Evaluating the educational impact of pre- and post-visit activities on elementary students following a field trip to a public garden

by

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Signatures have been redacted for privacy
For Mom, Dad, Andrew, and Dan
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ABSTRACT

Many public gardens offer tours to schoolchildren. Informal educators argue that preparing students for a field trip by providing pre- and post-visit activities can positively impact learning. However, there is little research that supports the efficacy of pre- and post-visit activities on learning at public gardens. Therefore, the purpose of this research was to determine the impact of pre- and post-visit activities on learning after a field trip to a public garden.

This quasi-experimental study’s population included four fifth-grade classrooms assigned to one of two treatments: 1) a field trip only (control) and 2) a field trip with pre- and post-visit activities (treatment). A post-trip assessment consisted of open-ended questions and was scored quantitatively. Differences between treatment groups were analyzed by using a t-test.

Findings indicated that there was no significant difference in post-test scores between the treatment groups. Although pre- and post-visit activities have been found to prepare students for a field trip and to tie the field trip to classroom learning, this case study did not show an increase in learning outcomes. A limitation of this research was the small number of students involved and should be conducted again with more students. However, the novel method of analysis may have implications for assessing what students learn on field trips to informal settings. This research has implications for informal education settings such as public gardens, botanical centers, and arboreta that seek to measure visitor learning.
CHAPTER 1. GENERAL INTRODUCTION

Introduction

Field trips account for one-quarter to one-half of all visitors to science museums (Danilov, 1982). However, the Colloquium on Museums as Educational Institutions (1982) reported that schools view these visits as “events” rather than educational experiences. An “event” visit is one that has no educational organization. On these “event” visits, there are limited or no participatory activities for students. In order to make these visits educational field trips rather than events, museums need to implement hands-on programs and organized tours (Bitgood, 1991). With these participatory activities, field trip destinations such as museums and public gardens can be not only beautiful and interesting places to visit, but educational places as well.

Focus group research with volunteer groups at Reiman Gardens in Ames, Iowa, recently revealed the need for structured activities and lessons for school group tours (Haynes and Trexler, in preparation). Volunteer tour guides expressed that school tours needed these activities and lessons in order to keep students’ attention. It has been found that both cognitive and affective learning can be increased when teachers link the visit with classroom work (Finson and Enochs, 1987; Koran et al., 1983; Wolins et al., 1992).

Field trips provide students with the opportunity to see and experience what they cannot in the classroom. However, some school administrators frown on excessive numbers of field trips due to the ever-increasing cost of transportation. One way museums are helping to change this is by helping teachers link field trips to the classroom with pre- and post-visit activities. These activities are designed to help maximize the educational impact of a field trip by turning a one-hour field trip into an outing and a lesson.
Rationale

By offering pre- and post-visit materials, a garden can help teachers and students make the most of their limited time on a field trip. Many studies have shown that students who have been prepared by their teacher before going on a field trip concentrate better and learn more from the experience (Delaney, 1967; Koran and Baker, 1978; Melton et al., 1936; Gennaro, 1981; MacKenzie, 1986). For example, a study at the Minnesota Landscape Arboretum showed that students who were given pre-visit activities scored higher on a post-visit assessment than students who did not participate in pre-visit activities (Tanck, 1982).

Pre-visit preparation is also important to familiarize students with the environment they will be visiting. Falk et al. (1978) found that students who were familiar with the environment exhibited more conceptual learning than students for whom the setting was novel. The novelty of a field trip to the garden could be reduced or even eliminated by showing students slides, a video, maps and doing pre-visit activities in the classroom.

Bitgood and Benefield (1989) reported that a high percentage of teachers use the follow-up activities provided by museums, but the effectiveness of these activities has not been proven. Post-visit activities are potentially important for tying the experience to the classroom and they encourage children to discuss what they learned while on the field trip. Whether or not a teacher decides to use the materials, they are available for those teachers who do not feel comfortable teaching plant sciences to their students.

Carla Pastore, Executive Director of The American Association of Botanical Gardens and Arboreta, recently noted several trends within the public garden arena. One of these trends was that “gardens are becoming a vital part of their community” (Pastore, 2001, p.1). She also says “studies show that if you capture the interest and imagination of a child, he or
she will visit gardens their entire life” (2001, p.1). By creating programs that interest children, public gardens can keep up-to-date with trends and be places children, as well as adults, enjoy visiting. These activities can help gardens increase visitorship and community involvement of all ages.

Because there is so much evidence that field trips have a positive impact on learning, and because little or none of this research has been conducted at public gardens, this study will investigate a field trip at a public garden.

**Purpose**

The purpose of this research was to compare the effectiveness of two field trip models (Model A and Model B) based on learning outcomes. Model A included organized activities and a tour while at the garden and Model B included pre-visit and post-visit activities as well as organized activities and a tour while at the garden (Fig. 1).

