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Do Plants Play a Part in Student Satisfaction?

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To the Graduate Council:

I am submitting herewith a thesis written by Amanda Diane Plante entitled "Do Plants Play a Part in Student Satisfaction?." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Plant Sciences.

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Do Plants Play a Part in Student Satisfaction?

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Abstract

Environmental psychologists have found relationships between plants, nature and satisfaction. Student satisfaction is important across grade levels. Two studies were conducted to determine the effect of spending time with live plants on student satisfaction and academic performance. In the first study, a quasi-experimental nonequivalent control group design was used to determine how participation in garden labs would affect high school student satisfaction with school and academic performance. Ecology students in the variable group participated in ten gardening labs during the semester. During labs, students did hands-on gardening activities in the school greenhouse and garden. Students in the variable and control groups completed a questionnaire before and after the ten-week garden lab period. Interaction with plants during the labs and outside of school was somewhat related to student satisfaction and academic performance.

In the second study a survey instrument was developed to determine how frequently undergraduate students interact with live plants, gauge student satisfaction with school, and measure academic performance. Time spent interacting with live plants was broken into two groups. Active interaction involved activities where the individual had sought-out plant based activities (e.g. gardening). Passive interaction with plants included activities where the individual may not have desired a plant based activity even though it was in a "green" environment that has live plants (e.g. walking outside or reading outdoors). Both active and passive interaction with live plants was related to student satisfaction with school and academic performance. These findings support the proposition that plants do play a part in student satisfaction with school and academic performance. Schools should provide opportunities to experience plant life.

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Chapter 1: Introduction

Background

Adolescent student satisfaction with school is important. In the U.S., most young people (93.8%) between the ages of 5 and 19 spend the majority of their time in school ("School Enrollment"). Therefore, how these students feel about their school experience is important. What students do while they are in school plays a role in how students feel about school. When students interact with their school surroundings, they develop constructs and beliefs that affect their behavior in class and level of participation (Baker et al., 2001, 2003).

Student satisfaction with school is important to colleges and universities because these institutions are in the service industry of higher education. Student satisfaction is believed to be related to student retention, which is currently a major focus in higher education (Letcher & Neves, 2010). The American College Testing program reported in 2013 that the national average first-to-second year retention rate was 64.9 percent for a public bachelors program and 67.3 percent for a private bachelors program. The national average for persistence to degree (5 year completion) was 36 percent for a public bachelors program and 58.5 percent for a private bachelors program (ACT, 2013). Student attrition leads to decreased income from student tuition for institutions of higher education.

Undergraduate student retention is believed to relate to a "sense of belonging" within the institution. Hoffman et al. (2002) posited that this sense of belonging to school would be positively related to student satisfaction with school, and student satisfaction would in turn lead to improved retention. Many colleges and universities have put in place various programs such

as freshmen seminar courses and learning communities to improve sense of belonging, student satisfaction, and retention rates.

Research in environmental psychology suggests spending time with real, living plants influences different types of satisfaction. Although interaction with plants has been shown to influence satisfaction with life, place of residence (Kaplan, 2001), and work (Kaplan, 1993), little work has been done to investigate the relationship between plants and student satisfaction. One experiment found that undergraduate psychology and sociology students whose classroom had interior plants provided better course and instructor evaluations at the end of a semester than students whose classroom did not have plants (Doxey et al., 2009). If further research supported this relationship between live plants and student satisfaction with school, it would surely be of importance to schools that are looking for ways to improve student satisfaction.

Research Focus

Two studies were conducted to explore whether or not there is a relationship between student interaction with live plants and satisfaction with school. The first study was an experiment conducted with a sample of students enrolled in Knoxville's Austin-East High School. The purpose of this experiment was to determine whether participation in a gardening curriculum, home gardening and the amount of time spent outdoors in general has an affect on high school student satisfaction with school.

The second study was a survey of a sample of undergraduate students enrolled in institutions of higher education in the Knoxville area. This study had two purposes. The first purpose was to create reliable measures of undergraduate activity with live plants and of their enjoyment of those activities. The second purpose was to use an online survey to determine

whether the level that undergraduate students engage in activities with plant life influences their level of satisfaction with school.

This paper will begin with a brief review of the literature surrounding student satisfaction and the psychological benefits of time spent with living plants. Next will come a summary of supporting theory. Then Study 1 hypotheses, methodology and results will be discussed. After that, Study 2 hypotheses, methodology and results will be discussed. The paper will conclude with an overall discussion, suggestions for future research and some policy recommendations.

Chapter 2: Literature Review

Does interaction with plant life influence student satisfaction? Some readers may reflect on personal experiences and come to their own conclusions on the subject. Although it is generally acknowledged that time spent with plants outdoors is good for you, this does not provide a solid foundation for research. Before exploring the relationship between interaction with plants and student satisfaction, a literature review was required to better understand current scientific knowledge as it relates to these projects. The purpose of this literature review was to find material that would provide a useful foundation for the design of these research projects.

This review will begin with an introduction to relevant theory. The following section will focus on the psychological benefits that can be derived from spending time with living plants. That section will focus on what is known about the relationship between plants and satisfaction. Next will be an overview of the current knowledge of satisfaction, adolescent student satisfaction, undergraduate student satisfaction, and supporting information from similar concepts. Both sections will include information about methods of item creation for measuring relevant constructs. The review will conclude with a summary and a brief evaluation of the findings.

Theory

Attention Restoration Theory

Mental fatigue is a condition that is brought on by spending time in a state of directed attention. This process happens when humans have to suppress distracting stimuli to focus on a task. This process grabs attention using a top-down approach. That is, activities that require

directed attention start from the general and moves to the specific aspects required to complete an activity. Mental fatigue is especially common in urban environments where traffic, billboards, signs, and bus ads are constantly vying for attention. School environments can also require a great deal of directed attention when listening to lectures, completing assignments and assimilating information.

One's ability to maintain directed attention decreases over time, resulting in mental fatigue (Parsons, 1991). Symptoms of mental fatigue include reduced concentration ability, irritability, increased incidence of stress (Han, 2009), aggression and reduced impulse control (Kuo & Sullivan, 2001). As an individual becomes more mentally fatigued, they become less able to evaluate a situation rationally, and they are more likely to have an unnecessary outburst (Kuo & Sullivan, 2001). Mental fatigue can lowered through recreation, taking a vacation and sleep (Kaplan, 1993). Activities that provide opportunities to experience fascinating stimuli that intrigue the senses, such as nature, are another way to reduce mental fatigue (Parsons, 1991).

Natural environments can be rich in fascinating elements. According to Attention Restoration Theory, nature grasps one's attention involuntarily using intriguing stimuli. This process works in a bottom-up fashion. For instance, in a typical sunset experience, there are many interesting natural phenomena occurring during the sunset (e.g. crickets chirp, the sky begins to change colors, etc.) that will subsequently direct attention to the sunset itself. Natural environments that spark human fascination provide an opportunity for the mind to recover from mental fatigue caused by directed attention (Parsons, 1991).

Attention restoration is facilitated by a landscape that meets certain criteria (Kaplan 1984). An example of a restorative landscape would be an environment with elements of mystery, where participants in the environment feel drawn in to explore around a bend of a

curving path or over a hill just out of view. Since the type of environment is of primary importance in attention restoration theory, much of the research supporting the theory typically involves some type analysis of the qualities of the natural landscape (e.g. mystery).

Despite the prevalence of landscape analysis in the research supporting Attention Restoration Theory, Rachel Kaplan (1984) once asked, “Is presence in the setting sufficient to reap the benefits? Or is some involvement or commitment [activity in the environment] on the part of the individual essential?” Kaplan went on to note three types of involvement in the landscape that could also contribute to Attention Restoration Theory. The first type of involvement is active involvement in the natural environment, which could include gardening or a walk through the neighborhood. The second type of involvement is observation (passive), which would include a looking out on a natural scene from a window or watching plants grow and develop. The third level of involvement is on a conceptual nature. Conceptual involvement has to do with knowledge or memory. One could imagine participating in a natural environment through an activity like planning a garden or reflecting on a prior outdoor experience (Kaplan, 1984).

Expectancy Theory

What motivates people to spend time with live plants? There are several widely accepted theories of human motivation that could be used to answer this question. Victor Vroom’s (1964) Expectancy Theory has been used to explain motivation across disciplines. According to Vroom, "people consciously chose a particular course of action, based upon perceptions, attitudes, and beliefs as a consequence of their desires to enhance pleasure and avoid pain." (Van

Eerde & Henk,1996). Expectancy Theory defines motivational force as a combination of expectancy, instrumentality and valence.

Valence is conceptualized as one's orientation (intrinsic attractiveness or averseness) towards an event, object or situation. If a student expects some sort of a reward (intrinsic or extrinsic) for participation in activities with plants, they would have a higher valence (intrinsic attractiveness) than a student who does not expect a reward for such activities (Van Eerde & Henk, 1996). In the context of this study, if a student primarily expects to feel refreshed after gardening, they would have a higher valence than a student who primarily expects to feel dirty after gardening.

Vroom conceptualized instrumentality as an outcome-outcome association. If a student perceives a high likelihood that they will feel refreshed after gardening, they would have high instrumentality. On the other hand, a student who recognizes they might feel refreshed after gardening, but does not feel like it is very likely that their gardening experience will lead to feeling refreshed would have a low instrumentality. Expectancy is conceptualized as the probability that an effort will result in performance (Van Eerde & Henk, 1996). A student who believes their gardening effort will yield a restorative experience would have a higher expectancy than a student who does not believe that engaging in the activity will yield the desired experience.

For the purpose of this study, Expectancy Theory is used to explain what motivates students to engage in activities with living plants. The idea that valence, instrumentality and expectancy lead to motivational force, essentially means that when people perceive that something good is likely to happen from engaging in activity, the likelihood that they will engage in the activity will increase.

Interaction with Live Plants

Plants and Satisfaction

There are a variety of psychological benefits that come from being in the presence of live plants, such as increased productivity, reduced stress (Lohr et al., 1996), reduced aggression (Kuo & Sullivan, 2001), reduced mental fatigue, and improved attention restoration (Han, 2009, Kaplan & Kaplan, 1989, Kaplan, 1993, 1995, 2001). Plants and nature have also been found to contribute to different types of satisfaction (Doxey et al., 2009, Kaplan, 1983, 2001).

Plants and nature are related to neighborhood satisfaction. Individuals that actively engage in gardening are more satisfied with their neighborhood than those who do not. One survey of apartment dwellers found that permitting gardening activities within or near a neighborhood increased resident satisfaction. In addition to the benefits from gardening, researchers found a strong positive correlation between merely having a view of nature from the home and residential satisfaction (Kaplan, 2001).

A view of nature is also related to satisfaction with work and life. A longitudinal study of employees over a 6-month period found that individuals who had a view of nature in their workspace were more satisfied with their jobs than individuals who did not have a view of nature (Kaplan, 1983). Another survey found that of 615 office workers, individuals with a view of nature were more satisfied with their lives and were more enthusiastic with their jobs than workers who did not have a view of nature (Kaplan, 1983).

Furthermore, some findings indicate the presence of plants plays a role in student satisfaction with school. One experiment exposed undergraduate sociology and psychology students to a classroom containing living interior plants. A similar control group did not have live plants in their classroom. Although there was not a significant difference in academic

performance between these groups, students who were exposed to plants turned in better course evaluations and instructor evaluations at the end of the semester than students from the control group (Doxey et al., 2009).

Current Instruments for Measuring Interaction with Plants

Surveys and experiments have varied a great deal in measuring types of interactions with live plants. Research on experiences with plants has ranged from a studying the responses of a photograph of nature (Kweon et al., 2008) to gardening opportunities (Kaplan, 2001). Many survey items appear to have been generated based on known information about the population of interest.

In one study, Kaplan (2001) developed 11 items that were intended to measure the frequency of participation in nature-based activities. These activities ranged from gardening to biking to jogging in the neighborhood. Factor analysis divided the 11 activities into three factors – outdoors, quiet nature, and gardening. The seven items that loaded on the "outdoors" component had good reliability (alpha = 0.81). The two items that loaded on the "quiet nature" component had fair reliability (alpha = 0.77), as did the two items that loaded on the "garden" component (alpha = 0.75). Methods of item creation and tests of reliability and validity were not discussed in this paper.

In Lohr and Pearson-Mims' (2005) study of the how children's interaction with plants influence adult attitudes toward trees and gardening, five items were created that were intended to measure the level of childhood interaction with plants. These five items were divided into two distinct groups. The first group was defined as passive interaction with plants, which included activities like visiting state parks and spending time around trees and plants. The second group

was defined as active gardening, which included activities like picking flowers, planting seeds, and caring for plants.

Although there are instruments that have been used to measure level of interaction with plants, they were not designed for use beyond the original studies' populations of interest. There was not information found about methods of item generation, reliability or validity, although face validity was assumed. The types of plant interactions vary by study. For these reasons, previously published measures of plant interaction were not used in this research.

Satisfaction

Overview

Satisfaction has been defined as "a person's subjective evaluation of the degree to which his or her most important needs, goals, and wishes have been fulfilled" (Frisch, 1998). Satisfaction has been conceptualized as "one component of an individual's subjective well-being" (Haranin et al., 2007). Likewise, the definition of subjective well-being (SWB) is described in terms of satisfaction. Frisch (1998) describes the currently understood definition of SWB as judgments based on life satisfaction that determine the frequency of positive and negative experiences. That is, people choose to pursue experiences in the hopes they will contribute to their life satisfaction.

Adolescent Satisfaction

U.S. minority groups may experience reduced life satisfaction due to their need to deal with stresses that arise from living in conflicting cultures. Adolescent students are often pulled in different directions because of conflicting expectations set by their family, peers, and schools

(Bradley & Corwyn, 2004). Low satisfaction with school has been linked with negative behaviors, such as a high use of cannabis in adolescents (Hoff et al., 2010). Goal attainment activities that require setting tasks, meeting objectives, and persistence can increase feelings of satisfaction in this population (Bradley & Corwyn, 2004). Baker et. al. (2001) studied the developmental context of school satisfaction. The authors explained the importance of student interaction with their school setting when developing social constructs and personal beliefs.

> As they interact with school settings, children construct meaning about themselves, others, and the nature of school. The meanings children derive influence their beliefs about themselves as individuals, as learners, and about the purposes, nature, and goals of education. These beliefs in turn affect children's engagement and participation in school. Within this perspective, schools influence development because their characteristics affect children's appraisals of the school environment which, in turn, affect school-related cognitions and, ultimately, school-related behavior (Baker et al., 2001; Roeser, Eccles, & Strobel, 1998).

Undergraduate Satisfaction

Undergraduate student satisfaction with school is often considered from one of the following perspectives: psychological-wellness, job-type, or consumer-type satisfaction (Wiers-Jenssen et al., 2002). Sense of belonging would be an example of the psychological-wellness facet of student satisfaction. The idea is that if a student feels like they belong in their school, they will be more satisfied with their experience at that school (Hoffman et al., 2002). Colleges and universities are in the service industry of higher education, which means they should be interested in consumer-type student satisfaction (Letcher & Neves, 2010). Job-type student satisfaction with school may have more to do with student performance (Wiers-Jenssen et al., 2002). For example, job-type school satisfaction would be a student's satisfaction with their performance on a project or with their grade point average. Pike's study from the University of Tennessee, Knoxville suggests that student satisfaction has a greater effect on grades than vice

versa (Pike, 1991). In other words, students who are more satisfied with school are likely to have good grades, whereas students who have good grades are not necessarily as likely to be more satisfied with school.

Current Instruments for this Measure

Satisfaction scales may be global in nature and free of context, or they may be specific to context. The Brief Multidimensional Student Life Satisfaction Scale (BMSLSS) was designed to measure adolescent life satisfaction (Zullig et al., 2009). The scale contains 5-items, each of which reflects the domains that are believed to be related to student satisfaction. When tested on a sample of sixth graders, the BMSLSS was found to have adequate internal consistency (alpha = 0.75) and inter-item reliability (alpha = 0.64 to 0.73) (Seligson et al., 2002). This scale is the refined product of a long line of scales (Haranin et al., 2007, Seligson et al., 2002, Zullig et al., 2009), each of which was shown to be a reliable and valid instrument. Over time, the original 40-item Student Life Satisfaction Scale was decreased to the 5-item BMSLSS.

The Brief Multidimensional Student Life Satisfaction Scale – College version (BMSLSS-C) (Zullig et al., 2009) seems to be the most relevant student life satisfaction scale for use with undergraduate students. Each of the seven items in the BMSLSS-C measures a dimension of life satisfaction – family life, friendships, school experience, myself, where I live, relationships, and physical appearance. Questions for the scales were either asked on a 6-point Likert type scale, or a 7-point "delighted / terrible" scale. Initial tests during scale development were concerned with reliability and validity. These tests found the scale was reliable (alpha = 0.80) and had good construct validity ($r = 0.81$, $p < 0.001$) (Zullig et al., 2009). The BMLSS-C did include one domain to measure school satisfaction (assessed with one item).

Some scales that are intended to measure consumer-type student satisfaction ask multiple questions to gauge satisfaction with various aspects of a student's university experience. However, these scales tend to be technical and extremely specific (Bhamani & Hussain, 2012, DeShields et al., 2005, Shim & Morgan, 1990). For example, the Student University Satisfaction Scale measured six dimensions of student satisfaction – learning facilities, curriculum, teaching and learning, university climate, administrative facilities, and policies and procedures. Items ranged from "I find IT [information technology] labs well equipped to meet students' need," to "I am satisfied with the toilet facilities in my university." The scale had a Cronbach's alpha statistic of 0.911, which indicates good reliability (Bhamani & Hussain, 2012). Measures of student satisfaction with school tend to be broad, as is the case with the BMLSS-C, or very specific and technical, as with the SUSS.

According to the developers of the Sense of Belonging Scale, student sense of belonging is believed to be an indicator for satisfaction with school (Hoffman et al., 2002). The scale is a 26-item inventory that assesses four factors. Even though sense of belonging can be used as an indicator of school satisfaction, the Sense of Belonging Scale does not claim to capture a complete picture of school satisfaction (Hoffman et al., 2002).

Summary and Evaluation

There is a wealth of literature about satisfaction in general and life satisfaction in particular. Valid, reliable scales have been developed to measure college student satisfaction with school, but they tend to be too broad or too specific in nature – especially the consumer-type satisfaction scales. Sense of belonging is believed to be positively related to school satisfaction, which in turn contributes to improved retention. A valid, reliable scale was

developed to measure sense of belonging in undergraduate students. Although sense of belonging may be a facet to school satisfaction, on its own it is not a sufficient indicator of school satisfaction.

