

HIGH SCHOOL LANDSCAPES

BY

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THESIS

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ABSTRACT

Today, many high school students are under considerable stress from school work, pressure to apply for college, and the burden of having to make money to pay for college or other needs. The level of stress that many students feel is likely to result in decreased academic performance and increased levels of inappropriate behaviors in classrooms and on school campuses. Fortunately, research suggests that natural landscapes can help high school students recover from this stress. Students benefit academically, socially, and behaviorally from school campuses with natural landscape features and greener window views. What we don't know, however, is to what extent high school students prefer barren, traditional and best management landscape configurations. To what extent do variations in the density of the vegetation impact their preferences? To what extent do preferences change when we consider different landscape types and the two levels of vegetation at the same time? To what extent do these findings hold for the various spaces on high school landscapes?

I investigated three public high schools in Central Illinois to examine the interests of students in different kinds of landscape configurations found on high school campuses. Based on the photo-questionnaires completed by high school students, I found that high school students prefer school campuses with best management practices landscapes more than those with traditional or barren landscape configurations. Analysis also suggests that high school students prefer school campuses with a higher density of vegetation over the low density vegetation campus landscapes.

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CHAPTER 1: INTRODUCTION

Every day, students spend a substantial amount of time in schools across America. Academic and extra-curricular activities require the use of directed attention, and high school students are constantly at risk for attentional fatigue. Students direct their attention when they force themselves to pay attention to something that requires concentration (Morecraft, Geula, & Mesulam, 1993). Attentional fatigue usually follows intense use of mental effort and is manifested as a decreased capacity to concentrate, that is, to direct attention (Cimprich, B. 1992). Mental fatigue is known to cause distraction and reduced performance. It is also known to create negative emotions such as irritability and tension, impulsiveness and hostility, or even behavior such as aggression and violence (Han, 2009). Students constantly need to focus on their studies, social life and other every day distractions and are thus highly vulnerable to mental fatigue.

Fortunately, research indicates that a substantial amount of time spent outdoors in green spaces can reduce attentional fatigue and reduce Attention Deficit-Hyperactivity Disorder symptoms (Faber Taylor and Kuo, 2009; Faber Taylor et al., 2001; Kuo and Faber Taylor, 2004). Over the last decade, there has been considerable interest in the rejuvenation and greening of school campuses. Studies now suggest that impacts of green spaces in schools may be more important than previously assessed. The influence of the outdoor environment on teenagers' physical, cognitive, social and emotional development has been constantly debated. A significant amount of research has been carried out to identify a connection between nature and natural features, social behavior and academic achievement of students in various contexts. As a result, tree planting and environmental courses have gained popularity in schools. Given the importance of physical and visual contact to nature in everyday life, consistent interaction with a green

environment is bound to positively influence physical and psychological health, decrease stress, and promote physical activity.

Research indicates that having natural views over urban landscape views offers greater health benefits. Verlarde et al. (2007) reviewed the literature on landscapes and psychological health, examining various landscape categories and levels of greenness, various categories and scope of landscapes in psychological studies, and the existing evidence of health effects related to viewing these landscapes. The study emphasizes environmental perception as multi-sensory and not just restricted to visual aesthetics. Close to half of the studies reported in this review were conducted using photographs and videos of different landscape images to simulate contact with nature. The rest of the studies explored contact with nature in actual landscapes. The types of landscape depended on the activities performed. Most of the health findings related to binary comparisons: urban vs. nature or landscape vs. no-landscape comparisons, where views of nature were found to provide greater positive health effects compared to urban views. The review also collected the negative effects of viewing landscapes with no natural components. These findings showed that in most cases natural views provided the strongest positive effects. The review made recommendations for what can be done to improve urban settings from a health and wellbeing point of view.

With all of this evidence, one would expect high school students to have constant interaction with nature and consistent interest in being connected to nature. However, there is a decline in contemporary teenagers' daily outdoor experiences. This generation of children is in danger of being completely detached from nature and missing the value of being outdoors.

Although we know that campus green landscape views can have measurable positive impacts for student academic performances and attentional recovery, we do not know what kind of landscape configurations students are drawn to. Previous studies primarily concentrate on the physical and psychological impact of natural and nature based settings in schools, and do not address the preference of the student community in campus design. For example, what kind of views would teenagers like to have from classroom windows and the cafeteria? How interested are the students in the greenness of their school campuses? Students' preference for a landscape is a good indicator of how they will function in a place. Will they want to spend time there? Will they feel restored when they look out the window? If they do not prefer a landscape, it may not have such a restorative, positive effect. They may also be unwilling to engage in physical activity in such a space. Answers to such questions addressing the preferences of teenagers in school landscape design, could be useful when outlining design guidelines for high school campuses.

In particular, we do not fully understand students' preference for different levels of greenness in campus landscapes and also preference for landscapes with a variety of plant materials and enriched biodiversity vs. landscapes with one or two variety of trees within the school periphery. Without this knowledge, we lack the evidence necessary to more assertively promote nature-based connections for better social behavior and academic performance.