<table>
<thead>
<tr>
<th>Model A (Control)</th>
<th>Model B (Treatment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Organized tour</td>
<td>- Organized tour</td>
</tr>
<tr>
<td>- Hands-on activities</td>
<td>- Hands-on activities</td>
</tr>
<tr>
<td></td>
<td>- Pre-trip and Post-trip activities</td>
</tr>
</tbody>
</table>

**Figure 1. Model A and Model B For Sod Houses of Iowa Program.**

The hypothesis was that a field trip that is more closely linked to the classroom with pre-trip and post-trip activities will be more effective educationally (i.e., help reach local or national standards and benchmarks for certain subjects and grades). By offering these “links” to the classroom, gardens are better reaching out to their communities.
This study examines an educational field trip program implemented at a university-based garden. The study will determine whether or not a designed set of pre- and post-trip activities makes enough of an impact on students to make them worthwhile (i.e., time of teachers, students, garden staff, and costs of materials). In doing so, garden staff will know where to focus energy; on the pre/post activities, or solely on tour activities. By providing these structured activities and field trip programs, teachers can choose to incorporate a field trip into the classroom more easily.

This study uses an assessment technique different from techniques used in similar studies (Gennaro, 1981; Stoneberg, 1981; Tanck, 1982). While these studies assessed students with a multiple-choice test, this study uses an open-ended assessment. Open-ended questions are used to encourage a higher order of thinking. Unlike a multiple-choice question, this type of question forces students to think of an answer, rather than simply recognizing a correct answer (Gall et al., 1996; Pedhazur and Pedhazur-Schmelkin, 1991). By using this assessment technique researchers cannot only find out if students learn from a field trip, but what they learn from a field trip as well.

Thesis organization

The next chapter of this thesis is a literature review that discusses previous research conducted on field trips and pre- and post-visit activities. Following the literature review is a chapter, in manuscript form, which describes my research that took place in the spring of 2001. This chapter is formatted for submission to HortTechnology. Chapter 4 discusses conclusions and implications for this research study. Following the conclusions chapter are two appendices and acknowledgements.
Literature Cited

Bitgood, S. 1991. What do we know about school field trips? ASTC Newsletter 14:5-6,8.


Colloquium on Museums as Educational Institutions. 1982. New York: Clark, Phipps & Clark, & Harris, Inc.


Stoneberg, S.A. 1981. The effects of pre-visit, on-site, and post-visit zoo activities upon the cognitive achievement and attitudes of sixth grade pupils. PhD. Dissertation. University of Minnesota, Minneapolis.


CHAPTER 2. LITERATURE REVIEW

Introduction

By definition, a field trip is “any journey taken under the auspices of the school for educational purposes” (Sorrentino and Bell, 1970, p. 233). Many school field trips take place at museums such as science centers, nature centers, zoos, and botanical or public gardens. Twenty million elementary school and junior high students take field trips to museums, science centers, and other informal learning environments each year (Kubota and Olstad, 1991).

Recently there has been an increasing interest in garden-based curricula, and therefore, an increasing popularity in field trips to public gardens. In an effort to make these field trips more educational, institutions are faced with the task of developing programs for school groups. As a result, many gardens and arboreta now have their own education departments or education coordinators to work more closely with schools, teachers, and school children.

Benefits of field trips

Just as the popularity of the field trip has grown, so has the amount of field trip research. To date, there is a substantial amount of research about children’s’ learning experiences during visits to informal learning centers (Balling and Falk, 1980; Falk et al., 1978; Flexer and Borun, 1984; Gennero, 1981; Gottfried, 1980; Kahtz, 1995; Kubota and Olstad, 1991; Ramey-Gassert et al., 1994; Rennie and McClafferty, 1996; Stronck, 1983). As a result of this research, field trips have been shown to benefit school children in three distinct areas: learning, social benefits, and attitudinal benefits.
Learning

Informal environments, when used correctly by incorporating them into the classroom, can be excellent learning tools (Balling and Falk, 1980; Eason and Linn, 1976; Sneider et al., 1979). Some benefits of taking field trips to informal environments include: 1) reinforcement of classroom learning (Wright, 1980); 2) direct student involvement with the subject matter (Prather, 1989); 3) excitement and pleasure (Flexer and Borun, 1984; Price and Hein, 1991); and 4) the ready involvement of non-English speaking students and students that do not excel in school (Hein, 1985). The president of the National Science Foundation, Walter E. Massey, strongly believes that these museums “can play a large role in nurturing curiosity in youngsters by creating a sense of wonder that underlies the basis for the desire to learn and understand” (Bresler, 1991, p.6).

Field trips are especially beneficial in their ability to help students understand abstract concepts that are difficult to understand in the classroom (Wiley and Humphries, 1985; Gagne, 1970). Topics such as plant diversity sometimes are more easily learned when students can see, firsthand, the diverse collection at a garden. Visiting a museum may help students to better learn newly acquired knowledge by allowing them to incorporate their prior experiences and background (Hancock and Farris, 1988).

These field trips to botanic gardens and similar institutions have great teaching potential because they emphasize participatory activities (Danilov, 1976; Whittlin, 1970). Participatory activities help students to learn-by-doing (King and Abbott-King, 1985) and to apply what they have learned in the classroom (McLure, 1985). Participatory activities can be in the form of pre-visit or post-visit activities conducted in the classroom to link a field trip to a classroom lesson. They may also be organized activities at the museum such as
interactive tours or hands-on activities. These activities engage students and help them connect science to their daily lives (King and Abbott-King, 1985).