Environmental psychologists have found connections between plants and satisfaction, but there have been shortcomings in the literature linking plants to student satisfaction with school. Additionally, a generalizable measure of plant interaction was not found for use in the populations addressed by the following research projects. Survey-based studies often lack information about item creation, reliability or validity. It is safe to assume that survey items that measure interaction with live plants are often developed by the investigators based on the population of interest and their own knowledge about the outdoors. Typically, information about reliability or validity is not provided, and items are not used again.

This literature review gives rise to two distinct needs within this field. First, there is a need for an inventory or inventories that reliably measure the frequency of interaction with live plants. These scales should be designed based on current knowledge, feedback from the population of interest and expert feedback. These scales should be tested for reliability and, to the extent possible, validity.

Second, there is a need to conduct more research on whether plants play a part in student satisfaction with school. This can be accomplished by conducting an experiment that compares the level of school satisfaction between students who do and do not spend time with plants. This can also be achieved by administering a large-scale survey in order to determine if the frequency that students participate in plant-based activities is related to satisfaction with school. Gaining such knowledge would inform plans to provide plant-based experiences that facilitate student satisfaction with school.

Chapter 3: High School Garden Experiment

This experiment was conducted with students from Knoxville's Austin-East High School. At the time of the study, the school required "Corrective Action" per the No Child Left Behind act. According to information gathered during the 2010 - 2011 school year, 95 percent of the students that attended Austin-East High School were economically disadvantaged. 89.6 percent were African-American (Fly, 2011). The school's graduation rate in 2011-2012 was 84 percent (pers comm Boring).

However, the graduation rate did not take into account the 15 special needs students that finished high school but were not able to receive a diploma. The graduation rate is calculated from that year's cohort. The cohort is tracked through high school. Students may be added to and subtracted from the cohort by transferring to Austin-East. According to the school's head counselor, a student may be categorized as an out-of-state transfer and removed from the cohort, but their new school from out of state never calls for the student's record. If that happens, the graduation rate might be inaccurate because some students would have slipped through the cracks (pers comm Boring).

In 2009, the average income for an individual without a high school diploma was nearly $10,000 less than a high school graduate, about $15,000 less than a person with an associate's degree, and nearly $30,000 less than an individual with a bachelor's degree ("The High Cost", 2011). If a gardening curriculum and time spent outside has a positive affect on student satisfaction, it would be a useful tool to engage students to succeed in and graduate from high school. With a high school diploma, students will be able to earn more money and break the low-income cycle. Students who develop love of gardening and the outdoors in their youth will

also be more likely to continue to seek those experiences as an adult (Asah et al., 2012, Lohr, 2004, Smith, 2005) and continue to benefit from the people-plant relationship.

Hypotheses

The purpose of this experiment was to use a quasi-experimental design with a non-equivalent control group to determine whether participation in a gardening curriculum, home gardening or the amount of time spent outdoors in general affects high school student satisfaction with school or academic performance. According to Attention Restoration Theory, when people participate in restorative environments, their attention is restored from mental fatigue that is caused by directed attention (Kaplan, 1995, Kaplan & Kaplan, 1989). The body of research supporting this theory has found that access to nature has other psychological benefits, including increased satisfaction with life, work (Kaplan, 1993), place of residence (Kaplan, 2001), and with school (Doxey et al., 2009). This body of research supports hypotheses 1, 4, and 7.

Although the main purpose of this study is to determine whether time spent with plants influences student satisfaction, satisfaction with school is believed to lead to better academic performance (Pike, 1991). Some research that supports Attention Restoration Theory has found that when students are exposed to live plants, they experience increased productivity on difficult tasks (Lohr et al., 1996). Although previous research in this field has not found exposure to live plants in a classroom setting produces significant improvement in academic performance (Doxey et al., 2009, Han, 2009), this hypothesis has not been tested under similar conditions. It is possible that 10 gardening labs during normal class time, gardening at home, or just spending time outdoors will have a stronger effect on academic performance than just the presence of plants in a classroom. This justification supports hypotheses 2, 5, and 8.

Although the main purpose of this study is to determine whether time spent with plants has an effect on student satisfaction, satisfaction with school is believed to lead to improved student retention. School attendance records will be used as a way to measure short-term student retention. These will be used to examine hypotheses 3, 6, and 9.

- **H1: Participation in a gardening curriculum will lead to increased satisfaction with school.**
- **H2: Participation in a gardening curriculum will lead to better academic performance.**
- **H3: Students who participated in the gardening curriculum will have better school attendance than students in the control group.**
- **H4: Gardening at home will be related to higher satisfaction with school.**
- **H5: Gardening at home will be related to better academic performance.**
- **H6: Gardening at home will be related to better school attendance.**
- **H7: Time spent outdoors will be related to higher satisfaction with school.**
- **H8: Time spent outdoors will be related to better academic performance.**
- **H9: Time spent outdoors will be related to better school attendance.**

Methods

This section will begin with a description of the population of interest, followed by a description of the sample. The next section will focus on experimental design and a summary description of the final instrument. The final section will describe data entry and analysis of hypotheses.

Sample

Student participants for the study were part of the University of Tennessee Human Dimensions (HD) Lab "Every Child Outdoors" garden program. The HD Lab established the garden program in 2010 through a grant from the Tennessee Department of Health (TNDOH) "Project Diabetes." Students in the experimental group were recruited from Austin-East ecology courses, and the control group was comprised of biology, history and culinary arts students. Subjects, or experimental units, for this research project were individual students from ten ecology classes, three biology classes, two history classes, and one culinary arts class.

Random sampling was not possible due to the fact the garden lab treatments were administered to whole classes during the normal school day. Two ecology teachers were willing to set aside ten classes in each semester for the garden lab treatments. The sample for the treatment group was comprised of all the students who took ecology in the semesters of interest. One biology teacher was willing to set aside two classes each semester for students to participate in the survey. Two history teachers and one culinary arts teacher were willing to set aside two classes in the spring semester for students to participate in the survey. The sample for the control group was comprised of all students who took biology in the fall and spring semesters and all students who took history or culinary arts in the spring semester.

In order to avoid an overlap between participants in the control and experimental groups, sophomore level biology was initially chosen to serve as the control. However, although this was the first year that questions pertaining to student satisfaction and academic performance had been included in the survey, it was the second year of the garden program. As a result, several former participants from the gardening program were identified in the fall "control" group. Non-science classes participated in the spring control group in order to increase the number of

participants. Two history teachers and one culinary arts teacher were willing to set aside two classes for students to participate in the survey. Although the students were not freshmen or science students, they had similar demographic backgrounds with the exception of age.

Surveying freshmen ecology students at another school for the control was considered. However, the environment and demographic background of students from another school would be more dissimilar than the aforementioned solution. The use of a control group that is similar to the treatment group in the nonequivalent control group design should help control for confounding effects, history, maturation, testing effects, and statistical regression toward the mean as threats to internal validity.

The University of Tennessee's Institutional Review Board approved research on human subjects before initial surveys. Prior to participation in the survey, student and parental consent forms were sent home with the students. Consent forms clearly stated that the survey would be anonymous and voluntary. Participation in the survey was not a prerequisite to participate in garden labs or normal classes. Both semesters combined, there were 126 students in the experimental group and 48 students in the control group, and 27 students in the persistence group who had consent to participate in the study.

Experimental Treatments

Student participants in the experimental group took part in a 10-week gardening program through their ecology classes. Treatments were administered in the fall semester of 2012 and the spring semester of 2013. Each garden lab was tied to fruits and vegetables or physical activity, and included a health component in order to satisfy criteria for TNDOH "Project Diabetes." Students in the treatment group participated in growing a vegetable garden in the school

courtyard and worked in the school greenhouse. Over the 10 weeks, lab participants learned gardening basics including:

- An introduction to gardening and garden maintenance,
- Plant parts, leaf and stem propagation,
- Seed anatomy and seed propagation,
- Plant nutrients, composting and vermicomposting,
- Aquaponic gardening,
- The water cycle and rain garden basics,
- Fruit anatomy,
- Garden planning and design,
- Transplanting and garden economics,
- Review and conclusion of ongoing garden experiments.

Lab content was determined based on grant objectives, seasonal garden needs, and the ecology syllabus. Each lab filled the entire class period. Austin-East High School followed a "block" schedule format, which meant labs were typically 1 hour and 50 minutes long. Half of the lab (55 minutes) was dedicated to gardening education, and the other half was dedicated to health education.

Survey Description

Questions for this project were added to a survey already in use for the TNDOH "Project Diabetes" study with the population. The existing survey contained 37 questions (165 items) over the following five sections: fruit and vegetables, gardening, physical activity, the outdoors, and sociodemographic characteristics. Existing sections that pertain to gardening, the outdoors,

and sociodemographic characteristics were of interest for this project. Sections about student satisfaction with school and academic performance were added to the survey for the purposes of this study (Appendix C).

The gardening section included items designed to measure whether students garden at home, garden knowledge and beliefs about gardening. The two items that measured whether students garden at home were binary "yes / no" questions. Students were asked whether or not their family grew fruits or vegetables, and whether or not they helped their family grow fruits or vegetables. The six items that measured gardening knowledge were asked on an ordinal 5-point agreement scale. The twelve items that measured gardening beliefs were asked on an ordinal 5-point agreement scale.

The outdoors section included items designed to measure time spent outdoors, outdoor activities and beliefs about the outdoors. Students were asked how much time they spent outdoors on a typical weekday and a typical weekend day. These two items were asked on a 6-point frequency scale that ranged from "None" to "4 or more hours" a day. Students were also asked the number of activities they were currently involved in outdoors. They were instructed to select one of four options that ranged from "None" to "5 or more" outdoor activities. This section included two open-ended questions, where students had to opportunity to write what they like to do most outside and to describe their last experience doing something outdoors. The eight items that measured beliefs about the outdoors were asked on an ordinal 5-point agreement scale.

The length of the existing survey resulted in a burden of response that was already fairly high for the participants in the study. The researcher had to adequately capture an exploratory measurement of student satisfaction with school without increasing the burden of response for the respondents. For this reason, students were asked only three questions pertaining to their

satisfaction with classes, their school experience, and their grades. Responses were provided on an ordinal 5-point agreement scale.

Some of the participants in the experiments were incoming freshmen who did not yet have a grade point average. Furthermore, this study was interested in measuring differences between the pre-test and post-test administrations, which would not be adequately captured by measuring a grade point average that was earned the prior semester. For this reason, students were asked to select an option on an interval scale that best describes their grades in school for the semester: mostly A's, mostly B's, mostly C's, mostly D's, or mostly F's with a "No answer" option. The question was modified from the Center for Disease Control's Coordinated School Health "Health and Academics" questionnaire (2010).

Academic performance was also measured by asking students how much time they spent studying during an average weekday and weekend day. Participants were asked to select the option that best represented the amount of time they spent outdoors on an interval 6-point frequency scale. All-in-all, three questions (six items) were added to the existing survey. The instrument that was ultimately administered to the sample of participants included 40 questions (171 items).

Survey Administration

The survey was administered to students during normal class time prior to and after the 10-week period of the garden lab treatments. The questionnaire was administered in a pen and paper format. Trained lab employees proctored the surveys in order to improve consistency of administration among different classes – particularly the control and experimental groups – and to improve survey confidentiality.

The 40-question survey began with a brief explanation about the type of questions the students would be asked. The explanation stated that all questions were voluntary and the survey was completely anonymous. Survey proctors were instructed to read the explanation aloud to ensure that all respondents were aware the survey was voluntary and anonymous. Students were asked not to write their names anywhere on the form. In order to keep track of pre- and post-test responses, students were requested to provide their student identification number, their teacher's initials, and the block number that the class was held.

Data Entry

Student identification numbers were used to identify which surveys the students' parents had consented to participate in the project. A database was created using IBM's Statistical Package for the Social Sciences (SPSS) program, version 20, and the probability level was set to $p = 0.05$. Survey responses were entered into the database by the researcher and a lab technician. Responses were correlated to identify any errors in data entry. Conflicting responses between datasets were isolated, and the student identification number was used to find the original survey and resolve the conflict. No severe outliers were identified.

Several students misunderstood the question about their grades over the past semester. Instead of selecting one response that best describes their grades, some students' selected more than one response. If three responses were selected, the middle value was entered into the database. If two responses were selected, the researcher flipped a quarter in the presence of a lab technician. If the coin landed on heads, the higher grade was entered, and if the coin landed on tails, the lower grade was entered. After data entry, the grade values were reverse coded using

the transformation function in SPSS so that higher grades would have a higher value (i.e. "Mostly A's" would have the value 5 instead of 1) and vice versa.

An account of data entry was kept in Microsoft Word. A record was made of each student identification number, actual question responses, and results of the coin toss for each instance where students selected more than one option on the question about grades. Instances of suspected satisficing were noted on the account. Only one set of responses was removed from the database. The student had turned in a pre-test with the treatment group and a post-test with the control group.

Data Analysis

The survey results were analyzed using SPSS version 21. Measures of central tendency were run on nominal background and demographic variables. Chi-squared tests were used to examine whether groups had significant differences for nominal background characteristics. Independent samples t-tests were used to examine whether groups had significant differences in continuous background characteristics.

Ordinal data was treated as continuous for the purposes of data analysis. Although this is a somewhat contentious issue, there is a precedent for treating traditionally categorical ordinal responses as continuous (Knapp, 1990). Mixed ANOVA were used to compare each group's pre-test and post-test responses [H1, H2]. These tests were used to find the amount of variance between the control group experimental groups at the pre-test, and also to determine if participation in the gardening curriculum did or did not affect student satisfaction and academic achievement.

Shapiro-Wilk tests of normality indicated the percentage of school days students attended school that year violated normality. Furthermore, the attendance data failed to follow the reference line in a quantile-quantile (Q-Q) plot, even after transformation. For this reason, non-parametric Mann-Whitney tests were used to compare the percentage of school days students attended school that year for students in the control group and treatment group [H3].

Independent samples t-tests were used to compare responses between students that reported gardening at home and students that did not report gardening at home [H4, H5]. Non-parametric Mann-Whitney tests were used to compare the percentage of school days students attended school that year for students who did and did not garden at home [H6].

Shapiro-Wilk tests of normality were run on each of the variables that would be correlated. Each of the test statistics were found to be statistically significant, indicating a violation of normality. Furthermore, the statistic values were all below .97, which is the optimum cut off point for the sample size (Kundu et al, 2011). However, the data – with the exception of attendance – closely followed the line in a Q-Q plot, indicating sufficient normality for the use of parametric tests. Therefore, Pearson correlations were used to examine whether the amount of time spent outdoors was related to school satisfaction [H7] and academic performance [H8]. Non-parametric Spearman correlations were used to examine whether the amount of time spent outdoors was related to school attendance [H9].

Results

Participant Characteristics

There were 152 students remaining in the survey sample for analysis. These students had parental permission to participate in the study. The experimental group included 87 students, the

control group included 38 students, and the persistence group included 27 students. The persistence group was excluded from analysis of hypotheses because of frequent problems with sparse data.

The treatment and control groups did differ in some aspects. Groups differed significantly in age, t (48.86) = - 8.47, $p < 0.001$. On average, students in the experimental group (mean = 14.59 years, SD = 0.74) were almost two years younger than students in the control group (mean = 16.31 years, SD = 1.12) (Table 1). Grade levels differed significantly between groups, χ^2 (6, 142) = 177.06, $p < 0.001$. The majority of the students in the treatment group identified themselves as freshman (90.1%), while most of the students in the control group were juniors (64.9%) or sophomores (21.6%) (Figure 1).

Although there were some differences between the control and experimental group, there were more similarities than differences. There were not any significant differences between groups in gender, ethnicity, or type of residence. All in all, there were more females surveyed (n = 74) than males (n = 66) (Table 2). The majority of participants identified themselves as black or African American (71.4%). Only 14 percent of the sample consisted of white participants, with even fewer participants that identified themselves as another ethnicity (Figure 2). Groups did not differ significantly in what type of residence they lived in. The number of students that lived in a house (76.6%) was nearly three times the amount that lived in an apartment or condo (21.2%) (Table 3).

Analysis of Hypotheses

There was not a significant change in student satisfaction with school between the pre-test and the post-test for either the experimental or the control groups [H1]. However, there was

a significant difference between student satisfaction in the control and treatment group ($p = 0.01$). Students in the experimental group, on average, reported higher satisfaction with classes (mean = 4.03) than students in the control group (mean = 3.42). There was not a significant change in academic performance between the pre-test and the post-test [H1]. The control and the treatment group did not differ significantly in the percent of school days attended in the academic year [H3]. Gardening at home was not significantly related to school satisfaction [H4], academic performance [H5], or attendance for the school year [H6].

There were some significant relationships between time spent outdoors and satisfaction with school [H7]. Time spent outdoors on weekdays was weakly correlated ($r = 0.20$, $p < 0.05$) to satisfaction with school experience. Time spent outdoors on weekend days was weakly correlated with satisfaction with classes ($r = 0.27$, $p < 0.01$) and satisfaction with school experience so far ($r = 0.32$, $p = 0.001$) (Table 4). There were some significant relationships between time spent outdoors and academic performance [H8]. Time spent outdoors on weekdays had a moderate, positive relationship to time spent studying on weekdays ($r = 0.21$, $p < 0.05$) and time spent studying on weekend days ($r = 0.26$, $p < 0.01$). Time spent outdoors on weekend days was moderately correlated to time spent studying on weekend days ($r = 0.27$, $p < 0.01$). There was a significant relationship between time spent outdoors and school attendance [H9]. Time spent outdoors on weekend days was actually negatively related to attendance for the school year ($r = -0.20$, $p < 0.05$) (Table 5).

Discussion

The nonequivalent control group design was the only option for this study. Groups were similar in many aspects, including ethnicity and gender, and they attended the same school.

However, the differences in age and grade might have confounded the effects of the garden lab treatment. In the future, it would be beneficial to find a more similar control group if it is possible. Additionally, future surveys should be more concise to reduce the burden of participation, test-taker fatigue, and to improve the quality of responses.

With one exception, participation in the school garden labs and edible gardening at home were not necessarily related to student satisfaction in school [H1, H4] or academic performance [H2, H5]. The differences that were found could have been due to the gardening treatment, or they could have been due to differences between the control and the experimental groups. The goal of the gardening labs was to use edible gardening as a way to prevent diabetes. Perhaps if the focus of the labs was limited to general gardening techniques instead of gardening for health, there would be a stronger relationship to school satisfaction. Furthermore, future questionnaires should measure whether or not students do other sorts of gardening activities at home beyond growing fruits and vegetables. A scale that is designed to measure the level of student interaction with plants would be a helpful way to measure the kind of plant-related activities students might be doing beyond the garden labs.