CHAPTER 2: BACKGROUND

2.1 IMPORTANCE OF HIGH SCHOOL CAMPUS DESIGN

Early research on high school campuses has emphasized the importance of understanding teenagers' needs and preferences when designing effective schools. Research has constantly focused on the physical setting of an environment for educational and behavioral welfare of children. In America, public school design guidelines are extensively prepared, which incorporate the most diminutive details. Lecaze (1936) questioned that, "If buildings have an influence on us, should we not insist that our school buildings work well, and be good looking?" In the early 1950s, research emphasized the importance of understanding the desires and needs of teenagers when developing appropriate building design (Tennessen and Cimprich, 1995). Since this time period, design writings have constantly focused on the aesthetic design standards of high school buildings for teen development (Heschong Mahone Group, Inc., 2003). The high school building and landscape design has barely progressed beyond the early attempts back in 1950s when there was a desire and need to respond to the needs of the individual and development of teenagers (Collins, 1975). In fact during the 1960s and 70s, ongoing research promoted windowless classrooms in school settings in order to remove unnecessary distractions (Kaplan, R., 1993). Findings also suggest that access to green spaces encourage physical activity.

In the past, research concerning physical school environments primarily focused on building design and school interiors. Only a handful of studies have directly investigated how views of natural features from school buildings can influence student behavior. Exposure to natural views has been shown to enhance students' directed attention. For instance, students who had natural views in their college dormitory rooms had better performance on attentional measures than

students with barren views (Tennessen & Cimprich, 1995). Matsuoka (2008) investigated 101 public high schools in Michigan to examine the influence of nearby natural environments on academic achievement and social behavior of high school students. The study results revealed that nature exposure from window views with natural landscape features did beneficially affect student performance.

2.2 INFLUENCE OF NATURE ON ADOLESCENTS

Research also shows that landscape design is important for the emotional and social development of teens. Owens (1997) reviews the different places designed for teens in the United States. The paper addresses the increase in teenage issue reporting such as teenage suicide, drugs which are unique to contemporary teens. The study shows that the design of certain places that are vital for the emotional and social development of teens is yet to be translated into designs.

Theories in landscape architecture and natural environment have postulated the importance of nature views for stress reduction and in improving the attention of students. School landscapes can be enriching and expressive and can give students rich and varied sensations. Their size, design, and features can provide abundant chances for students to socialize in a secure, protected built environment. Campus landscapes can be valuable resources. There are significant benefits of investing in school landscapes; however, the intangible, long term and non-monetary benefits of landscapes in form of academic performance and social behavior are yet to be identified and should not be undervalued. Views from classrooms can contain diverse natural view setting, and thus create opportunities for visual connection. Time spent at school is indeed substantial and the design of school campus landscapes should be and can be accentuated rather than being non-existent and perceived as inadequate. The impacts on high school student attitude and behavior

towards the campus landscapes should be both about the result of a better landscape and student satisfaction in the participatory process of improving the landscape, considering how effective both physical and visual experience of nature can be.

2.3 BENEFITS OF HIGH SCHOOL AND LANDSCAPE INTERVENTION

Literature examining the impacts of urban green spaces, especially urban trees, provides strong support for the argument that the inclusion of vegetation on city schoolyards would provide valuable benefits to students, both in terms of healthy development and behavior, as well as environmental quality and health. Based on the scientific research and available evidence, if in fact constant interaction with nature does improve students' academic and behavioral performances, it would be worth an effort to understand the teenagers' interest in their own school landscapes. Researchers have also determined that student psychological well-being and satisfaction with academic life are positively related to measures of school performance and productivity (Chambel & Curral, 2005; Chow, 2007; S. J. Cotton et al., 2002).

2.4 RESEARCH GAP

Although the benefits of greener landscapes in school campuses are well established, it is not clear what kind of landscapes teens prefer in a school context. There is a lack of understanding about students' preferences for the physical environment of high school landscapes or landscape configurations. Understanding students' preference for a particular landscape configuration may enhance the students' interest in spending more time outdoors and thus may play a vital role in benefitting students' academic performance and also satisfaction with school campus landscapes. Outside of the school context, the landscape preference research has constantly suggested that more natural settings are preferable to large, barren landscapes with less natural

features (R. Kaplan and Kaplan, 1989; Schroeder, 1987; Ulrich, 1986). Even though research supporting the significance of nature in high school campuses has been minimal, it does seem reasonable to expect that students would prefer greener landscapes over barren ones.

Although we know that green landscape views out of the window can enhance academic performance, we do not know what kind of landscape configurations students are drawn to. That is, are there different landscape configurations that students will look at more than other configurations? Will students be just as likely to look out the window at a relatively barren school landscape or at a more traditional, 20th Century Horticultural design? Or will they be more drawn to look at landscape designs that incorporate emerging best practices in landscape architecture – designs that include a greater variety of native plants? Now that we know that the green landscape view out of the window can have measurable implications for student academic performances, this study seeks to give a more detailed understanding of preferences for different kinds of landscape configurations. That is, are there different landscape configurations that students will prefer?