The knowledge that field trips are an effective teaching tool is not new. Studies on this subject date back to the 1930's. In a field trip versus classroom study, students who went on a field trip scored significantly higher than students who learned the same topic in a classroom, and students of lower ability received the most benefit from the field trip (Schellhammer, 1935). Even today, field trips have been shown to help students assimilate material into their schema more thoroughly than in the classroom (Wright, 1980).

Social

Vygotsky (1978; 1981) proposed that social interaction plays an important role in cognitive development. Field trips offer children the chance to socialize with each other (Prather, 1989) and the chance to develop cooperative ways of working together that may not be possible in a classroom setting (Price and Hein, 1991).

If we learn through social interaction, then structuring learning so that people collectively learn would greatly benefit learning. One study has shown that students learn more when they work together (Birney, 1986). This group participation may also promote self-confidence and enhance social skills and leadership among students (Hancock and Farris, 1988).

Attitudinal

Students find visits to museums exciting and different from being at school. The lessons are often considered by children to be more interesting and enjoyable than classroom
lessons (Flexer and Borun, 1984). This excitement stimulated by a museum environment is beneficial in promoting the development of positive attitudes toward science (Harvey, 1951; Brady, 1972; Prather, 1989; Rix and McSorley, 1999).

Dewey encouraged students to explore the world to make personal connections (1961). These personal connections allow students to become more excited and interested in the subject at hand. He believed that “all genuine education comes about through experience” (1938, p. 25). In an effort to help students become interested, some museums, science centers, and public gardens now offer participatory activities such as pre- and post-visit activities and organized on-site activities.

**Participatory Activities**

One way to make a museum experience more valuable is to use participatory activities. These activities may be done before (pre-visit), during, or after a field trip (post-trip).

**Pre-visit**

Piaget proposed the idea of assimilation, accommodation, and equilibrium to explain how people learn (Shymansky et al., 1999). If a learner goes to a garden already knowing what a garden is and what to expect, the setting is readily assimilated into already existing knowledge. On the other hand, if a garden is a novel setting to the learner, the setting is not readily assimilated. Instead, the learner first needs to accommodate new information before equilibrium can be reached.
There is much research showing that novel environments are poor settings for imposed task learning when compared to familiar settings (Falk and Balling, 1982; Falk et al., 1978; Lubow et al., 1976; Martin et al., 1981). Falk et al. (1978) found that placing children in an extremely unfamiliar setting may cause sufficient stress to block any meaningful learning experience. In these novel settings, children often devote more mental energy to familiarizing themselves with the new environment than they devote to the lesson being taught (Falk, 1983). Martin et al. (1981) reported that novel field trip situations require students to “adjust” to a new environment. This adjustment causes students to focus on their surroundings rather than on lessons and activities. In other words, children need time to adjust to a new environment before learning will occur. By reducing the novelty effect, “on-task” exploratory behavior increases and greater cognitive learning occurs (Kubota and Olstad, 1991).

In a study conducted by Balling and Falk (1980), pre- and post-trip scores of two groups of students were compared following a field trip to a wooded area. One group of students lived near a wooded area and the other group did not. Those students who lived near the wooded area scored significantly higher on a post-trip assessment than students who did not live near a wooded area. Balling and Falk attributed this higher score average to the fact that the group was familiar with the setting and therefore was able to learn more.

Today, in an effort to reduce the novelty effect, many museums create materials such as slides, websites, videos, picture brochures, and maps (Gennero, 1981; Gennaro et al., 1982; Koran and Baker, 1979; Melton et al., 1988; Stoneberg, 1981; Tanck, 1982). These materials are part of pre-visit activities to introduce the site and thus reduce the novelty effect.
The value of a field trip can be enhanced if students are prepared for what they will learn and what they will see (Gennaro, 1981). The constructivist theory of learning recognizes that students construct new understandings by combining previous understandings with new discoveries (Ramos, 1999). In order to construct new meaning, students need to have some previous knowledge. Students’ prior knowledge is also important in determining how they interact and what they learn from exhibits at museums (Beiers and McRobbie, 1992; Eberbach, 1997; Falk et al., 1986; Gottfried, 1980; Lucas et al., 1986; Sakops, 1984; Sneider et al., 1979; Tulley and Lucas, 1991). The more prior knowledge a visitor has, the more they will learn at a museum (Falk et al., 1986; Shettel et al. 1968).

Gross and Pizzini (1979) studied the effects of pre-visit instruction and a one-day field experience on environmental orientations of upper elementary students. This study used what Campbell and Stanley (1963) call a separate sample pre-test, post-test design. Two groups were given a unit on woodlands approximately one to two months before a field trip to a woodlands area. Results showed positive effects of advance organizers when combined with field experience.

Introducing students to field trip objectives before the visit gives students some foundation on which to build during the field trip experience. Koran and Baker (1979) recommend the use of advance organizers such as slides, lectures or supplemental reading related to what the students will experience in the field to provide a conceptual structure for incorporating and interpreting the experience. These advance organizers help students connect new material with material already known (Ausubel, 1963).

These activities not only prepare students for what they will see, but they help link the visit to the classroom. Finson and Enochs (1987), Koran et al. (1983) and Wolins et al.
(1992) found both cognitive and affective learning can be increased when teachers link the visit with classroom work.