Time spent outdoors was often related to school satisfaction [H7] and some measures of academic performance [H8]. Although there were two open-ended questions designed to explore what students did outdoors, participants' responses did not provide an adequate description of their outdoor activities. In the future, there should be probing, closed-ended questions to measure what exactly students are doing outdoors. The results of this study indicate that it would be beneficial for schools to provide opportunities for their students to spend time outdoors during the normal school day.

Although students in the treatment group did have better attendance for the school year than students in the control group [H3], this could be attributed to differences in age and grade level rather than participation in the garden lab treatment. There was no relationship between home gardening and school attendance [H6]. There was actually a negative relationship between time students spend outdoors and school attendance [H9]. For the purposes of this experiment, the only attendance data available was for the overall school year. In the future, additional attendance information should be gathered for the semester in question or for the time period between pre- and post-tests. In addition to overall school attendance, it would be worthwhile to collect attendance data for the class that the student is surveyed in as well. More detailed, specific attendance data would be a more sensitive way to gauge effects of the garden lab treatment.

All-in-all, these findings could justify the statement that there is no relationship between school gardening or home gardening and student satisfaction or academic performance. However, time spent outdoors was related, in some ways, to satisfaction with school and academic performance. It is the belief of this researcher that the results are inconclusive. It would be worthwhile to repeat the experiment with the changes that have been recommended in this section before coming to a final conclusion.

Furthermore, the researcher experienced the students' responses to being outdoors firsthand during the garden lab treatments. Although statistics and numerical results are necessary in many scientific studies and to justify educational policies, there is no substitute for observing the look of joy on a student's face when they learn they get to go outside in the sunshine during class, probably for the only time that week. Primary schools should provide outdoor opportunities for students, not only because time outdoors is related to satisfaction with

students' school experience and time spent studying, but also because these types of experiences would be desirable for teachers as well. It would be worthwhile to conduct a national survey to determine student, teacher and administrator perceptions of holding class outdoors.

Chapter 4: Undergraduate Study

Once again, this study had two purposes. The first purpose was to create reliable measures of undergraduate activity with live plants and of their enjoyment of those activities. Prior research in the field of environmental psychology has used surveys to measure these constructs (Kaplan, 2001, Lohr & Pearson-Mims, 2005). However, in those studies items were generated for the specific population of interest, and were not intended for use across studies or populations. A reliable instrument that can be used for similar populations across multiple studies would be a useful tool in this field.

The second purpose was to use a web survey to determine whether the level of undergraduate engagement in activities with plant life influences their level of satisfaction with school. If student interaction with live plants is related to school satisfaction, institutions of higher education may be more interested in supporting and developing restorative outdoor spaces and opportunities to engage in plant-based activities. In turn, this may contribute to other positive outcomes including student retention and possibly even better academic performance.

Hypotheses

The following hypotheses were developed on the basis of a literature review and an understanding of relevant psychological theory. According to Attention Restoration Theory, people who participate in restorative environments will experience psychological benefits (Kaplan, 1995, Kaplan & Kaplan, 1989). Students who spend time interacting with living plants could be said to be participating in a restorative environment, which would reduce mental fatigue and restore attention capacity. Theory supports the idea that frequency of both active and

passive (observational) interaction with live plants yields positive psychological benefits (Kaplan, 1984). Research that contributes to Attention Restoration Theory shows that satisfaction with work, place of residence and life is one of the positive outcomes of participation in a restorative environment (Kaplan, 1983, 2001). This knowledge supports hypotheses 1 and 2.

Although active and passive interaction with plant life are two domains within attention restoration theory, theory does not give more weight to one than the other. However, research of restorative landscapes has shown that people respond more positively to some landscape qualities than others (Kaplan, 1984). Research of how active and passive interaction with plants affects attitudes has found that active interaction tends to have a more positive, statistically significant relationship to environmental attitudes than passive interaction (Lohr & Pearson-Mims, 2005). Therefore, students who seek out the experience of being around live plants are expected to experience reduced mental fatigue and increased attention restoration, which will in turn lead to positive psychological outcomes, including satisfaction with school. This knowledge is the foundation for hypotheses 2 and 5.

The measures of active and passive interaction are limited to a specific set of activities. However, students may be spending time outdoors in ways that are not defined by the active and passive plant interaction scales. Although the type of outdoor environment is not specified, there might still be natural elements that contribute to attention restoration and reduce mental fatigue (Kaplan, 1985, 1989). For this reason, it is expected that when students spend time outdoors in general, they will be more satisfied with school than students who do not spend time outdoors. This supports hypotheses 3 and 6.

If spending time with live plants reduces mental fatigue and improves attention restoration, it would be expected that this would also lead to better academic performance.

Support for this idea has differed in the literature. One experiment found students who did a difficult computer task in the presence of live plants in a windowless environment had higher productivity than students who did the same task in a similar environment without plants (Lohr et al., 1996). Another found that undergraduates who had live plants in their classroom the entire semester did not have significantly higher grades than students who did not have plants in their classroom (Doxey et al., 2009). However, going from the framework of Attention Restoration Theory, one could logically expect students who spend more time with live plants to experience positive psychological outcomes which lead to better academic performance. This supports hypotheses 4, 5 and 6.

Hypothesis 7 rests on the valence component outlined by Expectancy Theory. Students who find the idea of either actively or passively interacting with live plants to be attractive, desirable, of importance, etc., will be more likely to pursue the outcome of spending time with live plants.

- **H1: Time spent with plants will be positively related to satisfaction with school**
- **H2: Active interaction with plants will have a stronger relationship to student satisfaction with school than passive interaction with live plants.**
- **H3: Time spent outdoors will be positively related to satisfaction with school.**
- **H4: Time spent with live plants will be positively related to academic performance.**
- **H5: Active interaction with live plants will have a stronger relationship to academic performance than passive interaction with live plants.**
- **H6: Time spent outdoors will be positively related to academic performance.**
- **H7: Students who enjoy being around live plants will spend more time around living plants.**

Methods

This section will begin with a description of the population of interest, sampling frame, sample size and sampling procedures. The next sections will focus on the survey design, construction, testing and summary description of the final instrument. The following section will discuss survey administration and implementation. The final section will describe data entry, scale development and analysis of hypotheses.

Sampling Methods

Target Population

Although it would be desirable to generalize to all undergraduate students, for the purposes of this study, the scope has been reduced to the undergraduate students who are enrolled in institutions of higher education in the greater Knoxville area. The reason for this is that the primary investigator is located at the University of Tennessee, Knoxville. The sample included students who were enrolled in two community colleges and a public university in the summer semester of 2013.

Further qualifications for the target population were that the students had to be currently enrolled, degree-seeking undergraduate students. There were not enough full-time students enrolled at Pellissippi State (PSCC) and Roane State (RSCC) in the summer semester to meet the needs of the survey. For this reason, the requirements for the schools were reduced to currently enrolled, degree-seeking undergraduate students. Graduate and doctoral students were not included in the sample. It is hoped that imposing these qualifications for participation limited the variation in answers that would be caused by including students who were not pursuing a degree, or pursuing a different type of degree (associate's, master's, etc.).

Sample

The sample included students who were enrolled in two Knoxville area community colleges - Pellissippi State Community College and Roane State Community College - and a public university - the University of Tennessee, Knoxville (UTK). Recruiting students from more than one institution would provide more diverse results, which would be helpful in refining items to create scales that are more generalizable across schools. Broader sampling would also provide richer, more generalizable results.

Sample Frame

Each school provided a list of undergraduate students who met the criteria for participation. The list included names and contact information of each eligible student. The registrar office for each school sent their sample frame in Microsoft Excel via email. The schools might have differed as to how up-to-date their lists were. However, each school said the lists were based on information that was updated at the beginning of the summer semester.

Sampling Procedures

At least 100 responses were required to conduct a principle components analysis, although 300 is generally agreed as the number that is ideal for this type of analysis (DeVellis, 2012, Furr & Bacharach, 2013). Previous web surveys of undergraduates that were conducted by this researcher yielded a 10 percent response rate, so 1000 students were randomly selected from each of the three sample frames. Since only 963 Pellissippi State students were eligible for the study, the final sample size was 2,963.

Scale Design and Construction

Construct Definition

For the purposes of this project, it was desirable to measure the amount of time students spend with plants and the level of enjoyment they have for these activities. Students were asked about a variety of activities that literature review, expert feedback, and focus groups have defined as having the potential to be in environments that contain plants. These activities were divided into two groups: active and passive interaction. "Active" interaction refers to experiences where students sought out the experience of being around plants (e.g. gardening). "Passive" interaction refers to activities where students did not seek out the experience of being around plants, but it is likely there was a high level of surrounding plant life (e.g. hiking, camping).

Methods of Item Creation

The first step of item creation was a review of available literature pertaining to measurement of interaction with plant life. Many items appeared to have been created for each study's population of interest and were not transferrable to this study. Based on the literature review, it was determined that defining the constructs of active and passive interaction with plant life would be necessary (Lohr & Pearson-Mims, 2005, Lohr 2004, Kaplan, 1984). Brainstorming was used to create two preliminary sets of items – a frequency scale and a likert agreement scale -- for each type of interaction. Qualitative information gathered during pretesting was instrumental in further development of the items. Results of this survey will be used refine the scales to only include items that are useful in measuring these constructs.

Pretesting

An informal pretest of the instrument included members of the target population (n = 15), graduate students (n=9) and experts in the field of environmental psychology, sociology, and education psychology (n=4). Members of the population were a convenience sample of University of Tennessee plant sciences undergraduate students. The pretest was used to develop the items pertaining to interaction with plant life and to improve question clarity and survey format. Frequency and agreement scales intended to measure interaction with plant life were followed by an open-ended item where participants listed other activities they engage in outdoors and with plants. Responses were divided by themes and items in a content analysis (Appendix D), which was used to add items to the plant interaction scales.

Survey Administration

Due to time and financial restrictions of the researcher, the pilot survey was administered in an online format. Each school provided a list of official student emails for the desired samples. The list of email addresses was compiled into an email listserv. The online survey application Qualtrics was used for survey administration, and the survey link was emailed to the sample population through university email.

A lottery incentive was offered in the hopes that would increase the response rate (Bosnjak & Tuten, 2003). Participants who completed the survey within the first day or first week were entered in a drawing to win one of two gift cards. Survey completion was necessary in order to enter the lottery. An impartial third party from the University of Tennessee's Office of Information Technology selected lottery winners, and identifying information was deleted from the researcher's Qualtrics account following the drawing.

Similar items were grouped on one web page instead of asking questions individually. The survey itself was 5 web pages (Appendix E). A reminder email was sent to students 6 days after the initial contact. The response rate was poorer than expected. The overall response rate was a mere 6.24 percent (2.8% PSCC, 8.8% RSCC, and 7% UTK). However, there were 185 responses, which was sufficient for principal components analysis and tests of reliability.

Data Analysis

The data was downloaded from the Qualtrics web survey application into IBM SPSS 21 statistical software package, and the probability level was set at $p = 0.05$. Measures of central tendency were conducted on demographic variables to learn about respondent characteristics. A new variable was computed to separate participants by type of school – public university or community college. Chi-squared tests were used to determine whether there were differences among nominal background characteristics for each institution type. A one-way analysis of variance (ANOVA) was used to determine whether there were differences between continuous background characteristics for each institution type.

Each scale item's skewness and kurtosis values were examined before conducting factor analysis. Principal components analysis (PCA) was conducted on each of the four scales to determine the number of factors that contribute to the overall scale. Once components were identified, each scale and subscale was subjected to the Cronbach's alpha test of inter-item reliability. It was not possible to conduct statistical tests of validity, so face validity was used for each scale and subscale. Based on these analyses, composite scores were created for each scale and subscale.

Ordinal response variables were treated as continuous data for statistical analyses (Knapp, 1990). A one-way ANOVA was used to determine if there were differences in plant interaction scores, school satisfaction, and academic performance among grade levels. Tukey Honest Significant Difference (HSD) tests were used to examine statistically significant differences between group means. An independent t-test was used to determine if there are differences in interaction with plant life, school satisfaction, and academic performance by gender and school types. Pearson correlations between continuous variables and composite scores were used to test hypotheses. Nonparametric Spearman correlations were used to examine Pearson correlations.

Although composite scales are one way to test hypotheses, there was a concern about validity of only using composite scales. For instance, if a person reported gardening daily, but reported never doing any of the other items on the "common" active frequency subscale, their composite score for the subscale would be lower (mean = 2.0) than someone who reported doing each activity "every few months" (mean = 3.0). For this reason, responses for each scale and subscale were sorted into three groups. Those who reported doing one of the activities on a scale or subscale one or more times a week were placed in the group "Once a week to daily." Those who reported doing activities on the scale, but none more frequently than once a week, were placed in the group "Once a year to once a month." Those who reported never doing any of the activities in a scale or subscale were placed in the group "Never."

One-way analyses of variance (ANOVA) were used to determine if these three groups differed in terms of satisfaction with school or academic performance. If there was an instance where none of the participants reported doing one of the above categories, an independent

samples t-test was used instead of ANOVA. The results of these analyses paralleled those found by examining the composite scales, and for this reason are not included in this paper.

Results

Participant Characteristics

More than half of the participants were enrolled in a community college (62.2%). Most of the participants were sophomores (38.5%), and fewer than 10 percent of the respondents identified themselves as freshman. The grade level of respondents differed significantly across institution, χ^2 (4, 182) = 58.34, $p < 0.001$. Most of the participants that were enrolled in a community college were sophomores (54.5%), whereas most of the university participants were seniors (45.7%) (Figure 4).

On average, the participants were enrolled in 9.45 credit hours during the semester of the survey. The number of credit hours students were enrolled in did not significantly differ between school types. Respondents had attended their current institution for an average of 5.7 semesters including the semester of the survey. Groups did differ significantly in how long they had attended their current school, F (1, 174) = 14.082, $p < 0.001$, with university students reporting being in their school longer (mean =7.40 semesters) than community college students (mean = 4.66 semesters).

Source of funding for tuition did differ significantly between school types, χ^2 (4, 182) = 38.87, $p < 0.001$. Most of the community college students were primarily funded by a scholarship or grant (46.9%), whereas most of the university students' parents or another family member (43.5%) paid their tuition (Figure 5).

On average, survey participants were 27 years old, although the mode was 20 years of age. There were significant differences is mean age between groups, F (1, 176) = 2.237, $p < 0.001$. Community college participants tended to be older (mean = 30 years, SD = 11.08) than university participants (mean = 23.23 years, SD = 4.71). Most of the respondents identified themselves as female (68.6%). Gender did differ significantly between school types, χ^2 (1, 181) = 21.16 = $p < 0.001$. The university participants were evenly distributed (50% female), whereas most of the community college participants were female (82.3%).

Many of the students lived in a house (67.6%) or an apartment (28.1%). The type of residence was significantly different between school types, χ^2 (3, 182) = 30.21, $p < 0.001$. Most of the community college students lived in a house (81.4%), while the university students were split between living in a house (47.8%) or an apartment (50.7%) (Figure 6).

Active Enjoyment Scale Development

Description of PCA

Frequencies were run on the twelve items that were designed to measure student enjoyment of active plant activities. Skewness and kurtosis values were within the acceptable range to justify a principal components analysis. Since there were few missing cases (n = 4), cases in the PCA were excluded pairwise instead of listwise. All twelve of the items were correlated at least .3 with one or more other items, which suggested good factorability. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was also good at 0.89. Bartlett's test of sphericty was significant (χ^2 (66) = 1791.26, $p < 0.001$). The commonalities were all greater than .3, which confirmed that variance was shared among some items. These statistics indicated that a principal components analysis would be suitable for items in the scale.

Summary of PCA Results

In the PCA, there were only two factors that had Eigenvalues greater than 1. Initial eigenvalues reported indicated that the first two factors explained 56.9 percent and 13.3 percent of the variance. Understanding of theoretical underpinnings of items suggested that factors would not be orthogonal. This suspicion was confirmed by correlating the regression coefficients. For this reason, an oblimin rotation was used.

Ten of the twelve items loaded highest on the first factor, and three shared variance with the second factor. The two items that loaded highest on the second factor did not correlate as highly with the other items in the correlation as the other ten items did. Although the reliability of the scale with all twelve items was relatively high (alpha = 0.92), it was improved by removing the two items that loaded highest on the second factor (alpha = 0.94). Therefore, the two items (mowing grass and tree climbing) were removed from the scale.

Final Solution of PCA

A univariate, one factor solution with the ten remaining items explained 65.74 percent of the variance. Further, the KMO was raised to 0.92, and Bartlett's Test of Sphericity was still significant with 21 fewer degrees of freedom ($df = 45$). The one factor solution was preferred because it was more parsimonious and made more sense statistically than the two-factor solution (Table 6).

Active Frequency Scale Development

Description of PCA

Frequencies were conducted on the twelve items that measured active plant interaction, which showed the skewness and kurtosis values were within an acceptable range for PCA. There were not many missing cases (n = 8) for items in the scale, so cases in the PCA were excluded pairwise instead of listwise. All twelve of the items were correlated at least 0.4 with at least one other item, which suggested good factorability. The KMO measure of sampling adequacy was also good at 0.87. Bartlett's test of sphericty was significant (χ^2 (78) = 1163.84 $p < 0.001$). The commonalities were all greater than .3, confirming that variance was shared among some items. This analysis indicates principal components analysis would be suitable for the items in the scale.

Summary of PCA Results

There were three factors in the PCA that had Eigenvalues greater than 1. Initial eigenvalues reported that the first three factors explained 64.96 percent of the variance, with the first component explaining 43.05 percent of the variance, and the second 12.91 percent, and the third 9 percent. Understanding of theoretical underpinnings of items suggested that factors would not be orthogonal. This suspicion was confirmed by correlating the regression coefficients. The correlations between these coefficients suggested that the items were related to each other, and an orthogonal rotation would not be appropriate. For this reason, an oblimin rotation was used.

PCA was run with an oblique rotation for a four, three, two and one factor solution. In the two-factor solution, nine items loaded onto the first component and five factors loaded onto

the second component. The item "work with plants indoors" was the only one that loaded on both components. Factor loadings for each component were typically greater than 0.4. Factor loadings improved with the four-factor solution, and the rotation converged in five iterations. Loadings were similarly acceptable for the three and one-factor solution, although only two items loaded on the third component for the three-factor solution.

Final Solution of PCA

The three, two or one-factor solutions would each have been acceptable. Each solution had adequate loadings, was easy to explain theoretically, and had identical KMO and Bartlett's Test of Sphericity statistics. The two-factor solution was preferred to the univariate solution because it explained more variance and provided a better level of detail (Table 7). It was also preferable to the three-factor solution because an insufficient number of items loaded on the third component.