2.5 RESEARCH QUESTIONS

In previous studies, researchers have found that green views make a difference. But what we don't know concerns the content of the green or the extent of the green. To what extent do high school students prefer the barren, traditional landscaping, or best-practice landscape configurations? To what extent do variations in the density of the vegetation impact their preferences? To what extent do preferences change when we consider landscape types (traditional and best-practice) and two different levels of vegetation (low and high) at the same

time? To what extent do these findings hold for the various high schools landscape spaces (window views, entrances, etc.)?

CHAPTER 3: METHODS

In this study, I measured the preferences of various high school landscape configurations. I conducted photo-questionnaire surveys in two high schools in Champaign, Illinois and one high school in Urbana, Illinois. In addition, I administered verbal surveys to these students to measure the students' perception of their own high school landscapes' various physical features.

The purpose of this study is to understand students' preferences for five kinds of high school landscapes: 1) relatively barren campuses; 2) campus landscapes with low greenery density using a traditional horticultural model; 3) campus landscapes with high density and a traditional horticultural model; 4) campus landscapes with low greenery density and best water and vegetation practices, such as greater biodiversity and a wide variety of trees; and 5) campus landscapes with high greenery density and best water and vegetation practices. High school landscape sites with barren landscape views were selected for the photo-questionnaire. The photos were then modified to meet the five different conditions for the questionnaire.

High schools were chosen for this study rather than elementary schools or middle schools as most of the school-based research in the past has largely concentrated on elementary schools. Different studies in the past have focused on intervention between certain aspects in adolescent development with respect to cafeteria, classrooms, athletic fields, main entrances and parking lots. I will be concentrating on landscape views in these five spaces to enhance the generalizability of the results.

3.1 SITE SELECTION

To select barren high school landscapes for the photo questionnaire (to be modified to meet the five conditions), I used Google Earth images to identify 136 public high schools across Illinois with similar student population, socio-economic status and student academic performance.

Students of landscape architecture in University of Illinois, Urbana Champaign were asked to rate the Google Earth images of these high schools on a scale of 0 to 4, 0 being barren and 4 being very green.

I visited four of the most barren schools identified from this survey and then selected five schools for my research design. The barren photos from these schools were then modified according to greenness density and landscape type for the photo questionnaire. I made observations and identified five high school campus spaces to incorporate in my research design.

Photo questionnaire and verbal surveys were circulated in three high schools, all of which categorized “very green” in the ratings provided by the students of landscape architecture in University of Illinois, Urbana Champaign.

3.2 SITE OBSERVATION

All the high schools that were photographed for the questionnaire are located in Illinois. The schools are located in suburban or rural locales. These designations are based on the classification reported by the Public School Review Organization. The immediate vicinity of all the schools was either residential or agrarian primarily. There weren't great differences in the neighboring sites around the three different schools. Residential houses, farmlands, vacant lots, and industrial factories defined the high school site boundaries.

Most of the schools are single-storied buildings. Classroom views were primarily of parking lots in addition to the large turf grass expanses lacking views of natural elements, without many trees. Even though the immediate vicinity of schools was comparatively much greener, the campus landscape itself lacked aesthetically appealing views. Cafeterias are integrated outdoor and indoor spaces. The views, however, did not vary much as they were mostly barren with large area of mowed grass, devoid of natural features. Athletic fields are conventional and consist primarily of open expanses of turf and asphalt and are located along the school periphery. Parking lots are spread over throughout the campus, with almost shrubs, trees or even hedges and have almost the same built up as that of the school building. Main entrances are comparatively more landscaped with more biodiversity including shrubs and trees, which provide pleasant views for visitors and school administrators. Students, however, rarely get views of the vegetation near the main entrance during the entire school day. Planning of school landscapes appears to be more from outside the school campus, than the types of views students will have from the building.

3.3 PARTICIPANT SELECTION

In order to evaluate preferences for various high school landscape configurations, I developed and distributed photo-questionnaires in three public high schools in east central Illinois, Champaign County. The schools were chosen from a single region of the state to minimize differences in building designs, school district policies and socio-economic background of the students.

Letters introducing the study were emailed to the principals of 3 schools, and follow-up telephone calls were made to obtain permission to conduct the study. The photo-questionnaires

were distributed to high school students during lunch time and study halls. Students took about 15 minutes to complete the survey.

This research did not ask students for any personal information, including name or signature. No other personal details of the students were collected and no students were screened in the selection process; it was an opportunistic sample and completely voluntary. Questionnaires were distributed among the students who wished to participate. A total of 173 students participated in this research.

3.4 PHOTO-QUESTIONNAIRE

The photo-questionnaire consisted of three parts: an introduction page, color photographs of various types of high school landscapes, and written questions. The introduction page included a brief outline of the survey and informed participants that the survey was created to gather information on high school students' preference for various high school landscape configurations. It instructed all participants to respond based on their own opinions.