The visit

The structure of tours at museums can have a great influence on how children react to the experience. One study showed that a structured tour results in more learning, but students get more pleasure out of an unstructured tour (Stronck, 1983). Another researcher found that students learn a great amount even on unstructured tours (Carlisle, 1985).

Sakops (1984) conducted a study exploring the educational impact of two types of tours at a museum. Sakops concluded that students learn more on a less structured tour because they are not being overloaded with facts in an effort to fit a lot of information into a one to two-hour tour. Stronck (1983) studied two types of museum field trips: a docent-led group of students and a group led by the students’ teacher. The docent led tour included a very structured lesson while the teacher led tour was very unstructured. Both groups were then assessed with a knowledge test and an attitudinal test. Docent-led students scored higher on the knowledge test, whereas teacher-led students scored higher on the attitudinal test. Keeping this study in mind, the challenging part of field trip design is deciding how much of the visit should be structured and unstructured.

Post-visit

Until recently, research dealing specifically with the effectiveness of post-visit activities had been neglected. Bitgood and Benefield (1989) reported that while a high percentage of teachers use post-visit activities, the impact of these activities on student
learning is not known. In a more recent study, Anderson et al. (2000) provided evidence that students constructed knowledge about science as a result of a field trip and classroom-based post-visit activity.

Field trips at public gardens

While zoos and public gardens are considered museums by granting and administrative agencies, none of the aforementioned studies was conducted at a public garden. Gardens are a unique type of museum because they allow for many hands-on and participatory activities on a variety of subjects in an outdoor environment. However, schools often view field trips to public gardens and other museums as “events” rather than educational experiences (Colloquium, 1982). An “event” visit is one that includes no educational activities or connections to the classroom. Unfortunately, not all gardens offer teachers materials to make a field trip more educational.
Literature Cited


Colloquium on Museums as Educational Institutions. 1982. New York: Clark, Phipps, Clarks and Harris, Inc.


Stoneberg, S.A. 1981. The effects of pre-visit, on-site, and post-visit zoo activities upon the cognitive achievement and attitudes of sixth grade pupils. PhD. Dissertation. University of Minnesota, Minneapolis.


CHAPTER 3. “THE EFFECT OF PRE- AND POST-VISIT ACTIVITIES ON STUDENT LEARNING AT A PUBLIC GARDEN”

A paper submitted to HortTechnology

Sarah Jane Gross

Abstract

The purpose of this research was to determine the impact of pre- and post-visit activities on learning after a field trip to a public garden.

This quasi-experimental study’s population included four fifth grade classrooms assigned to one of two treatments: 1) a field trip only (control) and 2) a field trip with pre- and post-visit activities (treatment). A post-trip assessment consisted of open-ended questions and was scored quantitatively. Differences between treatment groups were analyzed using a t-test.

Findings indicated that there was no significant difference in post-test scores between the control and treatment groups. Although pre- and post-visit activities have been found by other researchers to prepare students for a field trip and to tie the field trip to classroom learning, this case study did not show an increase in learning outcomes. A limitation of this research was the small number of students involved. For this reason, the study should be conducted again with more students. This study utilized an open-ended assessment, rather than a multiple choice or other traditional means of assessment. Because of the novel method of analysis, this study may have implications for assessing what students learn on
field trips to informal settings. This research has implications for informal education settings such as public gardens, botanical centers, and arboreta that seek to measure visitor learning.

**Introduction**

Many public gardens offer tours to schoolchildren. Anecdotal evidence from educators suggests that preparing students for a field trip by providing pre- and post-visit activities can positively impact learning (Delaney, 1967; Koran and Baker, 1978; Melton et al., 1936; Gennero, 1981; MacKenzie, 1986; Tanck, 1982). This preparation helps reduce what Falk et al. call the "novelty effect" of a field trip (1978). Falk et al. found that placing children in a new or "novel" setting can cause enough stress to block meaningful learning (1978). However, to date, there is little research that rigorously supports the efficacy of pre- and post-visit activities on learning at public gardens. Therefore, the objective of this research was to determine the impact of pre- and post-visit activities on learning after a field trip to a public garden.

This study utilized an assessment technique different from many other field trip studies. While multiple-choice questionnaires seem to be a popular assessment method, this study used an open-ended assessment. Because students were assessed this way, fewer students were involved in order to more deeply examine student responses. This assessment technique will not only help researchers know if students learned, but what they learned as well.
Materials and Methods

Setting

The children’s garden at Reiman Gardens, located on the campus of Iowa State University, was the destination used in this project. Because the children’s garden was only one year old and there has been little educational programming at the site, many school children had not experienced educational programs at Reiman Gardens. When this research was conducted, this program was the first organized school field trip program offered at the garden. Some students participating in the research may have participated in family programming at the garden, but not with their schools.

The design, plantings, and structures within the children’s garden have an “Iowa” theme, with a covered bridge, sod house and corncrib. This provided an excellent opportunity to teach students about Iowa history in the garden. Because the early prairie settlers depended on sod and sod houses, the sod house structure in the children’s garden was the focus of this research project.

Subjects

Fifth graders from the Ames Community School District were chosen to participate in this study. Local curriculum guidelines suggest that Iowa History be taught at the fifth grade level in the Ames Community School District. Because Iowa does not have state educational standards, different districts teach Iowa History at different grade levels and each district has their own teaching guidelines.
Four fifth-grade teachers from three elementary schools in the school district agreed to participate in the study. The four groups were assigned to one of two treatments. They are as follows in Table 1:

Table 1. Treatments and Number of 5th Grade Students Involved in a Field Trip to Reiman Gardens.