Items that loaded onto the first component were more common, familiar traditional gardening activities, including "Pick vegetables" and "Pick flowers". All of the items on the first component were highly and significantly correlated. The items that loaded onto the second component were activities that plant enthusiasts would probably do rather than the general public, including "Visit a public garden" and "Work with plants as a volunteer." These items were typically moderately correlated. All of the correlations were significant.

Passive Enjoyment Scale Development

Description of PCA

Frequencies were run on twenty-six items designed to measure the level of student enjoyment of passive plant experiences. Skewness values were within the acceptable range to justify a principal components analysis. Kurtosis levels were a bit high for some of the items, which suggested the possibility of an outlier or non-normal data. However, for the purpose of this project, kurtosis was acceptable enough to justify a PCA. There were not many missing cases (n = 5) for items in the scale. For this reason, cases in the PCA were excluded pairwise instead of listwise.

All twelve of the items were correlated at least .3 with at least one other item, which suggested good factorability. The Kaiser-Meyer-Olkin measure of sampling adequacy was also good at .91. Bartlett's test of sphericty was significant (χ^2 (325) = 3121.4, $p < 0.001$). The commonalities were all greater than .5, which confirmed that variance was shared among items. These statistics justified the use of PCA on items in the scale.

Summary of PCA Results

There were five factors in the PCA that had Eigenvalues greater than 1. Initial eigenvalues indicated that the first three factors explained 44 percent, 7.5 percent and 6.7 percent of the variance, respectively. Understanding of theoretical underpinnings of items suggested that factors would not be orthogonal. This suspicion was confirmed by correlating the regression coefficients. For this reason, an oblimin rotation was used.

PCA was run with an oblique rotation for a five, four, and three factor solution. In the five-factor solution, four items loaded on the fifth factor and five items loaded on the fourth

factor, and there were several instances of cross loadings. Factor loadings improved with the four-factor solution. There were fewer instances of cross loading and the rotation converged in 9 iterations. Loadings improved further with the three-factor solution, with only four instances of cross loading. The rotation converged in 8 iterations.

Final Solution of PCA

A three-factor solution explained 58.23 percent of the variance. Fourteen items loaded onto the first component, with two items also loading on the second component and one item also loading on the third component. Nine items loaded onto the second component, with one item also loading on the third component. Six items loaded onto the third component. The three-factor solution was preferred because it was more parsimonious and easier to explain theoretically (Table 8).

The items that loaded onto the first component were mostly familiar, non-endurance outdoor activities. These items included "Eat or drink outdoors," "Relax outdoors," and "Go fishing." Although there may be some effort involved in participating in the activities that loaded on the first component, they do not typically require sustained effort. Items that loaded onto the second component required endurance, such as "Play team sports outdoors," "Exercise outdoors," and "Work outdoors as part of a paid job." Items that loaded onto the third component were all activities that could be done indoors, but participants chose to do outdoors. These items included "Write or journal outdoors," "Read outdoors," and "Nap outdoors." For each component, all of the items were at least moderately, significantly related to each other. Many were highly correlated.

Passive Frequency Scale Development

Description of PCA

Frequencies were run on the twenty-six items designed to measure frequency of passive plant activities. Skewness values were within the acceptable range to justify a principal components analysis. Kurtosis levels were a bit high for two of the items, which suggested the possibility of an outlier or non-normal data. However, for the purpose of this assignment, kurtosis was acceptable enough to justify a PCA. There were not many missing cases (n = 4) for items in the scale, so cases were excluded pairwise instead of listwise.

Items had good factorability, as all twelve of the items were correlated at least .4 with at least one other item. The KMO measure of sampling adequacy was also good at 0.85. Bartlett's test of sphericty was significant (χ^2 (325) = 1537.01, $p < 0.001$). The commonalities were all greater than .42, which confirmed that variance was shared among items. These statistics indicate that a principal components analysis would be suitable for items in the scale.

Summary of PCA Results

In the PCA, there were seven factors that had Eigenvalues greater than 1. Initial eigenvalues reported the first factor explained 26.51, the second factor explained 8.55, the third factor explained 6.91, the fourth factor explained 5.66, and the fifth factor explained 4.77 percent of the variance. Understanding of theoretical underpinnings of items suggested that factors would not be orthogonal. This suspicion was confirmed by correlating the regression coefficients. For this reason, an oblimin rotation was used.

PCA was run with an oblique rotation for a seven, six, five, four and three factor solution. In the seven-factor solution, there were many instances of cross-loading and mixed loadings.

The item "Kayak, canoe or other boating activity" loaded on three components, but did not have any loadings that were greater than or equal to 0.4. When the item was deleted, the Kaiser-Meyer-Olkin measure of sampling remained the same. Bartlett's test of sphericty was still significant with 25 fewer degrees of freedom (df = 300). Without the item, only six components were found to have eigenvalues greater than 1. However, the six factor solution also had many instances of cross-loading and mixed loadings.

The loadings of items on each factor improved with the five-factor solution. There was only one instance of mixed loading, although some cross-loading persisted. The rotation converged in 24 iterations. Loadings and cross-loading did not improve on the four-factor solution, although there was only one instance of mixed loading. Rotation converged in 17 iterations. The problem of cross-loading worsened in the three-factor solution, which had seven instances of loading on two or more factors. The rotation converged in 20 iterations.

Final Solution of PCA

A five-factor solution explained 53.27 percent of the variance. Six items loaded onto the first component, with two items also loading on the third component. Five items loaded onto the second component, with one item also loading on the third component. Seven items loaded onto the third component, with one item cross-loading on the fifth component. There was one instance of mixed-loading on the third component. Five items loaded onto the fourth component, with one item also loading on the fifth component. There was one instance of mixed loading. Seven items loaded on the fifth component. The five-factor solution was preferred because it was easier to explain theoretically (Table 9).

The items that loaded on the first component all involved outdoor relaxation. Some items included "Nap outdoors," "Listen to music outdoors," and "Relax outdoors." The items that loaded on the second component all required some amount of endurance and sustained activity. Some items included "Jog outdoors," "Exercise outdoors," and "Do volunteer work outdoors." The items that loaded on the second component were familiar outdoor activities that may require some effort, but may not necessarily require much endurance. Some items included "Walk outdoors," "Walk with, exercise with, or play with a pet outdoors," and "Go exploring or sightseeing." There was one instance of mixed loading on the third component – "Swim outdoors" had a positive loading, whereas the other items each had negative loadings. The items that loaded on the fourth component were activities the participants could have done indoors but chose to do outdoors. These activities included "Read outdoors" and "Draw or paint outdoors". The item "Work outdoors as part of a paid job" loaded negatively on the fourth component. The reason for this is probably because if working outdoors is a person's job, they do not have as much freedom to choose to do work activities outdoors. The items that loaded on the fifth component all had to do with more traditional outdoors activities. Some items included "Hike outdoors," "Go camping," and "Go fishing."

Reliability Analysis

A factor label was unnecessary for the active plant enjoyment scale, as it had a univariate solution. Reliability was excellent, with the unstandardized Cronbach's alpha value of 0.94. A composite score was created for this scale for later statistical analyses.

Because the remaining three PCAs were run with an oblique rotation, tests of reliability for the remaining scales were done on the three subscales and on the scale as a whole. The

reliability of the active frequency scale altogether was good (alpha = 0.88). Inter-item reliability for the overall scale could be improved by removing "Climb trees" and "Mow grass". The reliability for the first component – "Common" – was very good (alpha = 0.89). Although alpha could have been improved (alpha = 0.91) by removing "Mow grass," the item was left in the subscale. The reliability of the second component – "Rare" – was fair, with the unstandardized Cronbach's alpha value of 0.71. Alpha could not be improved by removing any items from the subscale.

The reliability for the passive plant enjoyment scale altogether was excellent (alpha = 0.94). Reliability could not be improved for the scale as a whole by deleting any items. The reliability for factor one - "Non-Endurance" - was good, with the unstandardized Cronbach's alpha value of 0.92. Alpha could be improved by removing one item "Go fishing" from the subscale. The reliability for factor two - "Endurance" - was good (alpha = 0.90). Alpha could not be improved by removing any items from the subscale. The reliability for factor three – "Choice" - was good with the unstandardized Cronbach's alpha value of 0.86. Alpha could not be improved by removing any items from the subscale.

The reliability of the overall passive frequency scale was good (alpha = 0.87). The reliability of factor one – "Relaxation" – was fair, with the unstandardized Cronbach's alpha value of 0.78. Inter-item reliability could not be improved by removing any items from the subscale. The reliability of the second component – "Endurance" – was also fair (alpha = 0.75). Reliability could not be improved by removing any items. Before calculating reliability for the third factor – "Non-Endurance" – the item "Swim outdoors" had to be reverse coded, because it loaded positively on this component, whereas the other items loaded negatively. The subscale had fair reliability (alpha = 0.65), and alpha could have been improved by removing "Swim

outdoors" from the analysis. The fourth component – "Choice" – also had an instance of mixed loading. The item "Work outdoors as part of a paid job" was reverse coded for the analysis. Reliability was fair (alpha = 0.65), and could have been improved (alpha = 0.75) by removing "Work outdoors as part of a paid job" from the analysis. The fifth component – "Great Outdoors" – had fair reliability (alpha = 0.68). Alpha could have been improved (alpha = 0.71) by removing "Work outdoors as part of a paid job" from the analysis. No items were removed from this scale or the subscales at the time of the study.

Validity Analysis

Statistical tests of validity were not conducted at this time. The reason is that prior to principal components analysis, the scales were only known to measure frequency and enjoyment of active and passive plant activities. There were not any adequate, albeit global, measures that could be used for tests of convergent validity. In the future, there may be scales or subscales that would be appropriate to correlate with components of the passive plant enjoyment scale.

These scales were developed under the guidance of experts in the fields of environmental psychology, public horticulture, and plant sciences. Further feedback was gathered during the national conference for the American Society of the Horticultural Sciences (2013). Feedback gathered from the committee and the conference showed that overall, none of the experts in these fields disagreed that these items were adequate measures of the constructs, and the test was appropriate for the population of interest. Although statistical tests of validity are recommended in the future, these scales do seem to have an adequate level of face validity given this stage of scale development.

Group Differences

Grade

The independent and dependent variables were examined to see whether they differed significantly across grade levels. Students across grade levels did not differ significantly in their responses to the plant interaction scales and subscales. There were significant differences between satisfactions with grades between each group, F (4, 176) = 4.48, $p < 0.01$. Post hoc comparisons using the Tukey HSD test indicated that the mean scores for juniors (mean = 4.64, SD = 1.52) were significantly different from freshmen (mean = 5.94, SD = 0.90) and students who classified themselves as some other grade (mean = 6.0, SD = 0.74). Grade point average differed significantly between groups, F (4, 165) = 4.46, $p < 0.01$. Post hoc comparisons using Tukey HSD found seniors' grades (mean = 3.09, 0.46) were significantly different from students who identified themselves as some other grade (mean = 3.54, SD = 0.41). Groups did not differ in terms of time spent studying during week and weekend days.

School Type

School type was examined to determine whether it had an influence on the dependent variables. Community college and university student did differ significantly in terms of grades, t (168) = 5.16, $p < 0.001$. On average, community college students reported higher grades (mean = 3.44 G.P.A., SD = 0.4) than university students (mean = 3.06 G.P.A., SD = 0.4). Groups also differed in terms of how much time they studied on weekend days, t (181) = 2.76, $p < 0.01$. Community college students (mean = 5.71, SD = 3.01) tended to study more frequently on weekend days than university students (mean = 4.57, SD = 2.12). Groups differed significantly in terms of satisfaction with classes so far, t (127.14) = 4.04, $p < 0.001$, college experience, t

(180) = 3.59, $p < 0.001$, and grades, t (180) = 5.12, $p < 0.001$. In each instance, community college students were significantly more satisfied with school than the university students.

School type was also examined to see if it influenced the independent variables. Groups did differ significantly in active plant enjoyment, t (132.56) = 3.19, $p < 0.01$. Community college students (mean = 4.99, SD = 1.5) enjoyed active plant interaction more than university students (mean = 4.2, SD = 1.7). The test was also significant for the "non-endurance" component of the passive plant enjoyment scale, t (107.88) = 2.14, $p <0$ .05. On average, community college students (mean = 5.89, SD = 0.84) enjoyed "non-endurance" activities more than students from the public university (mean = 5.53, SD = 1.25). There was only one significant difference for passive plant enjoyment, t (181) = 2.34, $p < 0.05$. Community college students (mean = 5.89, SD = 0.84) enjoyed "non-endurance" activities more than university students (mean = 5.53, SD = 1.25).

Groups also differed in active plant frequency, t (180) = 3.91, $p < 0.001$. Community college students (mean = 2.71, SD = 1.1) tended to engage in overall plant activities closer to "every few months," whereas university students (mean = 2.09, SD = 0.94) tended to engage in these activities about "once a year." There were also significant differences between groups on the "common" subscale, t (166.84) = 4.58, $p < 0.001$. On average, community college students (mean = 3.06, SD = 1.35) as a group engaged in activities on this subscale "every few months," whereas university students (mean = 2.23, SD = 1.09) only engaged in these activities about "once a year." There was only one significant difference found between groups for passive plant frequency, t (147.91) = -2.63, $p < 0.01$). Community college students (mean = 2.9, SD = 1.26) engaged in "endurance" activities less frequently than university students (mean = 3.4, SD = 1.24).

Gender

Gender was examined to see if responses to the independent and dependent variables differed between men (n = 54) and women (n = 127). Satisfaction with grades did differ between groups, t (178) = - 3.799, with males (mean = 4.63, SD = 1.69) tending to be less satisfied with their grades than females (mean = 5.56, SD = 1.41). Grade point average was found to be significantly different between groups, t (167) = -2.5, p = 0.01. Females (mean = 3.36 G.P.A., SD = 0.47) tended to report higher grades than males (mean = 3.15 G.P.A., SD = 0.5).

Significant differences were found between groups for overall enjoyment of active plant interaction, t (85.71) = -4.65, $p < 0.001$, with females (mean = 5.08, SD = 1.41) tending to somewhat enjoy those activities, whereas men (mean = 3.68, SD = 1.7) tend to be neutral. Significant differences were also found between how much groups enjoyed each passive plant enjoyment score, with one exception. Overall, women tended to enjoy each type of passive activity more than men, except for activities on the "endurance" subscale.

Groups differed in how frequently they did passive plant "endurance" activities, t (179) = 3.558, $p < 0.001$, with men (mean = 3.57, SD = 1.21) doing these activities more frequently than women (mean = 2.86, SD = 1.23). There were also significant differences in how frequently men and women did activities on the "choice" subscale, t (179) = - 4.08, $p < .001$, with women (mean = 3.51, SD = 1.0) reporting a higher frequency than men (mean = 2.84, SD = 1.0). Groups also differed significantly for the "great outdoors" subscale, t (179) = 2.67, $p < 0.01$. On average, men (mean = 2.72, SD = 0.83) reported doing those activities more frequently than women (mean = 2.35, SD = 0.86).

Analysis of Hypotheses

Shapiro-Wilk tests of normality were run on each of the variables that would be correlated. Most of the test statistics were found to be statistically significant, indicating a violation of normality. Furthermore, only the overall passive plant frequency scale, "relaxation" and "choice" subscales were greater than 0.97, which is the optimum cut off point for the sample size (Kundu et al, 2011). However, each of the scales and subscales seemed to sufficiently fit the line for the Q-Q plots to justify the use of Pearson tests.

There were significant relationships between active plant frequency scores and student satisfaction with school [H1, H2]. A positive relationship was found between satisfaction with the college experience and overall active plant frequency ($r = 0.17$, $p < 0.05$), and the "common" subscale ($r = 0.17$, $p < 0.05$). There was no relationship between frequency of active interaction with live plants and satisfaction with classes or grades (Table 10). Only one statistically significant relationship was found between passive plant frequency scores and student satisfaction [H1, H2]. Student satisfaction with the college experience had a moderate, positive relationship to the "non-endurance" subscale ($r = 0.22$, $p < 0.05$) (Table 11).

There were some significant relationships between time spent outdoors and school satisfaction [H3]. Time spent outdoors on weekdays was weakly correlated to satisfaction with classes ($r = 0.16$, $p < 0.05$) and satisfaction with the college experience (0.16, $p < 0.05$). There was not a significant relationship between the amount of time spent outdoors on a typical weekend day and satisfaction with school (Table 12).

There were some significant relationships between active plant frequency scores and academic performance [H4, H5]. There was a positive relationship between grade point average and overall active plant frequency ($r = 0.16$, $p < 0.05$), and the "rare" subscale ($r = 0.19$, $p <$

0.05). There were also positive, moderate, statistically significant ($p < .001$) relationships between each of the active plant frequency scales and time spent studying on weekdays and weekend days and (Table 13).

There were some significant relationships between passive plant frequency scores and academic performance [H4, H5]. There was a weak, positive relationship between the "choice" subscale and grade point average ($r = 0.16$, $p > 0.05$). Each passive plant frequency score had a moderate, positive relationship with time spent studying on weekdays. The strongest relationship was to the overall passive plant frequency score ($r = 0.305$, $p < 0.001$) and the weakest correlation was to "the great outdoors" subscale ($r = 0.17$, $p < 0.05$). There were also some relationships between time spent studying on weekend days and overall passive plant frequency ($r = 0.19$, $p < 0.01$), the "non-endurance" subscale ($r = 0.26$, $p < 0.001$) and the "choice" subscale ($r = 0.19$, $p = 0.01$) (Table 14).

There were some significant relationships between time spent outdoors and academic performance [H6]. Time spent outdoors on weekdays was positively related to time spent studying on weekdays ($r = 0.28$, $p < 0.001$) and on weekends ($r = 0.15$, $p < 0.05$). Time spent outdoors on weekend days was positively related to time spent studying during weekdays ($r = 0.33$, $p < 0.001$) and weekend days ($r = 0.21$, $p < 0.01$). There was no relationship to time spent outdoors during the week or weekend and grade point average (Table 15).

Active and passive plant enjoyment and frequency were examined to see if enjoyment contributed to frequency [H7]. Active plant enjoyment had a strong positive relationship with overall active plant frequency ($r = 0.57$, $p < 0.001$), the "common" subscale ($r = 0.56$, $p < 0.001$) and the "rare" subscale ($r = 0.44$, $p < 0.001$). Furthermore, passive plant enjoyment was moderately and significant related to active plant frequency (Table 16).