The second part of the survey consisted of fifty 2.5 inch by 3.7 inch color photographs randomly assigned. Photos provided examples of the most commonly found high school landscapes in Illinois. The photographs were categorized under barren, traditional and best management practices landscape configurations. Traditional landscapes and best management practices categories were further divided into low and high greenness density configurations. Each of these configurations was differentiated based on the green cover percentage. Green cover can be defined as the total vegetation which includes ground cover, plants, trees and other biodiversity. The barren landscape photographs were photo-simulated to show 0-2% of green cover and mostly had lawn. For the traditional and best management practices photographs, the low-density

category had about 15% green cover and the high-density category had 30% or more green cover. Traditional landscape had single species of trees planted in traditional planting style with shrubs, and best management landscape incorporated rain gardens, native plants and different tree species. Table 1 shows the different types of landscape configuration, number of images and the percentage of green cover used in this research. Figure 1 gives an example of photo simulations carried out for parking lot in a high school campus.

| Type of landscape configuration | Number of photographs under each category | Percentage of green cover |
|---------------------------------------|---|---------------------------|
| Barren | 10 | 0-2% |
| Traditional-Low | 10 | 15-30% |
| Traditional-High | 10 | More than 30% |
| Best Management Practices-Low | 10 | 15-30% |
| Best Management Practices-High | 10 | More than 30% |
| Total number of photographs | 50 | |

Table 1. Types of landscape configuration, number of images and percentage of green cover examined in this study.



Barren (0-2%)



Traditional-Low (15-30%)



Traditional-High (More than 30%)



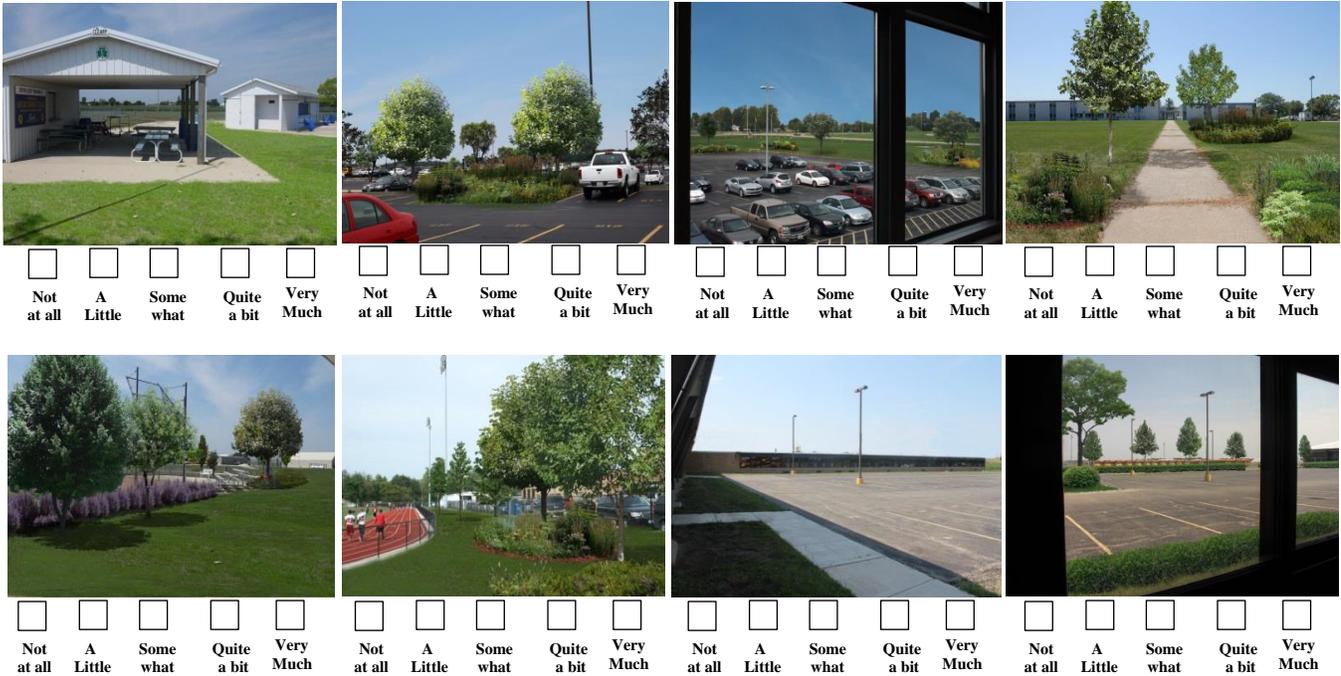
Best Management-Low (15-30%)



Best Management-High (More than 30%)

Figure 1. A typical photo simulation from the survey, in this case showing high school parking lot. Students rated their preference for each of these images on a five-point scale ranging from “not at all” to “very much.”

Survey photos were taken in high schools located in rural and suburban areas in Illinois with a digital camera of different architecture spaces like main entrances, cafeterias, athletic fields, views from cafeteria and views from classroom. For each of these spatial categories there were 2 base photos making a total of 10 base photos. These base photos were then modified by adding trees and vegetation to create the different conditions (traditional low density, traditional high density, best practices low density, and high density). There were 40 modified photos total. The colored photos were altered using Adobe PhotoShop to modify based on barren, traditional and best management practices. Participants were asked to rate each photo by marking one of five boxes that most closely matched their preferences. The responses were later coded on a five point numerical scale for analysis where 0 = not at all, 1 = a little, 2 = somewhat, 3 = quite a bit, and 4 = very much.



Sample Photo-questionnaire

Figure 2. These photos show a variety of high school landscapes that were included in the survey.