<table>
<thead>
<tr>
<th>Class</th>
<th>Treatment</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tour only</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>Tour only</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>Pre, tour, post</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>Pre, tour, post</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>65</strong></td>
</tr>
</tbody>
</table>

Again, because the state of Iowa does not have a standardized curriculum, it was difficult to choose a state-wide standard on which to base this field trip program. In order to make the Sod Houses of Iowa program adaptable to schools outside of Ames, one National Science Standard was chosen. The standard chosen was “organisms and environments” (National Research Council, 1996). The sod house program helped students meet this standard by: 1) allowing them to see how grass plants adapted to the rough prairie environments, and 2) by showing them how settlers adapted to their tree-less environment by using sod as a building material.

Choosing an Ames District Iowa History Guideline was even more challenging because many teachers across Iowa may choose what they want to teach for this topic. The researchers chose to meet an Iowa History guideline as listed by the Ames School District for this study. The guideline is to “describe the relationship between natural history (land) and human history (people)” (Ames Community Schools, 1998 p. 3). The sod house program
showed students an example of a relationship the settlers had with the land. Discussing grasses also taught students about our dependency on the land and plants for food.

Activities for this program were designed to help students meet these standards and guidelines. While one activity alone may not accomplish this, the program as a whole was intended to do so. A more detailed description of the activities and programming goals are listed in Table 2.
Table 2. Program Activities and Their Goals

<table>
<thead>
<tr>
<th>Activities</th>
<th>Goal</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-Visit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Virtual tour of garden</td>
<td>Familiarize students with</td>
<td>Click-able map posted on internet website</td>
</tr>
<tr>
<td></td>
<td>Reiman Gardens</td>
<td></td>
</tr>
<tr>
<td>Homes of The West book</td>
<td>Introduce the idea of sod homes</td>
<td>Book by Bobbie Kalman (1999)</td>
</tr>
<tr>
<td><strong>Tour</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grains garbage can</td>
<td>Heighten awareness of grasses in our daily lives</td>
<td></td>
</tr>
<tr>
<td>Fibrous vs. tap roots</td>
<td>Recognize and be aware of the types of roots</td>
<td></td>
</tr>
<tr>
<td>“Diversity of Grasses” display</td>
<td>Introduce students to the</td>
<td>Display with twelve varieties of grass (turf, prairie, agricultural)</td>
</tr>
<tr>
<td></td>
<td>different sizes, shapes, textures of grasses</td>
<td></td>
</tr>
<tr>
<td>Read Sod Houses of the Great Plains in the sod house</td>
<td>Discuss what life in a sod house was like</td>
<td>Book by Glen Rounds (1995)</td>
</tr>
<tr>
<td>Sod home hands-on construction activities</td>
<td>Learn techniques of sod house construction</td>
<td></td>
</tr>
<tr>
<td>“Sod Houses Through Time” display</td>
<td>Teach that sod is still used to construct homes</td>
<td>Display with historical and modern sod home photos</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Post-Visit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Build a miniature sod house</td>
<td>Apply knowledge of sod house construction</td>
<td></td>
</tr>
<tr>
<td>“The Survival of the Grass”</td>
<td>Learn why grass plants can tolerate fire, mowing, etc. while other plants cannot</td>
<td>Students grew and “mowed” grass and beans, then observed results.</td>
</tr>
</tbody>
</table>

**Independent Variables**

The four classes were randomly assigned a treatment. Thus, the treatment assigned is the independent variable. Students subjected to treatment one received an organized tour at
the garden focusing on sod houses and their part in Iowa history. The field trip also focused on characteristics of plants in the grass family. There were several exhibits set up to teach students about 1) the diversity of grasses, 2) grass products they know or consume, and 3) sod houses in past and present times. Students had a chance to explore the sod house in the children’s garden and participate in hands-on activities. Students in treatment group two had the same field trip experience as those in treatment group one with the addition of pre-trip and post-trip activities. Pre-trip activities were designed to reduce the novelty of the garden setting and introduce the idea of sod houses. Post-trip activities were designed to link the visit to the classroom and be an extension of the field trip experience. Examples of the pre- and post-trip activities can be found in Table 2. The purpose of these activities was to familiarize students with the garden and tie the garden to a classroom lesson or activity. Each activity was designed to take approximately fifteen minutes of class time while the field trip tour lasted two hours.

Procedures

Approval to do research in the Ames Community Schools was obtained prior to inviting fifth grade teachers to participate in the program. Approximately one to two weeks before the scheduled field trip, evaluation guidelines, evaluations, and pre-visit and post-visit materials were delivered to teachers in treatment group two. Those teachers selected for the pre- and post-trip classroom activities administered pre-visit and post-visit activities approximately one-week prior and one week following the field trip. All students and parents signed consent forms prior to visiting the garden.
Data Analysis/Evaluation

The field trip experience was evaluated using an open-ended questionnaire. This cognitive test was comprised of six multi-part questions worth zero to two points each. Partial credit was given for below satisfactory or partial answers. See Appendix A for sample test questions, answers, and scores. Open-ended questions were used to encourage higher order of thinking. Unlike a multiple-choice question, these types of questions force students to think of an answer, rather than simply recognizing a correct answer (Gall et al., 1996; Pedhazur and Pedhazur-Schmelkin, 1991).