Overall passive plant enjoyment scores had a strong relationship with overall passive plant frequency scores ($r = 0.40$, $p < 0.001$). There were statistically significant, moderate, positive relationships between each scale and subscale, with three exceptions. The first exception was between the "non-endurance" enjoyment subscale and the "endurance" frequency subscale. The second exception was between the "choice" enjoyment subscale and the "endurance" frequency subscale. The last exception was between the "choice" enjoyment subscale and the "great outdoors" frequency subscale. There were moderate, positive relationships between active plant enjoyment and overall passive plant frequency ($r = 0.29$, $p < 0.001$) and each subscale with one exception. The "endurance" subscale did not have a statistically significant relationship with active plant enjoyment (Table 17).

One additional test was conducted to determine what youth gardening experiences contributed to enjoying active and passive plant interaction as an undergraduate. The variable "I gardened as a child" was strongly related to active plant enjoyment ($r = 0.52$, $p < 0.001$), and moderately related to each of the passive plant scales. The variable "I gardened as an adolescent" was also strongly related to active plant enjoyment ($r = 0.55$, $p < 0.001$) and moderately related to each of the passive plant scales. The variable "I learned about gardening from my family" was strongly related to active plant enjoyment ($r = 0.46$, $p < 0.001$) and moderately related to the passive plant enjoyment scales. The variable "I learned about gardening in primary school" was moderately related to active plant enjoyment ($r = 0.29$, $p < 0.001$) and the passive plant enjoyment scales (Table 18).

Discussion

Dependent and independent variables were somewhat influenced by gender, grade level, and even the type of school the students were enrolled in. In future surveys, steps should be taken to get a more even distribution of participants in terms of gender and grade level. This could be achieved by surveying a stratified sample instead of a random sample from within each institution. In future studies it would be best to conduct future surveys during the normal school year instead of the summer semester. It is possible that students enrolled in summer school are quite different from students who only enroll during the academic year.

Although community college and public university students were pretty well represented in the sample, future surveys should include participants from private colleges as well. Including a fair distribution across backgrounds is important to produce generalizable results. Background characteristics, independent and dependent variables often differed between these two groups in this study. These differences do not threaten the validity of the results. Rather, they reinforce generalizability.

The results of the principal components analysis make theoretical sense to the researcher. Items within components tend to "hang together" relatively well, and they are adequately reliable. However, these scales are not ready for widespread use. The scales should be tested on a larger scale to improve generalizability. The sample should include at least two private colleges and one more public university. Confirmatory factor analysis (CFA) should be used to confirm whether the components identified in this study are reproducible on a larger scale.

The results of this study seem to indicate some relationship between time spent with plants and student satisfaction with school [H1]. It seemed that active interaction with live plants had a more significant relationship to school satisfaction than passive interaction [H2]. Time

spent outdoors during the week was also weakly related to school satisfaction [H3]. The school satisfaction variables that were used in this study were very simple and exploratory. In the future, these items should be improved and expanded on, or another scale that has established reliability should be used instead. A better measure of student satisfaction with school would provide a better picture of the extent that time with live plants is related to school satisfaction.

Time spent with live plants was also related to academic performance [H4]. Correlations were found between active and passive interaction with plants and grade point average and time spent studying. These results could be attributed to the benefits of attention restoration from mental fatigue. Students who spent more time around live plants are more refreshed and focused, whereas other students' only respite from mental fatigue comes from sleep. Although there was not a relationship between time spent outdoors and grades, time spent outdoors was moderately related to time spent studying. However, this relationship could be due to similarities in question wording and response categories for these two groups of questions.

Finally, strong evidence was found confirming that students who enjoy interacting with plant life are more likely to participate in such activities [H5]. Enjoyment of active interaction was strongly related to frequency of active interaction. Similar results were found for the passive scales, with three logical exceptions. It makes sense that the "non-endurance" enjoyment subscale would not be related to the "endurance" frequency subscale. Students who prefer activities outdoors that do not require endurance are not likely to seek out endurance activities. Similarly, activities in the "choice" enjoyment subscale were mostly activities that did not require any exertion (e.g. "Read outdoors"). It makes sense that "choice" is not related to "endurance" or the "great outdoors" frequency subscales. These findings confirm what one

would expect from a basis of Expectancy Theory. People tend to do things they enjoy and avoid things they do not enjoy.

Given the benefits of time spent with plants, including satisfaction with school and academic performance, it would be worthwhile to encourage students to pursue such activities. Although more work is required to confirm the relationship between interaction with plants and school satisfaction, it is safe to say that time spent with live plants does improve school experience, either in terms of school satisfaction or academic performance. Institutions of higher education should provide opportunities for students to pursue some of these activities on and off campus. However, Expectancy Theory reveals that students who do not enjoy such activities are unlikely to seek them out, even if their school does provide opportunities for students to participate in such activities.

It would be worthwhile for schools to not only provide such opportunities for all students, but to put a gardening or outdoor program in place for incoming freshmen. Such a program could have loose guidance from university or community outdoor enthusiasts. Early, loosely supervised exposure could be a useful way for students to learn whether or not they do or do not enjoy plant-based activities. It is possible that some students report they do not enjoy such activities because they are unfamiliar with them.

A handful of variables about youth gardening were included in the survey as a way to control for plant interaction as an undergraduate. These rudimentary variables proved to be an interesting way to explore the pathways for plant interaction. Gardening as a child or adolescent was strongly related to enjoyment of plant activities – particularly active plant enjoyment – as an undergraduate. Learning about gardening from family was strongly related to active plant enjoyment, whereas learning about gardening in primary school was only moderately related to

active plant enjoyment. The results of analyses that confirm H5 showed that enjoyment of such activities was related to participation. These correlations indicate encouraging youth gardening is a good way to ensure continued plant-based activities into adulthood. The finding that learning how to garden with ones' family is more strongly related to whether undergraduates enjoy spending time with plants than learning how to garden in primary school is especially interesting. The benefits of school gardening in comparison to home gardening should be explored more fully in primary school gardening experiments and surveys.

Chapter 5: Conclusion

Spending time with plants outdoors has proven psychological benefits, including attention restoration (Han, 2009, Kaplan & Kaplan, 1989, Kaplan, 1993, 1995, 2001), increased productivity, and reduced stress (Lohr et al., 1996). Access to nearby nature and live plants is also related to satisfaction with one's place of residence (Kaplan, 2001), work, and life (Kaplan, 1993). One study has found a connection between the presence of live plants in a classroom and improved course evaluations (Doxey et al., 2009).

The two studies that have been outlined in this paper show there is a relationship between spending time with plants, satisfaction with school and academic performance. This relationship does seem to vary depending on the context of the experience. Experiences with live plants seemed to have a stronger relationship to positive outcomes for undergraduates than high school students. However, these differences could be due to the different methods incorporated by each study. Further research is required to verify these differences. This should be done through experimental and survey research.

The statistical results of the undergraduate survey were more conclusive than those of the high school gardening experiment. Interaction with live plants was positively related to student satisfaction with school and academic performance. These findings are significant, because they are the first to determine that time with live plants and the outdoors is statistically significantly related to academic performance for undergraduates (Doxey et al., 2009, Han, 2009, Thorp & Townsend, 2001). The results of these studies provide good reason for schools to provide opportunities for students to engage in plant-based activities, on or off campus.

Providing such activities would be a good way to help students receive the benefits of time spent with live plants. However, it was also determined students who do not enjoy plant-based activities are not likely to take advantage of such opportunities, even if they were available. Furthermore, youth gardening was positively related to the extent that students enjoy plant-based activities. Steps should also be taken for students to learn whether they truly dislike plant-based activities or not. Gardening outreach would be helpful for primary schools and families with young children. At the university level, it would be beneficial for incoming freshmen to participate in plant-based activities, like gardening, as a part of a first year studies course or similar class. Students who are unfamiliar with gardening and plant-based activities will have the opportunity to learn whether it is something they enjoy.

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Appendices

Appendix A: Tables

Table 1.
Average Age by Experimental Group

Respondent Type	N	Mean Years	Std. Deviation	Std. Error Mean
Variable	82	14.59	0.736	0.081
Control	36	16.31	1.117	0.186
Persistence	24	15.33	0.481	0.098
Total	142	15.15	1.091	0.091

Table 2.
Gender by Experimental Group

			Gender		Total
			Male	Female	
Respondent Type	Variable	Count	35	44	79
		% within Type	44.3%	55.7%	100.0%
	Control	Count	16	21	37
		% within Type	43.2%	56.8%	100.0%
	Persistence	Count	15	9	24
		% within Type	62.5%	37.5%	100.0%
Total		Count	66	74	140
		% within Type	47.1%	52.9%	100.0%

Table 3.
Type of Residence

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A house	105	68.2	76.6	76.6
	An apartment or condo	29	18.8	21.2	97.8
	Other	3	1.9	2.2	100.0
	Total	137	89.0	100.0	
Missing	No Answer	6	3.9		
	System	11	7.1		
	Total	17	11.0		
Total		154	100.0		

Table 4.
Pearson Correlation between Time Outdoors and School Satisfaction

		Class Satisfaction	Grades Satisfaction	School Satisfaction
Time outdoors during week days	Pearson Correlation	0.157	0.192	**0.204***
	Sig. (2-tailed)	0.104	0.052	**0.034**
	N	109	103	**109**
Time outdoors during weekend days	Pearson Correlation	**0.270****	0.175	**0.322****
	Sig. (2-tailed)	**0.005**	0.083	**0.001**
	N	**105**	99	**105**
Number of outdoor activities	Pearson Correlation	0.145	0.110	**0.184***
	Sig. (2-tailed)	0.121	0.253	**0.048**
	N	116	110	**116**

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 5.
Pearson Correlation between Time Outdoors and Academic Performance

		*Grades	Time studying during week days	Time studying during weekend days
Time outdoors during week days	Pearson Correlation	0.130	**0.212***	**0.260****
	Sig. (2-tailed)	0.340	**0.030**	**0.008**
	N	56	**105**	**103**
Time outdoors during weekend days	Pearson Correlation	0.251	0.189	**0.275****
	Sig. (2-tailed)	0.070	0.058	**0.005**
	N	53	102	**102**
Number of outdoor activities	Pearson Correlation	-0.206	0.117	0.120
	Sig. (2-tailed)	0.114	0.227	0.220
	N	60	109	106

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 6.

Active Enjoyment Component Matrix[a]

	Component
	1
Pick vegetables	0.910
Pick fruits or berries	0.882
Do gardening activities	0.874
Plant trees, shrubs, flowers, or vegetables	0.861
Pick herbs	0.837
Pick flowers	0.835
Work with plants indoors, like watering houseplants	0.796
Visit a public garden	0.738
Work with plants as a volunteer (ex. clearing brush, garden activities, etc.)	0.681
Do yard work besides mowing, like weeding, pruning, or raking leaves	0.649

Extraction Method: Principal Component Analysis.

a. 1 component extracted.

Table 7.

Active Frequency Pattern Matrix[a]

	Component	
	Common	Rare
	1	2
Do gardening activities	0.874	
Pick flowers	0.724	
Pick fruits or berries	0.859	
Pick vegetables	0.906	
Pick herbs	0.750	
Plant trees, shrubs, flowers, or vegetables	0.747	
Climb trees		0.691
Mow grass	0.469	
Do yard work besides mowing, like weeding, pruning, or raking leaves	0.689	
Work with plants as a volunteer (ex. clearing brush, garden activities, etc.)		0.601
Work with plants indoors, like watering houseplants	0.395	0.403
Visit a public garden		0.869
Draw, paint, or photograph plants, flowers, or natural scenes		0.693

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.[a]

a. Rotation converged in 4 iterations.

Table 8.

Passive Enjoyment Pattern Matrix[a]

	Component		
	Non-Endurance	Endurance	Choice
	1	2	3
Hang out with friends outdoors	0.897		
Eat or drink outdoors (ex. grilling out, picnicking, etc.)	0.857		
Spend time outdoors	0.754		
Walk outdoors	0.751		
Listen to music outdoors	0.697		
Walk with, exercise with, or play with a pet outdoors	0.694		
Go exploring or sightseeing	0.692		
Relax outdoors	0.644		
Swim outdoors	0.580		
Kayak, canoe, or other boating activity	0.452	0.343	
Go camping	0.449		
Go fishing	0.383		
Play team sports outdoors		0.941	
Play games that are not necessarily team sports outdoors		0.742	
Exercise outdoors		0.701	
Jog outdoors		0.615	
Bike outdoors		0.598	
Work outdoors as part of a paid job		0.591	
Do volunteer work outdoors		0.451	0.339
Hike outdoors	0.382	0.403	
Write or journal outdoors			0.904
Draw or paint outdoors			0.768
Study or do homework while outdoors			0.671
Read outdoors			0.602
Nap outdoors			0.549
Hammock outdoors	0.332		0.466

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Table 9.

Passive Frequency Pattern Matrix[a]

	Component				
	Relaxation 1	Endurance 2	Non-Endurance 3	Choice 4	Great Outdoors 5
Spend time outdoors			-0.601		
Read outdoors				0.553	
Study or do homework while outdoors				0.511	
Draw or paint outdoors				0.716	
Write or journal outdoors				0.803	
Nap outdoors	0.391				
Hammock outdoors					0.567
Relax outdoors	0.572		-0.386		
Listen to music outdoors	0.580				
Eat or drink outdoors (ex. grilling out, picnicking, etc.)	0.689				
Walk outdoors			-0.580		
Hike outdoors					0.619
Bike outdoors					0.536
Jog outdoors		0.671			
Swim outdoors	0.672		0.407		
Play team sports outdoors		0.773			
Play games that are not necessarily team sports outdoors		0.680			
Exercise outdoors		0.552	-0.440		
Go camping					0.716
Do volunteer work outdoors		0.482			
Work outdoors as part of a paid job				-0.433	0.469
Go fishing					0.485
Walk with, exercise with, or play with a pet outdoors			-0.663		
Go exploring or sightseeing			-0.366		0.376
Hang out with friends outdoors	0.492				

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 24 iterations.

Table 10.

Pearson Correlation between Active Plant Frequency and School Satisfaction

		Classes so far	Grades so far	College experience so far
Overall, Active Plant Frequency	Correlation Coefficient	0.107	0.081	**0.167***
	Sig. (2-tailed)	0.152	0.277	**0.024**
	N	181	181	**181**
Common, Active Plant Frequency	Correlation Coefficient	0.125	0.116	**0.174***
	Sig. (2-tailed)	0.094	0.119	**0.019**
	N	181	181	**181**
Rare, Active Plant Frequency	Correlation Coefficient	0.044	-0.019	0.099
	Sig. (2-tailed)	0.554	0.799	0.183
	N	181	181	181

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 11.

Pearson Correlation between Passive Plant Frequency and School Satisfaction

		Classes so far	Grades so far	College experience so far
Overall, Passive Plant Frequency	Pearson Correlation	0.066	-0.068	0.144
	Sig. (2-tailed)	0.380	0.359	0.053
	N	182	182	182
Relaxation, Passive Plant Frequency	Pearson Correlation	0.025	-0.109	0.119
	Sig. (2-tailed)	0.737	0.144	0.109
	N	182	182	182
Endurance, Passive Plant Frequency	Pearson Correlation	0.021	-0.085	0.105
	Sig. (2-tailed)	0.776	0.253	0.158
	N	182	182	182
Non-Endurance, Passive Plant Frequency	Pearson Correlation	0.142	0.055	**0.216****
	Sig. (2-tailed)	0.055	0.463	**0.003**
	N	182	182	**182**
Choice, Passive Plant Frequency	Pearson Correlation	0.058	0.008	0.028
	Sig. (2-tailed)	0.434	0.918	0.707
	N	182	182	182
Great Outdoors, Passive Plant Frequency	Pearson Correlation	0.043	-0.067	0.092
	Sig. (2-tailed)	0.564	0.369	0.215
	N	182	182	182

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 12.
Pearson Correlation between Time Outdoors and School Satisfaction

		Classes so far	Grades so far	College experience so far
Time outdoors during week days	Pearson Correlation	**0.161***	0.091	**0.161***
	Sig. (2-tailed)	**0.030**	0.220	**0.030**
	N	**182**	182	**182**
Time outdoors during weekend days	Pearson Correlation	0.120	0.013	0.133
	Sig. (2-tailed)	0.109	0.865	0.075
	N	180	180	180

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 13.

Pearson Correlation between Active Plant Frequency and Academic Performance

		GPA	Time studying during week days	Time studying during weekend days
Overall, Active Plant Frequency	Correlation Coefficient	**0.163***	**0.294****	**0.316****
	Sig. (2-tailed)	**0.034**	**0.000**	**0.000**
	N	**169**	**182**	**182**
Common, Active Plant Frequency	Correlation Coefficient	0.143	**0.281****	**0.324****
	Sig. (2-tailed)	0.064	**0.000**	**0.000**
	N	169	**182**	**182**
Rare, Active Plant Frequency	Correlation Coefficient	**0.194***	**0.275****	**0.201****
	Sig. (2-tailed)	**0.012**	**0.000**	**0.006**
	N	**169**	**182**	**182**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 14.

Pearson Correlation between Passive Plant Frequency and Academic Performance

		GPA	Time studying during week days	Time studying during weekend days
Overall, Passive Plant Frequency	Pearson Correlation	0.085	**0.305****	**0.193****
	Sig. (2-tailed)	0.272	**0.000**	**0.009**
	N	170	**183**	**183**
Relaxation, Passive Plant Frequency	Pearson Correlation	-0.012	**0.244****	0.129
	Sig. (2-tailed)	0.872	**0.001**	0.082
	N	170	**183**	183
Endurance, Passive Plant Frequency	Pearson Correlation	-0.023	**0.227****	0.108
	Sig. (2-tailed)	0.767	**0.002**	0.146
	N	170	**183**	183
Non-Endurance, Passive Plant Frequency	Pearson Correlation	0.131	**0.292****	**0.259****
	Sig. (2-tailed)	0.088	**0.000**	**0.000**
	N	170	**183**	**183**
Choice, Passive Plant Frequency	Pearson Correlation	0.162*	**0.196****	**0.190****
	Sig. (2-tailed)	0.035	**0.008**	**0.010**
	N	170	**183**	**183**
Great Outdoors, Passive Plant Frequency	Pearson Correlation	0.074	**0.174***	0.065
	Sig. (2-tailed)	0.335	**0.018**	0.379
	N	170	**183**	183

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 15.

Pearson Correlation between Time Outdoors and Academic Performance

		GPA	Time studying during week days	Time studying during weekend days
Time outdoors during week days	Pearson Correlation	-0.010	**0.276****	**0.147***
	Sig. (2-tailed)	0.895	**0.000**	**0.046**
	N	170	**183**	**183**
Time outdoors during weekend days	Pearson Correlation	-0.042	**0.327****	**0.212****
	Sig. (2-tailed)	0.592	**0.000**	**0.004**
	N	168	**181**	**181**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 16.