HIGH SCHOOL LANDSCAPES

| | Not at all | A Little | Some what | Quite a bit | Very much |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Please indicate how much you agree with the following: | | | | | |
| I appreciate the look of my high school campus landscape | <input type="checkbox"/> |
| I appreciate the look of the area the athletic fields | <input type="checkbox"/> |
| I appreciate the look of the parking lots | <input type="checkbox"/> |
| I appreciate the look of the main entrance | <input type="checkbox"/> |
| | | | | | |
| My high school landscape is barren | <input type="checkbox"/> |
| The area around the athletic field is barren | <input type="checkbox"/> |
| The parking lot is barren | <input type="checkbox"/> |
| The main entrance is barren | <input type="checkbox"/> |
| | | | | | |
| My high school landscape has a lot of biodiversity | <input type="checkbox"/> |
| The athletic field has a lot of biodiversity | <input type="checkbox"/> |
| The parking lot has a lot of biodiversity | <input type="checkbox"/> |
| The main entrance has a lot of biodiversity | <input type="checkbox"/> |
| | | | | | |
| I am very satisfied with the variety of shrubs and trees in my high school landscape | <input type="checkbox"/> |
| I am very satisfied with the variety of shrubs and trees around the school parking lot | <input type="checkbox"/> |
| I am very satisfied with the variety of shrubs and trees around the athletic fields | <input type="checkbox"/> |
| I am very satisfied with the variety of shrubs and trees Around the main entrance | <input type="checkbox"/> |

Verbal questionnaire

Figure 3. Items from the portion of the survey that asked questions about high school landscapes.

For the third part of the survey, participants were asked to respond to written items based on the photos as well as questions about the aesthetics, barrenness, bio diversity and the number of trees located in different areas of their high school campus. The survey consisted of 16 open-ended questions which mainly focused on their general satisfaction of their high school campuses. For example, the item, “The main entrance is barren,” corresponds to photo-simulations of main entrances of high schools that were barren. Participants were asked to mark one of five boxes based on a five point scale, which was later numerically coded for analysis where 0 = not at all, 1 = a little, 2 = somewhat, 3 = quite a bit, and 4 = very much.

3.5 DATA REDUCTION AND ANALYSIS

Summary variables are created from responses to the photo questionnaire. The summary variables were calculated as the mean of the preference responses to a specific set of images. Data were analyzed using the statistical software SPSS 16 for PC. We examined differences in means through Student *t*-tests and analysis of variance. All differences reported are significant at $p \leq 0.05$

CHAPTER 4: RESULTS

I present results relative to four questions. To what extent do high school students prefer the three landscape types (barren, traditional, best-management practices)? To what extent do variations in the density of the vegetation impact their preferences? To what extent do preferences change when we consider landscape types and the two levels of vegetation at the same time? To what extent do these findings hold for the various spaces on high school landscapes? Finally, I examine responses to a series of qualitative preference questions about high school landscape configurations.

4.1 To what extent do high school students prefer the three landscape types?

Are there differences in high school students' preference for various types of landscape configurations? To answer this question, I compared the mean approval ratings of the photo-questionnaire for the three landscape configurations by conducting a repeated measures analysis of variance (ANOVA) and found that there were indeed significant differences among the three landscape configurations ($df= 1.425$, $F = 104.9$, $p < .0001$).

Table 2 summarizes the results comparing the mean approval ratings of the three different landscape configurations. The barren landscape configuration earned a mean rating of 1.42, while the traditional landscape configuration mean is 1.93, a significant difference. Further, the best management practices mean value is 2.01. The average mean of best management practices is significantly greater than the mean the traditional landscape configuration and of the barren configuration. These findings suggest that high school students prefer school campuses with best management practice landscapes more than those with traditional or barren landscape configurations.

| Landscape Configuration | Mean | SD | N |
|----------------------------------|--------------------|-------|-----|
| Barren | 1.416 ^a | 0.659 | 173 |
| Traditional | 1.931 ^b | 0.693 | 173 |
| Best Management Practices | 2.007 ^c | 0.784 | 173 |

Here, M=Mean, SD = standard deviation and N=number of participants. Means followed by the same letter are not significantly different at $p \leq .05$.

Table 2. A one-way ANOVA was used to test for preference for various types of landscape configurations.

4.2 To what extent do variations in the density of the vegetation impact the preferences of high school students?

The questionnaire included images of traditional Landscapes and best management practices at both low and high planting densities (see Table 3). Taken together, did higher levels of vegetation produce higher preference among the students? That is, when you combine all the scores for the low density of vegetation images and compare their mean scores with all the images for the high density of vegetation images, was there a significant difference?

To address this question, I conducted a Student-t test and found that, indeed, the images with more vegetation did earn higher preference ratings (see Table 4).

| Type of Planting | Low density of vegetation | High density of vegetation |
|------------------------|---------------------------|----------------------------|
| Traditional | 10 | 10 |
| Best Management | 10 | 10 |

Table 3. Number of images in the questionnaire for two different planting types at two densities of vegetation.

| | Low | | High | | t-statistic | p-value |
|-----------------------------|------|------|------|------|-------------|---------|
| Levels of Vegetation | M | SD | M | SD | | |
| Levels of Vegetation | 1.90 | 0.74 | 2.05 | 0.85 | 3.9069 | <0.0001 |

Table 4. Shows the results of t-test conducted for Traditional Low, Best Management Low and Traditional High and Best Management High.