Because the goal of the research was to determine whether or not pre- and post-trip activities made a difference in this particular field trip, a pre-test was not used. Research has shown that pre-tests may interact with a treatment such as a pre-trip activity (Campbell and Stanley, 1966; Gall et al., 1996; Pedhazur and Pedhazur-Schmelkin, 1991; Van Dalen, 1979). It would be ideal to know the prior knowledge of students before they participated in the field trip to ensure equivalence of groups. For this study, however, a pre-test might have interacted with the assessment instrument (Isaac and Michael, 1981).

For this study, it needed to be determined if students were similar in their cognitive ability. A pre-test questionnaire is used to determine sample equality in many studies. Because of the possibility of a pre-test acting as a pre-visit activity, however, another method was used to determine sample equality prior to the field trip experience. Iowa Test of Basic Skills (ITBS) scores were analyzed, focusing on science and reading scores. Table 3 shows reading and science ITBS class score means.

A one-way analysis of variances (ANOVA) was used to determine whether or not there was a significant difference between class ITBS reading and science scores. For
reading scores between classes, $P = 0.505$ and for science scores between classes, $P = 0.532$. Since both $P$-values were greater than 0.05, there are no significant differences between science or reading score means. In other words, based on these ITBS scores, all four classes are on the same level, cognitively.

Table 3. Iowa Test of Basic Skills (ITBS) Science and Reading Score Class Averages for 5th Graders Receiving and Not Receiving Pre- and Post-visit Activities in Conjunction With a Field Trip.

<table>
<thead>
<tr>
<th>Class</th>
<th>Treatment</th>
<th>Reading Score Mean</th>
<th>P-Value (Reading)</th>
<th>Science Score Mean</th>
<th>P-Value (Science)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tour only</td>
<td>61.13</td>
<td></td>
<td>69.73</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Tour only</td>
<td>72.76</td>
<td>0.505</td>
<td>78.35</td>
<td>0.532</td>
</tr>
<tr>
<td>3</td>
<td>Pre, tour, post</td>
<td>73.47</td>
<td></td>
<td>81.65</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pre, tour, post</td>
<td>66.26</td>
<td></td>
<td>74.17</td>
<td></td>
</tr>
</tbody>
</table>

Content validity of the assessment was established by a science education evaluation professional. A list of important concepts was made and a six-question test was created based on these concepts. Reliability of the assessment was established by using an outside scorer who scored every third assessment that the researcher scored. Interrator reliability was found to be 92% (data not presented).

The scores were then analyzed using the Levene’s Test For Equality of Variances, t-test for Equality of Means, and ANOVA options of Statistical Package for Social Sciences (SPSS, Chicago, IL). Levene’s Test was the chosen procedure for determining variance homogeneity because it is the preferred method when data come from continuous, but not necessarily normal, distributions (Abrami, et al., 2001).
Results

Six multi-part questions on the assessment tool were used. The following are sample questions and sample answers given by fifth graders. A more complete list of questions and answers can be found in the Appendix.

Q1. Describe why sod was a good building material.
   
   A1. “It was a good insulator; cool in summer, warm in winter”.
   
   A1. “Because the roots held the soil in place”.
   
   A1. “It was a natural resource and you could use an unlimited supply”.

Q2. How are prairie grasses different from other plants?

   A2. “The grasses have longer roots and when burned can grow back”.
   
   A2. “Prairie grasses have long fibrous roots”.

The means and the standard deviation of the post-visit assessment scores of the “tour only” and “pre-visit, tour, post-visit” groups can be found in Table 4. The mean of the tour only treatment is 17.63, out of 20 possible, with a standard deviation of 2.70. The mean of the pre-visit, tour, and post-visit treatment is 17.77, out of 20 possible, with a standard deviation of 1.78.

Table 4. Means and Standard Deviations of Assessment Scores For Fifth Graders from Tour Only and Pre-visit, Tour, Post-visit Groups

<table>
<thead>
<tr>
<th>Treatment</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>T-value</th>
<th>Degrees Freedom</th>
<th>2-tail P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tour only</td>
<td>30</td>
<td>17.63</td>
<td>2.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre, tour, post</td>
<td>35</td>
<td>17.77</td>
<td>1.78</td>
<td>0.247</td>
<td>63</td>
<td>0.806</td>
</tr>
</tbody>
</table>

Test for Equality of Variances

Levene’s Test for Equality of Variances was used where F = 2.226 with 63 degrees of freedom. Because P = 0.141, and it is greater than 0.05, equal variances were assumed.
Test For Equality of Means

Treatment means were analyzed using a t-test for equality of means. The t-test found $t = 0.247$ with $P = 0.806$. Because the P-value is greater than 0.05, equal means are assumed. Therefore, no significant difference between the two treatment means was found.

The statistical analysis showed that pre- and post-visit interaction had no effect on student learning. This conflicts with prior research (Gennero, 1981; Stoneberg, 1981; and Tanck, 1982) that suggested pre-trip and/or post-trip activities do help children learn more. All three of these studies had larger populations and used different assessment methods than used in this study (Table 5).