Pearson Correlation between Plant Enjoyment and Active Plant Frequency

		Active Plant Frequency	Common, Active Plant Frequency	Rare, Active Plant Frequency
Active Plant Enjoyment	Pearson Correlation	0.573**	0.563**	0.445**
	Sig. (2-tailed)	0.000	0.000	0.000
	N	182	182	182
Passive Plant Enjoyment	Pearson Correlation	0.300**	0.281**	0.237**
	Sig. (2-tailed)	0.000	0.000	0.001
	N	182	182	182
Non-Endurance, Passive Plant Enjoyment	Pearson Correlation	0.288**	0.278**	0.208**
	Sig. (2-tailed)	0.000	0.000	0.005
	N	182	182	182
Endurance, Passive Plant Enjoyment	Pearson Correlation	0.257**	0.245**	0.187*
	Sig. (2-tailed)	0.000	0.001	0.012
	N	182	182	182
Choice, Passive Plant Enjoyment	Pearson Correlation	0.272**	0.233**	0.280**
	Sig. (2-tailed)	0.000	0.002	0.000
	N	182	182	182

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 17.

Pearson Correlation between Plant Enjoyment and Passive Plant Frequency

		Active Plant Enjoyment	Passive Plant Enjoyment	Non-Endurance, Passive Plant Enjoyment	Endurance, Passive Plant Enjoyment	Choice, Passive Plant Enjoyment
Passive Plant Frequency	Pearson Correlation	0.291**	0.399**	0.325**	0.432**	0.339**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	183	183	183	183	183
Relaxation, Passive Plant Frequency	Pearson Correlation	0.208**	0.327**	0.314**	0.314**	0.260**
	Sig. (2-tailed)	0.005	0.000	0.000	0.000	0.000
	N	183	183	183	183	183
Endurance, Passive Plant Frequency	Pearson Correlation	-0.006	0.257**	**0.130**	0.426**	**0.134**
	Sig. (2-tailed)	0.939	0.000	**0.080**	0.000	**0.070**
	N	183	183	**183**	183	**183**
Non-Endurance, Passive Plant Frequency	Pearson Correlation	0.295**	0.361**	0.318**	0.355**	0.282**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	183	183	183	183	183
Choice, Passive Plant Frequency	Pearson Correlation	0.379**	0.268**	0.220**	0.157*	0.430**
	Sig. (2-tailed)	0.000	0.000	0.003	0.034	0.000
	N	183	183	183	183	183
Great Outdoors, Passive Plant Frequency	Pearson Correlation	0.215**	0.223**	0.186*	0.285**	**0.133**
	Sig. (2-tailed)	0.003	0.002	0.012	0.000	**0.073**
	N	183	183	183	183	**183**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 18.

Pearson Correlation between Plant Enjoyment and Youth Gardening

		I gardened as a child	I gardened as an adolescent	I learned about gardening from my family	I learned about gardening in primary school
Active Plant Enjoyment	Pearson Correlation	0.522**	0.551**	0.458**	0.290**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	183	181	183	182
Passive Plant Enjoyment	Pearson Correlation	0.293**	0.297**	0.272**	0.285**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	183	181	183	182
Non-Endurance, Passive Plant Enjoyment	Pearson Correlation	0.295**	0.298**	0.246**	0.211**
	Sig. (2-tailed)	0.000	0.000	0.001	0.004
	N	183	181	183	182
Endurance, Passive Plant Enjoyment	Pearson Correlation	0.214**	0.222**	0.230**	0.269**
	Sig. (2-tailed)	0.004	0.003	0.002	0.000
	N	183	181	183	182
Choice, Passive Plant Enjoyment	Pearson Correlation	0.323**	0.317**	0.292**	0.335**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	183	181	183	182