As can be seen in Table 4, participants prefer the higher density of vegetation over the lower density. In addition, when asked to indicate the extent to which they agreed or disagreed with the statement, “My high school landscape has lot of biodiversity,” results reveal low agreement (M = 1.53, SD = 1.05). These findings suggest that high school students do prefer school campuses with a higher density of vegetation over the low density vegetation campus landscapes.

4.3 To what extent do preferences change when we consider landscape types and the two levels of vegetation at the same time?

Do preferences change when different landscape configurations are considered with different levels of vegetation? To answer this question I compared the mean approval ratings for various landscape configurations. As can be seen in Table 5, a repeated measures analysis of variance (ANOVA) found significant differences.

| | Barren | | Traditional Low | | Traditional High | | BMP Low | | BMP High | |
|--------------------------------|------------------|------|------------------|------|--------------------|------|--------------------|------|--------------------|------|
| | M | SD | M | SD | M | SD | M | SD | M | SD |
| Landscape Configuration | 1.4 ^a | 0.66 | 1.8 ^b | 0.67 | 2.1 ^{e,d} | 0.82 | 2.0 ^{c,e} | 0.81 | 2.1 ^{c,d} | 0.88 |

Means followed by the same letter are not significantly different at $p \leq .05$.

Table 5. A Repeated Measures ANOVA was used to test for preference differences among five landscape configurations of high school campus. Preferences for landscape configurations differed significantly across the five types, $df=2.405$, $F = 67.65$, $p < .0001$.

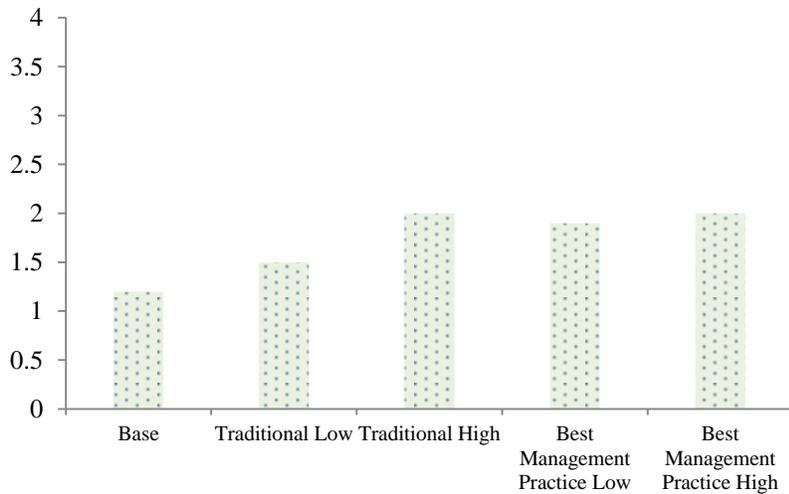


Figure 4. Comparison of preferential ratings for different landscape configurations and levels of vegetation in high school campuses.

Table 5 summarizes the Repeated Measures ANOVA results for various landscape configurations with varying vegetation. The base images earned the lowest preference ratings, significantly lower than the four other categories we tested. Traditional practices with higher density of vegetation earned higher preference than those with lower density of vegetation. Best management practice practices with a higher density of vegetation were preferred over traditional

practices with low levels of vegetation but were not significantly different from traditional high or best management low). This suggests that high school students do prefer landscape configurations with higher density of vegetation over the low density vegetation campus landscapes.

To explore this issue further, I asked high school students to respond to two issues. The first concerned their general satisfaction for the biodiversity in their high school campus with a special emphasis on the main entrance, athletic fields, and parking lots, views from class rooms and views from cafeterias. In this category they addressed questions like, “My high school landscape has a lot of biodiversity” ($M = 1.52$ and $SD = 1.1$). The second issue dealt with the nature of barren landscape of the high school campus. Here, students rated questions such as, “My high school landscape is barren” ($M = 2.0$ and $SD = 1.2$). Results demonstrate that the students prefer landscapes with higher density of vegetation.

4.4. To what extent do these findings hold for the various spaces on high school landscapes?

Are there differences in participants’ preferences for a specific landscape configuration for the various spaces on their campuses? To answer this question, I conducted a repeated measures analysis of variance (ANOVA) and compared mean preference ratings for a variety of campus spaces such as parking lots, athletic fields, main entrances, views from cafeteria and views from classrooms. Table 6 shows that there are no significant differences in the preferential ratings for the views from cafeteria, athletic fields and main entrances. Views from the classroom and of the parking lots have the least preferential rating. I interpret these findings to suggest that even though there is not much variation in views across high school campus; students prefer views from the classroom and of the parking lots least, indicating these views should be improved.

| | Mean | SD | N |
|-----------------------------|-------------------|-------|-----|
| Views from Cafeteria | 1.93 ^a | 0.775 | 173 |
| Parking Lots | 1.68 ^b | 0.775 | 173 |
| Athletic Fields | 1.96 ^a | 0.757 | 173 |
| Main Entrance | 1.96 ^a | 0.721 | 173 |
| Views from Classroom | 1.61 ^b | 0.848 | 173 |

Here, M=Mean, SD = standard deviation and N=number of participants. Means followed by the same letter are not significantly different at $p \leq .05$.

