhuis et al. (2014) also found that workers in plant-enriched environments reported higher workplace satisfaction, had higher objectively measured productivity, and experienced less disengagement than those in more lean office environments.

Significance

Research that examines ways to increase psychological and physical well-being is important. Students and faculty members on our campus face personal, work-related, and academic challenges that can lead to stress, under-performance, and even health problems. Our project provides an opportunity to evaluate a potential strategy to improve these outcomes for our campus community. As noted earlier, other researchers have found similar benefits, on both psychological and physical variables. For instance, Ulrich (1997) found that college students under exam stress had reduced anxiety and anger while they were in a room with a view of plants as opposed to being in a space with no plants present. Other researchers (Lohr, Pearson-Mims, & Goodwin, 2007) have shown similar stress reduction, even for physiological variables like systolic blood pressure. Another significant component of our study is its interdisciplinary nature. Our research team for the project consists of students and faculty from the Departments of Plant and Earth Sciences, Psychology, and Agricultural Economics. Finally, we would like to note that the significance of our project has been recognized by outside agencies. The National Foliage Foundation awarded a grant to our faculty mentors to cover much of the costs of the Green Wall installation. In addition, McRae Anderson, a leading expert on Green Wall installations, has agreed to assist us with this project by doing the installation for half the cost of a typical installation. His firm, McCaren Designs, is very interested in our research and its’ potential for demonstrating the benefits of indoor landscaping.

Objectives

- To study student well-being, engagement, and academic performance in a classroom whose physical space has been altered by the addition of a greenwall compared to a control setting.
- To examine whether these benefits are ongoing and might increase with longer-term exposure to such conditions.
Methodology

Experimental Process:
1. We assessed initial equivalence (fall semester) of the room targeted for the greenwall installation (N = 238) and a control classroom (N = 261) on work-related environmental perceptions, academic self-efficacy, and mood. All pre-existing comparisons were either non-significant or favored the control room.
2. We installed a greenwall in one of the classrooms during winter break.
3. We repeated the process, examining differences between the greenwall-enhanced room (N = 301) and the control room (N=304).
4. Embedded in the larger sample were four multi-section courses where the same instructor taught two sections, one in each room.

Dependent Measures:
- Work-Related Environmental Perceptions (Nieuwenhuis et al., 2014)
  - Workplace Satisfaction
  - Subjective Productivity
  - Perceived Concentration
- Academic Self-Efficacy (Self-Efficacy for Learning and Performance; Pintrich, 1991)
- Mood (Core Affect Scale; Västfjäll et al., 2000)
  - Valence (pleasant-unpleasant mood)
  - Activation (intensity of mood)
- Academic Performance (Course Grades)

Analysis
Our primary analytic strategy was to conduct t-tests to examine experimental (greenwall) and control group differences after installation on key study variables. All comparisons shown are significant at p < .001.

![Work-Related Environmental Perceptions](image1)

![Academic Self-Efficacy](image2)
In addition, for the paired spring classes, a regression analysis indicated that, after controlling for instructor, academic performance was significantly better in the greenwall room (mean GPA = 3.11) than in the control room (mean GPA = 2.91), $\beta = .13$, $t = 2.37$, $p < .05$.

**Conclusion**

- Overall, we can conclude from our research that student attitudes, mood, and academic performance were significantly higher in the greenwall-enhanced classroom as compared to the control classroom.
- In addition to the results reported in this poster, we found significant differences favoring the greenwall-enhanced room in perceptions of air quality, academic anxiety, and environmental restoration.
- Our results are consistent with previous studies showing significant psychological benefits of interior plantscaping in academic and work environments.
- Our results could be beneficial to the interior plantscaping industry as well as academic and professional organizations looking for evidence-based environmental designs that optimize student and worker well-being.
- In our ongoing research, we are examining whether the observed benefits would generalize to performance on complex, cognitive tasks and to other populations (e.g., schoolchildren).
- We have been invited and received grant funding to construct a replica of our greenwall as a featured exhibit at the Minnesota State Fair’s 2016 Eco Experience.

**References**