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix B: Figures

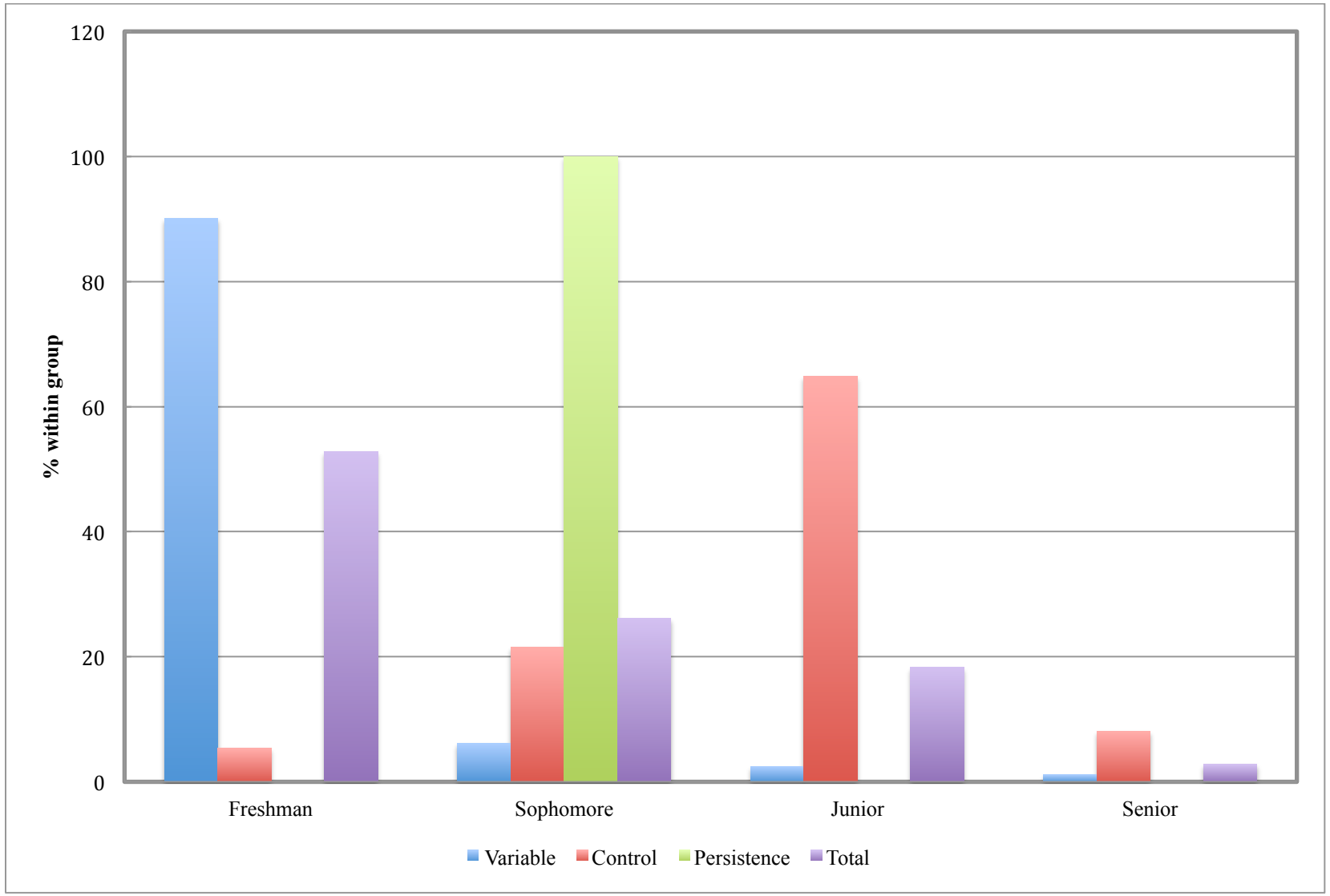

Figure 1. Grade by Experimental Group

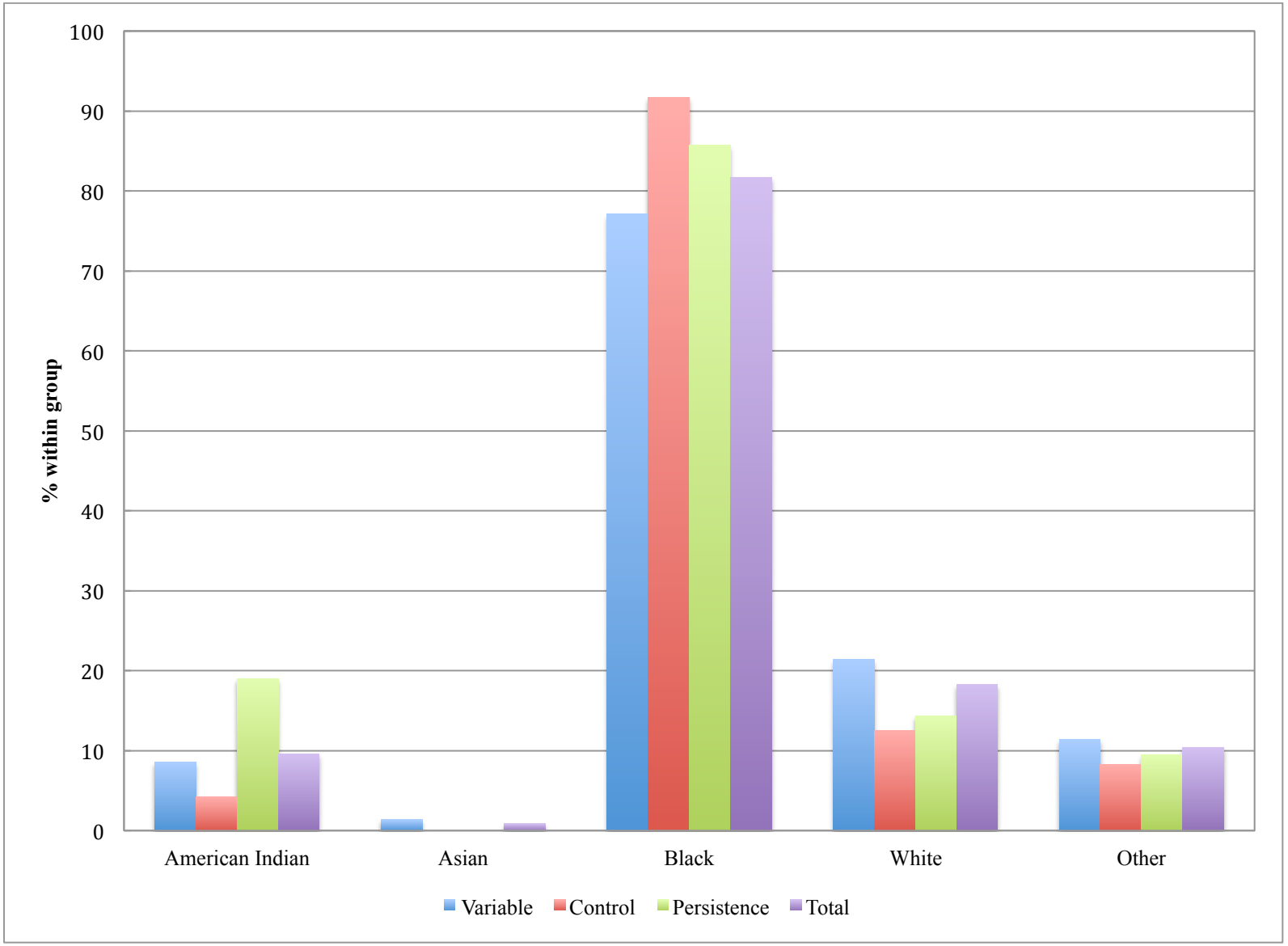

Figure 2. Ethnicity by Experimental Group

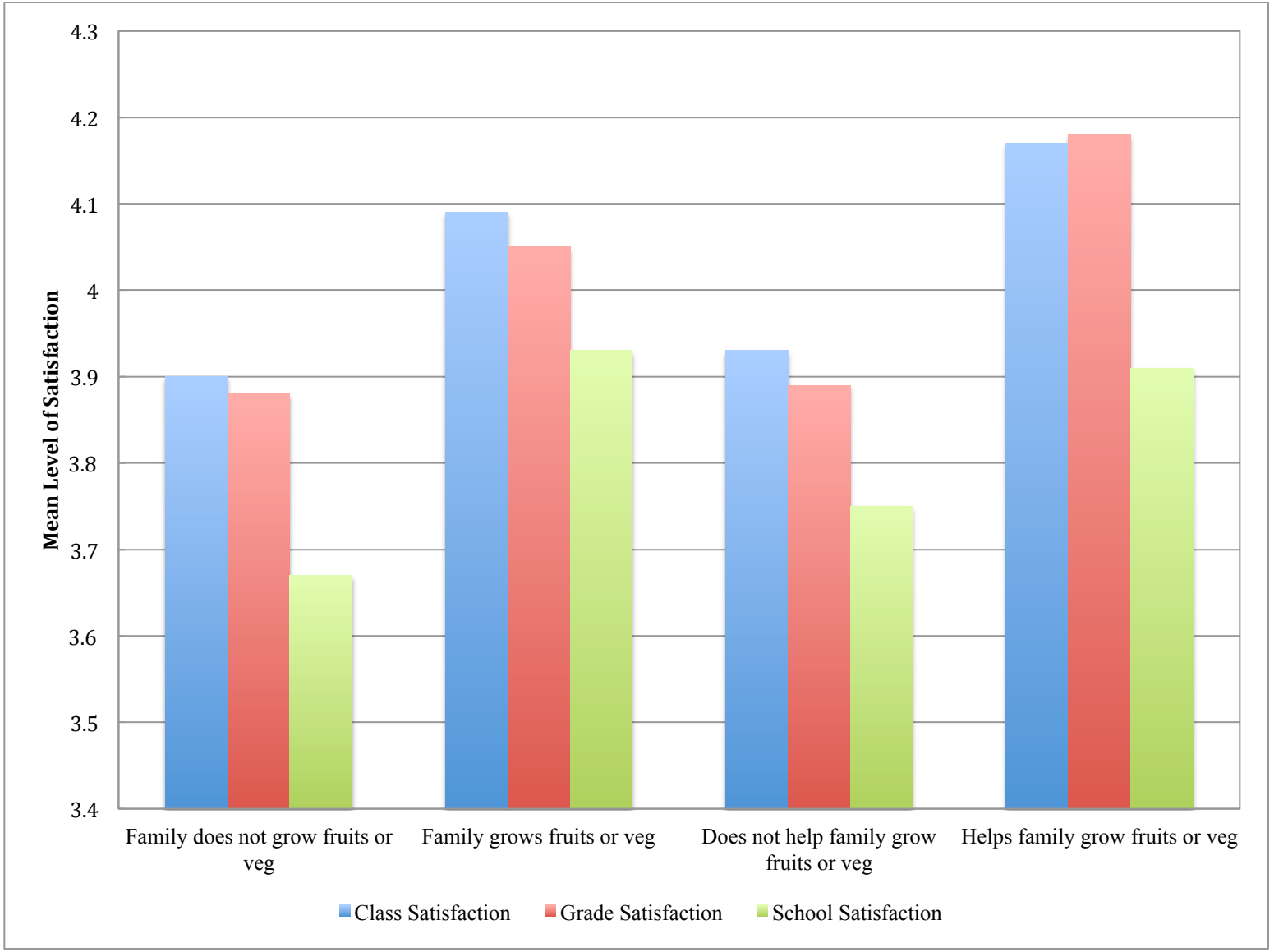

Figure 3. School Satisfaction by Home Gardening

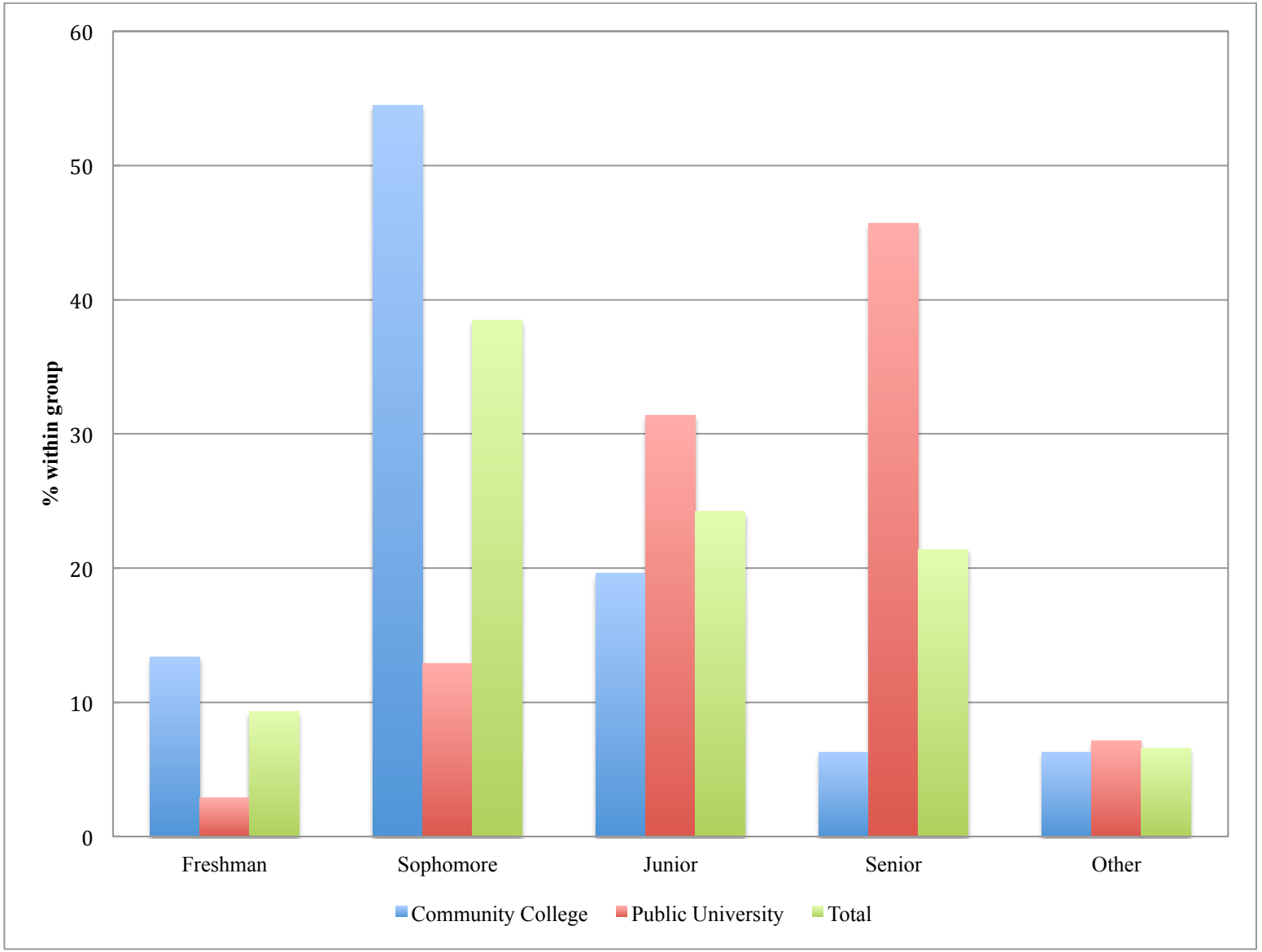

Figure 4. Grade by School Type

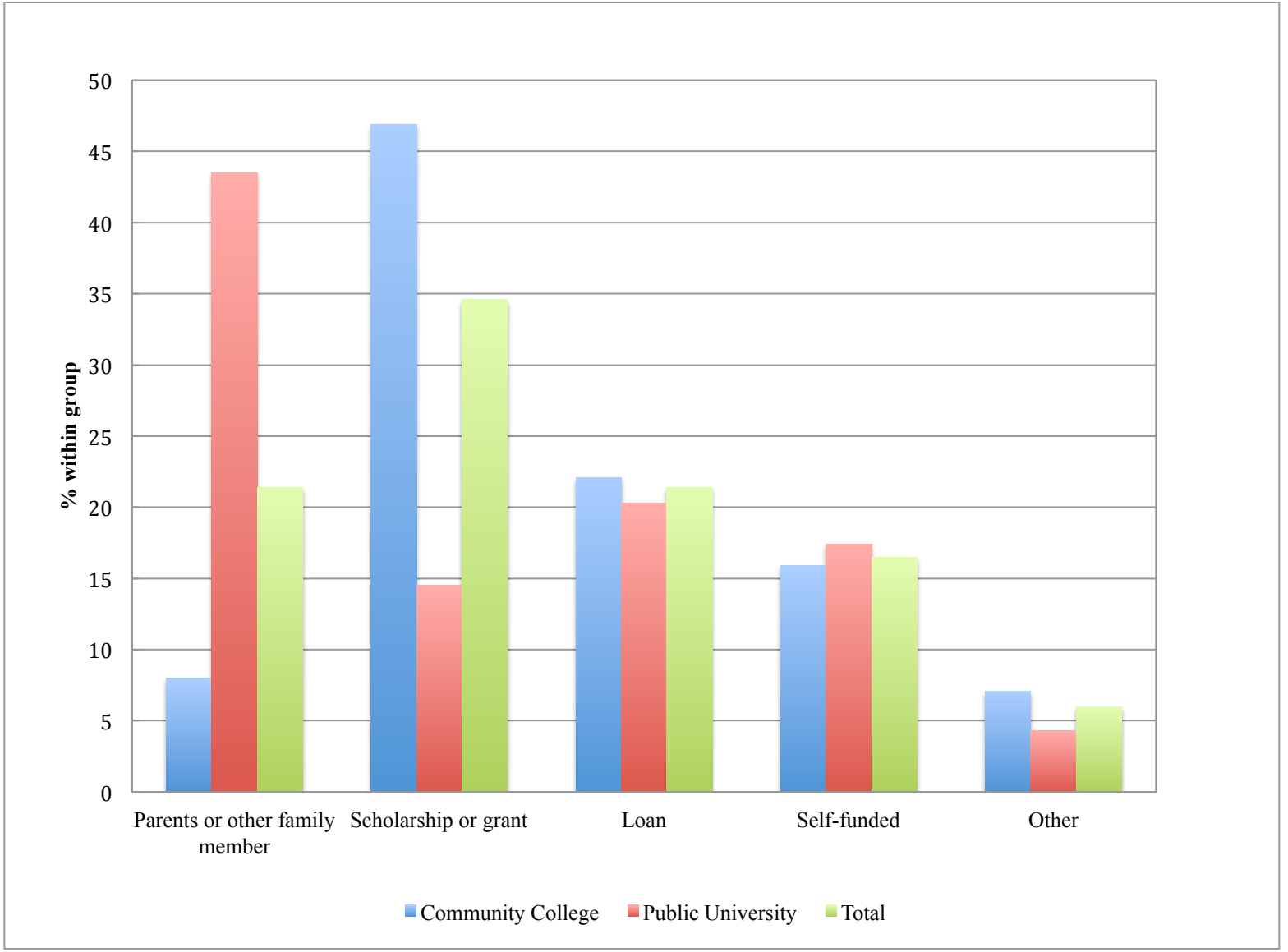

Figure 5. Tuition Funding by School Type

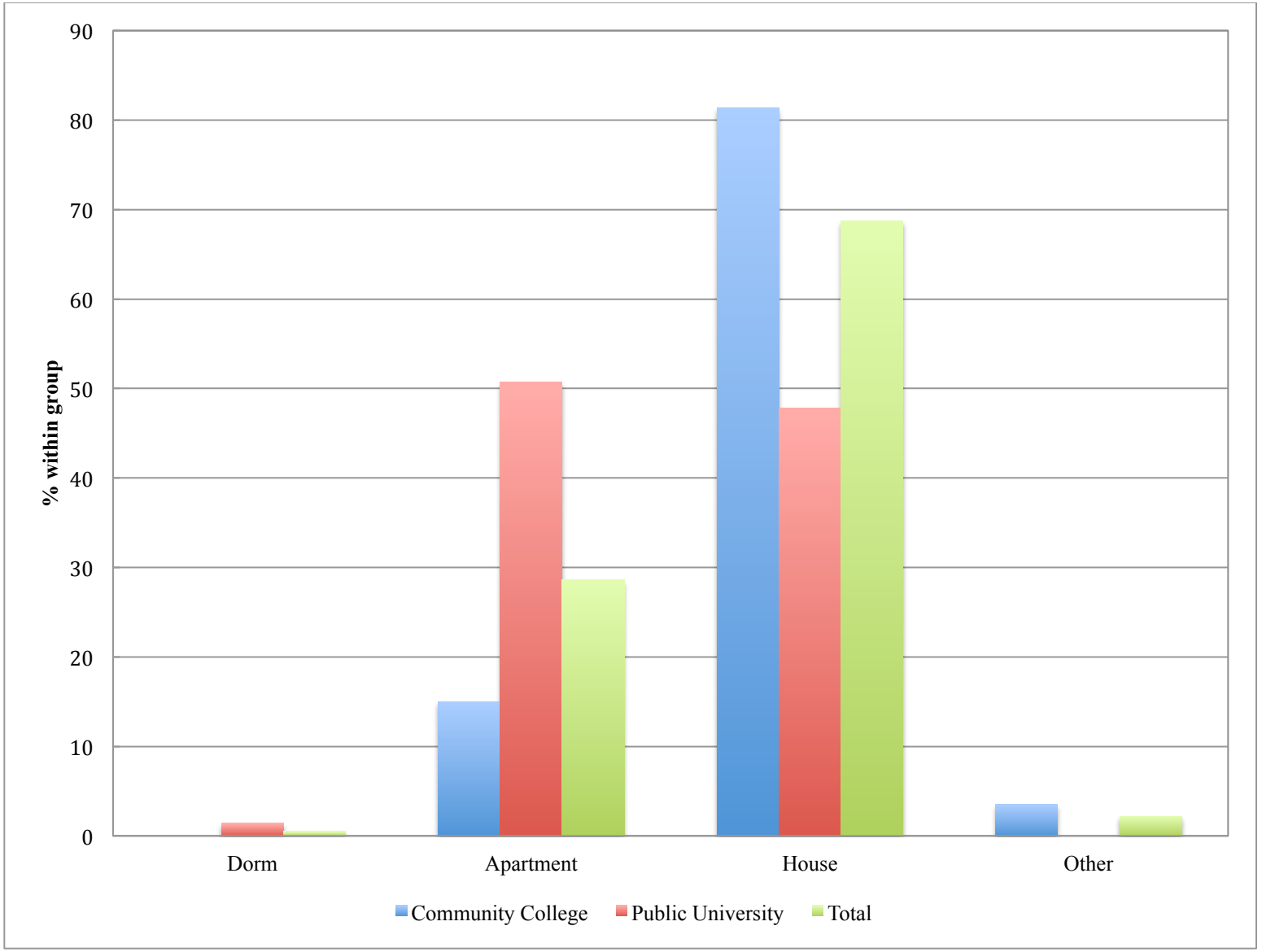

Figure 6. Residence by School Type

Appendix C: Austin-East High School Survey

This project is funded under an agreement with the state of Tennessee Austin-East Magnet High School Jan. 2013

Austin-East Gardening Survey

_____ _____ _____ _____

Student Identification Number **Teacher Initials** **Proctor Initials** **Block Number**

Your student identification number is the number that you use to log into school computers.

This is a survey to find out what you like, think and do in terms of eating, gardening, and physical activities. **There are no right or wrong answers.** When you do answer the questions, we simply want to know your honest opinion.

Please do not write your name anywhere on this form. We only want your ID number in the space above. Since your name is not on this form, we will not know who answered the questions. Answering these questions is completely voluntary. At any time, you may choose to say "I don't want to answer any more questions." If you do choose to stop, you may do so without any consequences.

1. **How old are you?** _____ **Years**

2. **What grade are you in?** **O Freshman** **O Sophomore** **O Junior** **O Senior**

3. **Are you male or female?** **O Male** **O Female**

Please indicate the extent that you <u>disagree</u> or <u>agree</u> with each of the following statements.

4. If I eat fruits and vegetables every day…	**Strongly Disagree**	**Somewhat Disagree**	**Neither Agree nor Disagree**	**Somewhat Agree**	**Strongly Agree**	**Don't Know**
a. I will become stronger.	O	O	O	O	O	O
b. My friends will start eating them too.	O	O	O	O	O	O
c. I will be healthier.	O	O	O	O	O	O
d. I will think better in class.	O	O	O	O	O	O
e. I will have a healthy weight.	O	O	O	O	O	O
f. I will have more energy.	O	O	O	O	O	O

PLEASE CHECK: **Did you accidentally leave any questions blank on this page?**

5. Please indicate the extent that you disagree or agree with each of the following statements.

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Don't Know
a. I believe that I have control over what foods I eat.	O	O	O	O	O	O
b. At my home, I always have vegetables available to eat.	O	O	O	O	O	O
c. At my home, I always have fruits or berries available to eat.	O	O	O	O	O	O

Now we will ask you about eating specific vegetables.

The vegetables can be cooked or not cooked (raw).

6. Have you ever eaten……..?	**No**	**Yes**	**6a. If Yes, How much do you like eating…….?**		
			Not at all	**A little**	**A lot**
Asparagus	O	O	O	O	O
Beets	O	O	O	O	O
Beans	O	O	O	O	O
Bell Peppers	O	O	O	O	O

Have you ever eaten……..?	**No**	**Yes**	**If Yes, How much do you like eating……?**		
			Not at all	**A little**	**A lot**
Black-eyed Peas	O	O	O	O	O
Broccoli	O	O	O	O	O
Cabbage	O	O	O	O	O
Carrots	O	O	O	O	O
Cauliflower	O	O	O	O	O
Celery	O	O	O	O	O

Have you ever eaten……..?	**No**	**Yes**	**If Yes, How much do you like eating……?**		
			Not at all	**A little**	**A lot**
Corn	O	O	O	O	O
Cucumbers	O	O	O	O	O
Green Beans	O	O	O	O	O
Green Peas	O	O	O	O	O
Lettuce	O	O	O	O	O
Mushrooms	O	O	O	O	O

2

PLEASE CHECK: **Did you accidentally leave any questions blank on this page?**

Have you ever eaten……..?	**No**	**Yes**	**If Yes, How much do you like eating……?**		
			Not at all	**A little**	**A lot**
Spinach	O	O	O	O	O
Sweet Potatoes	O	O	O	O	O
Tomatoes	O	O	O	O	O
Yellow Squash	O	O	O	O	O
White Potatoes *(chips and French fries don't count)*	O	O	O	O	O
Zucchini	O	O	O	O	O

Next, we will ask you about <u>eating fruit</u>.

The fruit can be cooked or not cooked (raw).

7. Have you ever eaten……..?	**No**	**Yes**	**7a. If Yes, How much do you like eating…….?**		
			Not at all	**A little**	**A lot**
Apples	O	O	O	O	O
Bananas	O	O	O	O	O
Blackberries	O	O	O	O	O
Blueberries	O	O	O	O	O
Cantaloupe	O	O	O	O	O

Have you ever eaten……..?	**No**	**Yes**	**If Yes, How much do you like eating……?**		
			Not at all	**A little**	**A lot**
Grapefruit	O	O	O	O	O
Grapes	O	O	O	O	O
Oranges	O	O	O	O	O
Peaches	O	O	O	O	O
Pears	O	O	O	O	O

Have you ever eaten……..?	**No**	**Yes**	**If Yes, How much do you like eating……?**		
			Not at all	**A little**	**A lot**
Pineapples	O	O	O	O	O
Plums	O	O	O	O	O
Raisins	O	O	O	O	O
Raspberries	O	O	O	O	O
Strawberries	O	O	O	O	O
Watermelon	O	O	O	O	O

PLEASE CHECK: **Did you accidentally leave any questions blank on this page?**

Now we will ask you about eating different kinds of fruits and vegetables.

The fruits and vegetables can be cooked or not cooked (raw).

8. Did you eat a breakfast today? Breakfast includes any food you may have eaten at home or at school this morning before lunch.

O No O Yes

9. *Now think about what you ate for breakfast this morning.*	**No**	**Yes**	**If Yes, how many different kinds did you eat for breakfast this morning?**			
			1	**2**	**3**	**4**
a. Did you eat any vegetables for breakfast this morning?	O	O	O	O	O	O
b. Did you eat any fruits or berries for breakfast this morning?	O	O	O	O	O	O

10. Either today or yesterday, did you eat a lunch?

O No O Yes

11. *Now think about what you ate for your most recent lunch.*	**No**	**Yes**	**If Yes, how many different kinds did you eat for your most recent lunch?**			
			1	**2**	**3**	**4**
a. Did you eat any vegetables for your most recent lunch?	O	O	O	O	O	O
b. Did you eat any fruits or berries for your most recent lunch?	O	O	O	O	O	O

12. Either today or yesterday, did you eat a snack between lunch and supper?

O No O Yes

13. *Now think about what snacks you ate between lunch and supper.*	**No**	**Yes**	**If Yes, how many different kinds did you eat for a snack between lunch and supper?**			
			1	**2**	**3**	**4**
a. Did you eat any vegetables for a snack?	O	O	O	O	O	O
b. Did you eat any fruits or berries for a snack?	O	O	O	O	O	O

4

PLEASE CHECK: **Did you accidentally leave any questions blank on this page?**

14. Did you eat a supper last night?

O No O Yes

15. *Now think about what you ate for supper last night.*	**No**	**Yes**	**If Yes, how many different kinds did you eat for supper last night?**			
			1	**2**	**3**	**4**
a. Did you eat any vegetables for supper last night?	O	O	O	O	O	O
b. Did you eat any fruits or berries for supper last night?	O	O	O	O	O	O

16. Did you eat a snack yesterday any time after supper?

O No O Yes

17. *Now think about what snacks you ate yesterday after supper.*	**No**	**Yes**	**If Yes, how many different kinds did you eat for a snack after supper?**			
			1	**2**	**3**	**4**
a. Did you eat any vegetables for a snack?	O	O	O	O	O	O
b. Did you eat any fruits or berries for a snack?	O	O	O	O	O	O

5

PLEASE CHECK: **Did you accidentally leave any questions blank on this page?**

Now we will ask you about gardening.

18. Does your family grow any fruits or vegetables?

O Yes O No O Don't Know

19. Do you help your family grow fruits or vegetables?

O Yes O No O Don't Know

20. I know how to……	**Strongly Disagree**	**Somewhat Disagree**	**Neither Agree nor Disagree**	**Somewhat Agree**	**Strongly Agree**	**Don't Know**
a. Plant a garden.	O	O	O	O	O	O
b. Plant a fruit tree.	O	O	O	O	O	O
c. Water a garden.	O	O	O	O	O	O
d. Plant vegetable seeds.	O	O	O	O	O	O
e. Take care of a garden.	O	O	O	O	O	O
f. Plant berry bushes.	O	O	O	O	O	O

21. Please indicate if you disagree or agree with each of the statements about gardening.

	Strongly Disagree	**Somewhat Disagree**	**Neither Agree nor Disagree**	**Somewhat Agree**	**Strongly Agree**	**Don't Know**
a. I like seeing plants grow.	O	O	O	O	O	O
b. I like to garden.	O	O	O	O	O	O
c. I like to taste foods from a garden.	O	O	O	O	O	O
d. Eating foods from the garden is important.	O	O	O	O	O	O
e. I think gardening is a good thing to do.	O	O	O	O	O	O
f. I consider myself a gardener.	O	O	O	O	O	O

PLEASE CHECK: **Did you accidentally leave any questions blank on this page?**

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Don't Know
g. When I am an adult, I want to plant a garden.	O	O	O	O	O	O
h. It is important that my family grows a garden.	O	O	O	O	O	O
i. Growing a garden saves money.	O	O	O	O	O	O
j. Growing a garden makes it easier to get fruits and vegetables.	O	O	O	O	O	O
k. Working in the garden is exercise.	O	O	O	O	O	O
l. We have a place to garden at home.	O	O	O	O	O	O

Now we will ask you about <u>exercise</u>.

22. Please select the option that best represents the amount of time you spend exercising (any time that you are active, whether at the gym, sports, or being generally active).

	None	Less than ½ hr	About ½ hr	About 1 hr	2-3 hrs	4 or more hrs	Not sure
a. During the school year, on a typical WEEKDAY, about how many hours do you spend doing exercise activities?	O	O	O	O	O	O	O
b. During the school year, on a typical WEEKEND DAY, about how many hours do you spend doing exercise activities?	O	O	O	O	O	O	O

PLEASE CHECK: **Did you accidentally leave any questions blank on this page?**

23. Please indicate if you <u>disagree</u> or <u>agree</u> with each of the statements about exercise.

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Don't Know
a. I enjoy being active and exercising.	O	O	O	O	O	O
b. I enjoy the feeling I get after being active and exercising.	O	O	O	O	O	O
c. I feel healthier after being active and exercising.	O	O	O	O	O	O
d. I feel better about myself when I am active and exercise.	O	O	O	O	O	O

24. Please indicate if you <u>disagree</u> or <u>agree</u> with each of the statements about exercise.

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Don't Know
a. I wish that I had more opportunities to be active and exercise.	O	O	O	O	O	O
b. I feel safe when I am active and exercise outside of school.	O	O	O	O	O	O
c. I know ways that I can be active and exercise.	O	O	O	O	O	O

PLEASE CHECK: **Did you accidentally leave any questions blank on this page?**

25. Please select all the exercise activities that you are *currently* involved in:

- o Organized team sports (ex. Sports through my school or another organization)
- o Playing sports or games with my friends not through an organization
- o Aerobic exercise activities on my own (ex. Jogging)
- o Anaerobic activities on my own (ex. Weight lifting)
- o Other _____

26. How many exercise activities are you *currently* involved in?

- o None
- o 1-2
- o 3-4
- o 5 or more
- o Not sure

Now we will ask you about <u>the outdoors</u>.