Table 6. A Repeated Measures ANOVA was used to test for preference differences among five landscape configurations of high school campus. Preferences for campus spaces differed significantly among the five spaces, $df=3.197$, $F= 25.4$, $p<0.001$

CHAPTER 5: DISCUSSION

Analyses conducted in this study provide new insights into student preferences for various landscape configurations in high school campus. The findings of the ANOVA analyses suggests that landscape features of the high school campus do significantly influence student preferences for various landscape configurations in high school campus. Results demonstrate that high school students prefer school campuses with best management practices landscapes more than those with traditional or barren landscape configurations. Analysis also suggests that high school students prefer school campuses with a higher density of vegetation over the low density vegetation campus landscapes.

To what extent do high school students prefer the three landscape types (barren, traditional, best-management practices)? The most prominent findings center on student preferences of the three different landscape configurations. First, the study provides some evidence for the assertion that given the three different landscape configurations, high school students have the least preference for barren landscapes. The barren landscape which mostly had lawn with no natural landscape features has a mean approval rating of 1.42.

Second, the results also show that high school students prefer school campuses with best management practice landscapes with a mean of 2.01 which is more than that of traditional landscapes with a mean of 1.93 or barren landscape configurations. Best management landscape configurations incorporated different tree species, a variety of ornamental grasses and shrubs, native plants, landscape buffers and rain gardens. Traditional landscape configurations had a single species of trees planted in traditional planting style along with shrubs. Therefore, our results suggest that students will prefer campuses with greater biodiversity.

To what extent do variations in the density of the vegetation impact the preferences of high school students? Given the two landscape configurations, traditional and best manages practices with substantial alteration in the green canopy, the low-density category with 15% green cover and the high-density category with 30% or more green cover, results for the variations in the density of vegetation suggest that high school students prefer school campuses with a higher density of vegetation over the low density vegetation campus landscapes. In accord with the attention restoration theory, these findings support the need for greater quantities of natural features which would provide more interesting elements that would aid the processes of resting an individual's direct attention and recovery from mental fatigue. Therefore, a reduction in stress and mental fatigue can yield non-monetary benefits of landscapes in form of better academic performance and social behavior of high school students.

To what extent do preferences change when we consider landscape types and the two levels of vegetation at the same time? While considering the students' preference amongst the two levels of vegetation at the same time I found that even though there was no significant differences between the means of traditional landscape configuration with higher vegetation density and the best management practices landscape configurations with higher vegetation, they are the most favored. Thus, one can say that higher levels of nearby vegetation and natural buffers may increase students' interest in nature and thereby benefitting from regular contact with nature resulting in reduced stress levels, work performances, social behavior etc.

To what extent do these findings hold for the various spaces on high school landscapes? There are no measurable preferential differences found in the ratings for campus spaces such as parking lots, athletic fields, main entrances, views from cafeteria and views from classrooms. One can argue that, for better results trees, shrubs and greater quantities of viewable natural features need

to be close to the viewer to have greater benefit. Hardscape areas such as parking lots and main entrances should be planted with trees, preferably in groups to increase the impact of green canopy.

However, the extent to which these findings hold for the various high school landscapes and the degree to which there can be proportional variations which signify measurable benefits is unknown, thus necessitating further research.

5.1 IMPLICATIONS

Although the literature provides a comprehensive analysis of the positive impacts of contact with nature, the studies are limited to high school campuses. This is the first study to systematically compare various types of landscape configurations in high school campuses. The findings here suggest that implementing higher density of planting on high school campuses is highly preferred over the prevailing high school campus landscapes. Campus landscapes not only improve visual appearance, but also provide many small, but commendable, ecological benefits. These benefits include reduction of soil erosion, surface runoff, and creation of wildlife habitats for small animals such as squirrels and rabbits. Taken together, these findings recommend high density vegetation on high school campus landscapes. In order to introduce higher vegetation on high school campuses, school authorities might develop a planting implementation plan and adopt strategies with detailed specifications for establishment of such buffers. The plans should include specific goals and time frames for planting implementation.

A key component of the research, and the focus of this paper, was the ranking of real and prospective high school campus landscape images that could be used to help determine student

values of the existing campus landscapes, thereby improving current landscapes. Students preferred best management practices landscapes with more green canopy, a variety of trees and shrubs, ornamental grasses and native plants more than traditional landscape techniques with less green canopy and a single variety of trees and shrubs.

Recent studies also suggest that traditional landscaping strategies are no longer practical or sustainable (Hough 2010). By using more sustainable landscaping practices, high schools would take a leadership role in showing how sustainable landscapes benefit society and improve our ecosystem. They would help students become more aware of the importance of sustainable landscapes and encourage them to have more sustainable lifestyles.