Table 5. A Comparison of Number of Students Participating and Assessment Methods Used in Four Studies at Informal Settings.

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Number of Students</th>
<th>Assessment Method(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gennero (1981)</td>
<td>105</td>
<td>Pre/post multiple-choice test</td>
</tr>
<tr>
<td>Stoneberg (1981)</td>
<td>1671</td>
<td>Pre/post multiple-choice test and attitude test</td>
</tr>
<tr>
<td>Tanck (1982)</td>
<td>516</td>
<td>Multiple-choice, post-test only and attitude test</td>
</tr>
<tr>
<td>This study</td>
<td>65</td>
<td>Open-ended post-test</td>
</tr>
</tbody>
</table>

Even though statistical analysis indicated no difference between treatments, the program seems to be a valuable addition to the Reiman Gardens. Both students and teachers appeared to enjoy the tours. Students and teachers who participated in pre- and post-visit activities referred to them many times throughout the field trip. This is a visible subjective sign that the pre- and post-visit activities were useful for this particular field trip program.


Discussion

The questions on the assessment were written to match the intended educational outcomes of the field trip. The assessment did not include material taught solely during pre- and post-visit activities. The assessment was designed to determine a disadvantage or advantage of having or not having pre- and post-visit activities.

ITBS scores may also be related to the lack of difference between treatment groups. Analysis of ITBS scores indicated that all classes were cognitively equal in science and reading. There may be differences, however, between the classrooms that ITBS scores do not detect, such as teacher enthusiasm for a particular subject, prior field trip experiences, or even what a child chooses to read or watch on television while at home. Reading and science scores were analyzed. For this study, it may have been helpful to have a score for social studies but ITBS does not include a test for this subject.

Due to the limited number of students in the study and their limited range of ages, it is difficult to generalize this study to other populations. Further research is needed to determine if the topic area, age, geographical location, or other factors influenced this study. The purpose of this research, was not to generalize across populations, but rather to determine pre- and post-visit advantages of a particular group of students. If, however, researchers wanted to generalize this study across populations, the study should be repeated with students in multiple school districts, from different parts of the state, and at different age levels. Although this particular program, Sod Houses of Iowa, was developed for students learning about Iowa history, not all districts teach this subject at the fifth grade level. Several districts in Iowa teach Iowa history at the fourth grade level. Therefore, it might be reasonable to conduct the study again with fourth graders and fifth graders who are learning...
Iowa history. Of course there is always the possibility of losing control of the study by expanding the audience too much.

An important issue is that all students in this study lived in or near the same town as the public garden they visited. Because these students live near the garden, this may have interfered with the control treatment. Because the students live near the garden there is a chance that some of them had visited the garden with their family or on a field trip in a previous grade. Pre- and post-visit activities were designed to reduce the novelty of the garden. These activities do so by introducing students to a novel environment and preparing them for what they will learn while in this environment. Perhaps students in the control group (no pre- or post-visit activities) were already familiar with the garden and did not need classroom activities in order to reduce the novelty effect and help prepare them to learn.

In a study conducted by Balling and Falk (1980), two groups of students went on a field trip to a wooded area. One group lived near a wooded area and the other did not. The group that lived near the wooded area and was familiar with this type of landscape, scored significantly higher on a knowledge-based assessment than the group that was not familiar with a wooded area. This issue might also be true for this study. Perhaps, because all students live in the same town as the field trip destination, group one (tour only) was just as familiar with the garden upon arrival as group two (pre-visit, tour, post-visit). Another study with students from a town other than the same town as the garden could be conducted to determine whether this had an effect on assessment results.

For this study, it would have been beneficial to formally survey students before the field trip to determine how many had already been to the garden. Tour guides did ask for a raise of hands from students who had been to the garden prior to the field trip. In each of the
four classes, approximately one-fourth to one-half of the students had already been to the

garden. Exact counts, however, were not taken for each class.

Another important issue to consider is that the field trip may have involved too much

information. In other words, the pre- and post-visit activities were redundant of material

covered on the field trip. It would be interesting to investigate solely the content of the field

trip. One way to do this is to conduct a study that involves a varying number of field trip

activities. For example one tour might include two sod house or grass activities, another tour

might involve four activities and so on.

Assumptions

Because this was a quasi-experimental study, there were many factors that were
difficult to control, unlike in a true experimental study. These difficult-to-control factors
may be part of the reason why there was no difference between treatments. This study was
conducted with the following assumptions:

- Teachers in the study followed their district curriculum.
- Teachers in the study were equally supportive of the field trip experience with their
  students.
- Teachers did not teach related content beyond that provided by the researchers for
  this study.
- Teachers followed assessment guidelines. (Provided students adequate time to
  complete assessment, assessment was given as scheduled by the researchers.)
- Students had the literacy skills required to read and comprehend the questions on the
  assessment.
If another study is conducted, these assumptions might be partially controlled by surveying students and teachers before or after the visit. A teacher evaluation would be extremely helpful as well. It would also be helpful if the researcher administered all pre- and post-visit activities at the schools. By doing this, pre- and post-visit activities would be delivered to all students in the same manner.