27. Please indicate the extent that you <u>disagree</u> or <u>agree</u> with each of the statements about spending time outdoors:

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Don't Know
a. I am satisfied with the amount of time I currently spend outdoors.	O	O	O	O	O	O
b. I believe that I focus better in class after spending time outdoors.	O	O	O	O	O	O
c. I feel safe being outdoors.	O	O	O	O	O	O

28. Please select the option that best represents the amount of time you spend outdoors for each scenario:

	None	Less than ½ hr	About ½ hr	About 1 hr	2-3 hrs	4 or more hrs	Not sure
a. During the school year, on a typical WEEKDAY, about how many hours do you spend outdoors?	O	O	O	O	O	O	O
b. During the school year, on a typical WEEKEND DAY, about how many hours do you spend outdoors?	O	O	O	O	O	O	O

PLEASE CHECK: **Did you accidentally leave any questions blank on this page?**

29. What do you most like to do outdoors?

_____
_____
_____

30. Describe your last experience doing something outdoors?

_____
_____
_____

31. How many outdoor activities are you *currently* involved in?

- None
- 1-2
- 3-4
- 5 or more
- Not sure

32. Please indicate the extent that you <u>disagree</u> or <u>agree</u> with each of the following statements:

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Don't Know
a. I like to hear different sounds in nature.	O	O	O	O	O	O
b. My actions will make the natural world different.	O	O	O	O	O	O
c. When I feel sad, I like to go outside and enjoy nature.	O	O	O	O	O	O
d. Being in nature makes me feel peaceful.	O	O	O	O	O	O
e. Humans are part of the natural world.	O	O	O	O	O	O
f. Being outdoors makes me happy.	O	O	O	O	O	O
g. People cannot live without plants and animals.	O	O	O	O	O	O
h. I like to see wild flowers in nature.	O	O	O	O	O	O

PLEASE CHECK: **Did you accidentally leave any questions blank on this page?**

33. Please select the option that best represents the amount of time you spend studying.

	None	Less than ½ hr	About ½ hr	About 1 hr	2-3 hrs	4 or more hrs	Not sure
a. During the school year, on a typical WEEKDAY, about how many hours do you spend studying aside from normal school hours?	O	O	O	O	O	O	O
b. During the school year, on a typical WEEKEND DAY, about how many hours do you spend studying?	O	O	O	O	O	O	O

34. Please indicate the extent that you are <u>dissatisfied</u> or <u>satisfied</u> with the following:

	Very Dissatisfied	Somewhat Dissatisfied	Neither Satisfied or Dissatisfied	Somewhat Satisfied	Very Satisfied	Don't Know
a. Overall, how satisfied are you with your classes so far?	O	O	O	O	O	O
b. Overall, how satisfied are you with your school experience so far?	O	O	O	O	O	O
c. Overall, how satisfied are you with your grades so far?	O	O	O	O	O	O

35. During this semester, how would you describe your grades in school?

- ○ Mostly A's
- ○ Mostly B's
- ○ Mostly C's
- ○ Mostly D's
- ○ Mostly F's
- ○ No Answer

PLEASE CHECK: **Did you accidentally leave any questions blank on this page?**

36. Which do you live in?
- o A house
- o An apartment or condo
- o Other

37. Are you Hispanic or Latino?
- o No
- o Yes

38. What is your race? (Check one or more)
- o American Indian
- o Asian
- o Black or African American
- o White
- o Other: _____

39. Were you in an ecology class during the last school year or fall 2012?
- o No
- o Yes

40. We want to know how the health and garden program helped you in class, at home, or any other way. Please write your response in complete sentences.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Thank you very much for your help!

12

PLEASE CHECK: **Did you accidentally leave any questions blank on this page?**

Appendix D: Open-ends, Preliminary Survey

What are some other activities that you like to do outdoors?

- Sports (15)
  - Sports, nonspecific (2)
  - Basketball (2)
  - Golf (2)
  - Baseball
  - Football
  - Tennis
  - Throw balls
  - Play frisbee
  - Play Volleyball
  - Kickball
  - Snow Boarding
  - Skateboard
- Exercise – Not Sports or Water (14)
  - Hiking (3)
  - Run (3)
  - Walk (3)
  - Exercise, nonspecific (2)
  - Camping (2)
  - Biking
- Relaxing (non-intensive) Activities (12)
  - Hammock (2)
  - Sleep (2)
  - Relax and Unwind
  - Lay outside
  - Sit
  - Meditate
  - Listen to music
  - Reading
  - Write
  - Hangout
- Plant-based Activity (10)
  - Garden (7)
  - Take pictures of plants
  - Weeding
  - Plant
- Water (9)
  - Swim (4)
  - Fishing (3)
  - Go to the pool
  - Kayak
- Eat or Drink (5)

    - Drink (3)
    - Grilling
    - Eat
- Hang out with friends (2)
- Work (2)
    - I work at a golf course
    - Work doing landscaping
- Explore
- Sightsee
- Go to the park
- Play with dogs

What are some other activities that you like to do that involve plants or gardening?

- Visits (5)
    - Visit gardens (3)
    - Plant expos
    - Go to nurseries
- Edible gardening (4)
    - Cooking plants (2)
    - Growing food
    - Harvesting
- Teaching others about plants (3) * 3 Plant ID TAs participated in focus group
    - Teaching plant to other students
    - Work with children's garden camps
    - Educational programs
- Art / Design (3)
    - Design garden beds
    - Drawing or sketching them
    - Nature photography
- Experience Based (2)
    - Touch / smell plants
    - Watching them grow
- Climb Trees (2)
- None, really bad allergies (2)
- Adding water features
- Landscaping job
- Pruning
- Weeding
- Playing outside
- Playing golf
- Everything

Appendix E: Pilot Survey

Introduction

This is a survey to learn more about what kind of outdoor activities you engage in. Your feedback is desired, even if you do not currently spend time outdoors or if you do not enjoy the outdoors. The questionnaire also includes questions about your experience as a University of Tennessee student. Results will be used to learn more about how certain activities that students engage in affect certain perceptions about school. This survey is intended for a sample of current undergraduate students enrolled at the University of Tennessee, Knoxville.

This survey is administered through the University of Tennessee for academic purposes. Completion of this survey shows your consent to participate. Completion of this survey is voluntary. You may skip any questions that you do not want to answer. There are no right or wrong answers – we only want your honest opinion. Overall, this survey is 5 pages and should take between 5 and 15 minutes to complete.

Participants that complete the survey within the first day of receiving the link will have the opportunity to enter to win a $25 VISA gift card. Participants that complete the survey within the first week of receiving the link will have the opportunity to enter to win a $25 VISA gift card.

If you are interested in receiving the results of this survey, you may request them by emailing aplante@utk.edu.

Thank you for your help.

Amanda Plante
aplante@utk.edu
University of Tennessee

Passive Plant

This section will focus on activities you may or may not participate in outdoors. Even if you do not participate in any of these activities, your feedback is still valuable.

Please select the response that best describes how much time you spend outdoors. If you are not sure about your answer, please give your best guess.

	None	Less than 1 hour a day	About 1 hour a day	About 2 hours a day	About 3 hours a day	About 4 hours a day	About 5 hours a day	About 6 hours a day	About 7 hours a day	About 8 hours a day	About 9 hours a day	About 10 hours a day	More than 10 hours a day
On a typical **week day**, about how much time do you spend outdoors?	○	○	○	○	○	○	○	○	○	○	○	○	○
On a typical **weekend day**, about how much time do you spend outdoors?	○	○	○	○	○	○	○	○	○	○	○	○	○

Please select the response that best describes how often you participate in each of the following activities this school year. If you are not sure about your answer, please give your best guess.

	Never	Once a year	Every few months	Once a month	Once a week	Several times a week	Daily
Spend time outdoors	○	○	○	○	○	○	○
Read outdoors	○	○	○	○	○	○	○
Study or do homework while outdoors	○	○	○	○	○	○	○
Draw or paint outdoors	○	○	○	○	○	○	○
Write or journal outdoors	○	○	○	○	○	○	○
Nap outdoors	○	○	○	○	○	○	○
Hammock outdoors	○	○	○	○	○	○	○
Relax outdoors	○	○	○	○	○	○	○
Listen to music outdoors	○	○	○	○	○	○	○
Eat or drink outdoors (ex. grilling out, picnicking, etc.)	○	○	○	○	○	○	○

	Never	Once a year	Every few months	Once a month	Once a week	Several times a week	Daily
Walk outdoors	○	○	○	○	○	○	○
Hike outdoors	○	○	○	○	○	○	○
Bike outdoors	○	○	○	○	○	○	○
Jog outdoors	○	○	○	○	○	○	○
Swim outdoors	○	○	○	○	○	○	○
Play team sports outdoors	○	○	○	○	○	○	○
Play games that are not necessarily team sports outdoors	○	○	○	○	○	○	○
Exercise outdoors	○	○	○	○	○	○	○

	Never	Once a year	Every few months	Once a month	Once a week	Several times a week	Daily
Go camping	○	○	○	○	○	○	○
Do volunteer work outdoors	○	○	○	○	○	○	○
Work outdoors as part of a paid job	○	○	○	○	○	○	○
Go fishing	○	○	○	○	○	○	○
Kayak, canoe, or other boating activity	○	○	○	○	○	○	○
Walk with, exercise with, or play with a pet outdoors	○	○	○	○	○	○	○
Go exploring or sightseeing	○	○	○	○	○	○	○
Hang out with friends outdoors	○	○	○	○	○	○	○

What are some other activities that you like to do outdoors?

Please select the response that best describes how strongly you agree or disagree with the following statements. If you are not sure about your answer, please give your best guess.

I think that I would like to...

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree nor Agree	Somewhat Agree	Agree	Strongly Agree
Spend time outdoors	○	○	○	○	○	○	○
Read outdoors	○	○	○	○	○	○	○
Study or do homework while outdoors	○	○	○	○	○	○	○
Draw or paint outdoors	○	○	○	○	○	○	○
Write or journal outdoors	○	○	○	○	○	○	○
Nap outdoors	○	○	○	○	○	○	○
Hammock outdoors	○	○	○	○	○	○	○
Relax outdoors	○	○	○	○	○	○	○
Listen to music outdoors	○	○	○	○	○	○	○
Eat or drink outdoors (ex. grilling out, picnicking, etc.)	○	○	○	○	○	○	○

I think that I would like to...

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree nor Agree	Somewhat Agree	Agree	Strongly Agree
Walk outdoors	○	○	○	○	○	○	○
Hike outdoors	○	○	○	○	○	○	○
Bike outdoors	○	○	○	○	○	○	○
Jog outdoors	○	○	○	○	○	○	○
Swim outdoors	○	○	○	○	○	○	○
Play team sports outdoors	○	○	○	○	○	○	○
Play games that are not necessarily team sports outdoors	○	○	○	○	○	○	○
Exercise outdoors	○	○	○	○	○	○	○

I think that I would like to...

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree nor Agree	Somewhat Agree	Agree	Strongly Agree
Go camping	○	○	○	○	○	○	○
Do volunteer work outdoors	○	○	○	○	○	○	○
Work outdoors as part of a paid job	○	○	○	○	○	○	○
Go fishing	○	○	○	○	○	○	○
Kayak, canoe, or other boating activity	○	○	○	○	○	○	○
Walk with, exercise with, or play with a pet outdoors	○	○	○	○	○	○	○
Go exploring or sightseeing	○	○	○	○	○	○	○
Hang out with friends outdoors	○	○	○	○	○	○	○

Is there anything else that you would like to share about your experiences outdoors?

Active Plant

This section will focus on activities you may or may not participate in outdoors. Even if you do not participate in any of these activities, your feedback is still valuable.

Please select the response that best describes how often you participate in each of the following activities this school year. If you are not sure about your answer, please give your best guess.

	Never	Once a year	Every few months	Once a month	Once a week	Several times a week	Daily
Do gardening activities	○	○	○	○	○	○	○
Pick flowers	○	○	○	○	○	○	○
Pick fruits or berries	○	○	○	○	○	○	○
Pick vegetables	○	○	○	○	○	○	○
Pick herbs	○	○	○	○	○	○	○
Plant trees, shrubs, flowers, or vegetables	○	○	○	○	○	○	○
Climb trees	○	○	○	○	○	○	○
Mow grass	○	○	○	○	○	○	○
Do yard work besides mowing, like weeding, pruning, or raking leaves	○	○	○	○	○	○	○
Work with plants as a volunteer (ex. clearing brush, garden activities, etc.)	○	○	○	○	○	○	○
Work with plants indoors, like watering houseplants	○	○	○	○	○	○	○
Visit a public garden	○	○	○	○	○	○	○
Draw, paint, or photograph plants, flowers, or natural scenes	○	○	○	○	○	○	○

What are some other activities that you like to do that involve plants or gardening?

Please select the response that best describes how strongly you agree or disagree with the following statements. If you are not sure about your answer, please give your best guess.

I think that I would I like to...

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree nor Agree	Somewhat Agree	Agree	Strongly Agree
Do gardening activities	○	○	○	○	○	○	○
Pick flowers	○	○	○	○	○	○	○
Pick fruits or berries	○	○	○	○	○	○	○
Pick vegetables	○	○	○	○	○	○	○
Pick herbs	○	○	○	○	○	○	○
Plant trees, shrubs, flowers, or vegetables	○	○	○	○	○	○	○
Climb trees	○	○	○	○	○	○	○
Mow grass	○	○	○	○	○	○	○
Do yard work besides mowing, like weeding, pruning, or raking leaves	○	○	○	○	○	○	○
Work with plants as a volunteer (ex. clearing brush, garden activities, etc.)	○	○	○	○	○	○	○
Work with plants indoors, like watering houseplants	○	○	○	○	○	○	○
Visit a public garden	○	○	○	○	○	○	○

Please select the response that best describes how strongly you agree or disagree with the following statements. If you are not sure about your answer, please give your best guess.

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree nor Agree	Somewhat Agree	Agree	Strongly Agree
Gardening is hard work	○	○	○	○	○	○	○
I like to spend time around plants	○	○	○	○	○	○	○
I wish that I could spend more time working with plants	○	○	○	○	○	○	○
I gardened as a child	○	○	○	○	○	○	○
I gardened as an adolescent	○	○	○	○	○	○	○
I learned about gardening from my family	○	○	○	○	○	○	○
I learned about gardening in primary school	○	○	○	○	○	○	○
I know about ways I can get involved with gardening on or near campus	○	○	○	○	○	○	○
I am satisfied with my school's landscape	○	○	○	○	○	○	○

Is there anything else that you would like to share about your experiences with plants or gardening?

Satisfaction

This section will focus on your perceptions, attitudes, and beliefs about a variety of topics that relate to your experiences this school year. Please provide your honest opinion.

Please select the response that best describes how dissatisfied or satisfied you are with each of the following items. If you are not sure about your answer, please give your best guess.

	Very Dissatisfied	Dissatisfied	Somewhat Dissatisfied	Neither Dissatisfied nor Satisfied	Somewhat Satisfied	Satisfied	Very Satisfied
My family life	○	○	○	○	○	○	○
My friendships	○	○	○	○	○	○	○
My school experience	○	○	○	○	○	○	○
Myself	○	○	○	○	○	○	○
Where I live	○	○	○	○	○	○	○
My romantic relationships	○	○	○	○	○	○	○
My physical appearance	○	○	○	○	○	○	○

Please select the response that best describes how dissatisfied or satisfied you are with the following statements. If you are not sure about your answer, please give your best guess.

Overall, how dissatisfied or satisfied are you with your…

	Very Dissatisfied	Dissatisfied	Somewhat Dissatisfied	Neither Dissatisfied nor Satisfied	Somewhat Satisfied	Satisfied	Very Satisfied
Classes so far	○	○	○	○	○	○	○
College experience so far	○	○	○	○	○	○	○
Grades so far	○	○	○	○	○	○	○

Is there anything else that you would like to share about your satisfaction with school?

Please select the response that best describes how much time you spend studying. If you are not sure about your answer, please give your best guess.

	None	Less than 1 hour a day	About 1 hour a day	About 2 hours a day	About 3 hours a day	About 4 hours a day	About 5 hours a day	About 6 hours a day	About 7 hours a day	About 8 hours a day	About 9 hours a day	About 10 hours a day	More than 10 hours a day
On a typical **week day**, about how much time do you spend studying?	○	○	○	○	○	○	○	○	○	○	○	○	○
On a typical **weekend day**, about how much time do you spend studying?	○	○	○	○	○	○	○	○	○	○	○	○	○

Demographics

This is the final section of the survey. This section includes questions about your background. This information will help us better understand answers provided to the previous sections. Again, this survey is completely anonymous and answers are voluntary.

Which of the following areas are you currently enrolled in for your major?

What is your current major?

Which of the following options best describes your status at your current university?

How many credit hours are you currently enrolled in for this semester?

Including this semester, how many semesters have you attended your current university?

What is your current ***overall*** G.P.A. (Grade Point Average)?

Which of the following would you say is your ***primary*** source of funding for tuition this year?

What is your gender?

What is your age?

Which of the following best describes your current residence?

Is there anything else that you would like to share?

Vita

Amanda D. Plante harkens from the small town of Monson, Massachusetts, and was born in a nearby city on September 11, 1988. She developed a love of plants at a young age when she would explore the natural environment around her family home. Her family moved to Seymour, Tennessee in 1999, where she attended the King's Academy. She was very involved in student government, competed in the annual Envirothon, and had the opportunity to attend the Tennessee Governors School for Agricultural Sciences and Natural Resources. Amanda then attended the University of Tennessee to pursue a bachelor's of science in plant sciences with a concentration in public horticulture. She continued to serve in student government and worked as a student intern for the UT Gardens. Upon her graduation in May 2011, Amanda worked with the "Every Child Outdoors" Youth Garden at the Knoxville Botanical Garden and Arboretum.

In August 2012, Amanda began graduate school at the University of Tennessee in the Department of Plant Sciences. During her graduate career, Amanda focused on developing skills in survey research in the context of public horticulture. She also gained valuable experience as a teaching assistant for plant identification and propagation courses. In May 2014, she graduated with her master's of science in plant sciences and a minor in statistics. She is now completing an internship with the Royal Botanic Gardens, Kew near London, England.