For an effective best management landscape configuration, shrubs, plants and trees should be native and must be locally adaptable. Even though best management landscapes may initially seem more expensive and labor intense, in the long run the maintenance cost may be much less. This will also prevent the rapid spreading of diseases in monoculture planting as commonly seen in traditional landscapes. Plant selection should be made so that regular maintenance will be at minimum. Campus planting design should integrate with existing vegetation. Rain gardens can decrease flooding, water runoff and pollution, and can have an aesthetic benefit as well. Defined edges and landscape buffers often give a naturalized planting appeal and provide evidence of habitation. These designs will not only improve the environment and the facilities, but will also benefit the students, especially if they are actively involved in the process of campus landscape design.

Students should be involved in landscape design by deciding which landscapes they would prefer and even by planting trees or other plants to increase awareness and to create a sense of

environmental responsibility towards their school campuses. Parents and families residing in the community should be directly involved as they can provide valuable input and help choose the landscape management strategy that best fits their community. Such careful planning and high level of community involvement will make way for the successful implementation of a new management of high school landscapes across America.

5.2 FUTURE RESEARCH

There are certain limitations to the present study that should be taken into consideration in interpreting the findings. First, the results of this study are limited by the size and nature of the sample. In particular, the study involved only three high schools in a single county. Another limitation is that the research data was collected without considering students' gender or age. There might have been variations in results if I had segregated boys and girls and further, it would be interesting to study student preferences based on year of study. A final limitation is that single measures were used in this study to calculate each predictor variable. The photo-questionnaires only consisted of campus nature features as the predictors, including campus site areas and natural elements because of the number of schools involved in this study. Other predictors could consist of regional and neighborhood variables or building features that potentially affect student exposure to natural views. Further studies are needed that utilize additional methods to measure these variables to enhance measurement validity.

Although this study provides evidence of the relationship between various landscape configurations and high school students' preference, further research is needed to understand the beneficial aspects of natural views on high school students. Longitudinal studies involving repeated measures are needed to understand better the effects of landscape configurations on

students' preference. Future research attempts should accommodate a larger sample group. A physiological study along with the survey may be beneficial as well.

5.3 CONCLUSION

In this study I investigated students' preferences for various high school campus landscape configurations. The results showed clear and consistent preferences for best management practices (that is, landscapes that were rich with native landscape plantings, rain gardens, and bioswales) more than traditional practices (large lawns with a few widely spaced trees and some shrubs near the building entrance) and more than barren landscapes (large lawns with very few trees or shrubs). Furthermore, I found that students prefer higher densities of tree plantings over lower density plantings or no trees at all. The results suggest that implementing a higher density of planting on high school campuses is highly preferred over the existing conditions.

Although students spend the majority of their day in school, there is a limited research concerning the potential benefits of physical environment on students. Insights provided by the results of this study can aid school administrators and designers in building and renovating campus landscapes in ways that may increase student satisfaction with the school environment. Students who are more satisfied with their school environment will likely want to have more contact with this environment and may benefit more from it. Given the importance of physical and visual contact to nature in everyday life, constant interaction with green environment is bound to decrease stress levels, increase attentional functioning, and encourage physical activity.

Currently, a large number of school campuses are mostly uninviting, featureless and lack natural aesthetic elements. This often is accompanied with student misbehavior like bullying, vandalism or even just plain boredom. High school campus landscapes can actually be developed into

interactive learning environments which will facilitate healthy school landscapes. Campus architect Louis Demonte states that “a campus should not have a hard edge, and yet should have a sense of place to which the community and public can come and supplement its aesthetics.” This holds true for any educational campus. School landscapes need to be reconceived and designed as interactive multifunctional spaces. The scope and opportunity for school landscape design is boundless. Research for long has experimentally proved the restorative advantage of natural environments in the ability to focus attention under psychological demands. It is only in more recent times that research has addressed alterations, additions, restoration and rejuvenation of high school campus landscapes.

Landscape planners should integrate student perspectives in campus design and development. To this day, high school students are rarely involved in design processes for high school campus landscapes. High school designs, including school grounds, should strive to meet the established psychological and social needs of high school students. Design decisions and campus planning should be made in the context of a sustainable environment, which will stay put and which will be changed, replaced and rejuvenated constantly.

A campus landscape is more than a lawn space between buildings. Emphasis must be placed on the students’ desirability in evaluating and mapping the best management land use practices and campus design. It is essential for us to understand how high school landscapes can effectively incorporate student values and entice students’ interest in campus planning. Student participation in the design and development of school landscapes brings a myriad of benefits to learning and design. Even though they are limited by their subject knowledge, their participation will give them an opportunity to develop their own opinions and learn more about landscape design. This in turn will help the designers to make informed decisions on campus landscape designs. Student

can contribute to design project issues and contexts; their valuable perspectives will help overcome the barren unwelcoming campus landscapes. A comprehensive design process provides insights to meaningful campus landscapes. The creation of successful school campus landscapes requires unified collaboration of various disciplines and interests. Actively involving students in campus planning might actually reduce the communication barriers between the student community and the governing bodies. As landscape architects, we should understand student preferences to better meet their needs and create effective campus landscapes.

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APPENDIX: SAMPLE SURVEY

The survey that was administered to students at each of the three participating high schools may be found in a supplemental file named SAMPLE_SURVEY.pdf.