**Conclusions**

This study will be valuable for public gardens that offer field trip programs to school children. It offers advice on how to develop a curriculum-based field trip and provides evidence for field trip design issues.

This study also made use of a very valuable assessment tool. By using an open-ended questionnaire, the researcher was able to learn not only if students learned from pre- and post-visit activities, but it also allowed the researcher to determine what the students learned and how their conceptions were constructed. For example, some students had trouble describing the difference between tap roots and fibrous roots. A display showing examples of these roots included many food items (radish and carrot), there were also examples of fibrous foods and non-foods. Some students took this to mean that tap roots could only be foods. Because this assessment technique showed misconceptions such as these, this study can be valuable to not only public gardens, but other types of museums as well.
Literature Cited


Stoneberg, S.A. 1981. The effects of pre-visit, on-site, and post-visit zoo activities upon the cognitive achievement and attitudes of sixth grade pupils. PhD. Dissertation. University of Minnesota, Minneapolis.


CHAPTER 4. CONCLUSIONS

Implications For This Research

This study was the first research to take place between schools and Reiman Gardens, and it provided valuable information about student field trips. This study has also led to the implementation of a curriculum-based field trip that will serve as an example for other programs in the near future. As a result of this research, relationships were established with school administrative staff, principals, and teachers. These relationships will set the stage for other research projects in the future.

Our goal was to get teachers to reevaluate field trips to informal settings. What was once an “event” field trip or an opportunity to get out of the classroom for an afternoon can now become an opportunity to learn.

Future Research

This was the first research of this type to take place within the Horticulture Department at Iowa State. Because of this, there are many aspects of this study that could be strengthened if a similar study were conducted again. Some suggestions for further research are:

- Increase number of students participating
- Involve students from outside Ames, Iowa
- Interview teachers who participated (amount of time spent on activities, related lesson taught prior to the field trip experience, amount of interest in this research, etc.)
- Evaluate teacher input of the web-based materials
• Ask participating teachers for advice on how to better suit their needs

• Incorporate a true control group (no pre- or post-trip activities, or organized tour; instead, tour by themselves) to evaluate the effectiveness of the program as a whole

This research study may provide a springboard for further research.

Because of the novel assessment technique used in this study, research may also be conducted to learn more about student misconceptions about sod homes and grasses. This information may then be used to revise the current Sod Houses of Iowa field trip program. For example, in one of the visit activities, the garbage activity, various grass and grain product wrappers were presented to the students. Students were asked to share with each other which grasses or grains their product contains. Based on group discussion, the researchers learned that some children did not know that grains are grasses. In order for students to learn from the activity, it was important for the researcher to back up and teach students what plants grains come from. Possessing an understanding of common nonconceptions or misconceptions could help guides know where they need to start instruction with a particular group of students.
APPENDIX A. SOD HOMES OF IOWA PROGRAM

Sod Houses of Iowa: Pre-Visit Activities

Sod Houses of Iowa: Visit Script

Sod Houses of Iowa: Post-Visit Activities
Sod Houses of Iowa: Pre-Visit Activities

We can’t wait to see you and your students!!

The following is a series of lessons for your students to help prepare them for their tour of Reiman Gardens. This pre-visit packet of information is divided into two lessons, each taking approximately 20 to 30 minutes to complete. There are two types of fonts in this series of lessons. The italic type font is a collection of notes for teachers. The other font is written to guide you quickly through the lessons.

It is important that students have some prior knowledge before visiting the site. We strongly suggest you do both pre-visit activities with your students.

**Goal of pre-visit:** Familiarize students with the Reiman Gardens and introduce them to the idea of sod houses and dugouts.

**Overview of Lessons:**

- Lesson #1: Where do our homes come from?
- Lesson #2: Introduce students to the Reiman Gardens by accessing website map.
  (Hyperlink to website)

**Materials for all activities:**

- Reiman Gardens web site
- *Homes of the West* by Bobbie Kalman
- Computer with access to the internet
- Butcher paper or chalk board
Lesson #1: Where do our homes come from?

Materials:
- Homes of the West by Bobbie Kalman
- Butcher paper or chalk board

Set-up: Write questions 1-6 on the board or type them up and hand out to students.

Ask your students the following questions to find out what they already know about early European settlers in Iowa. Write the answers to these questions on butcher paper or the board.

1. What were the homes of early Iowa settlers like?
2. Were their homes like ours today?
3. What did the land look like when the early settlers arrived in Iowa?
4. What other types of homes did early Iowa settlers live in?
5. What do you want to know about the early homes of settlers? Sod houses? Grasses?
6. What materials do we use to build our homes today?
7. Imagine that it is the late 1800’s. Your family has just moved to Iowa and you need to build a home. There are no trees anywhere and there is no railroad to bring in building materials. What will your family do for shelter?

The land was almost completely covered with prairie. Unlike today, there were not a lot of trees for timber. The settlers had to find other materials to build homes with. Some of them chose to build sod homes or dugouts. Read Homes of the West by Bobbie Kalman. (See resources) This book introduces sod homes and dugouts as well as log homes, adobe homes, native dwellings and more. If short on time, focus on the sod home (p. 8-9) and dugout (p. 10-11) sections of the book. Ask students “as you listen to Homes of the West try to notice some similarities and differences of the types of homes.”
Lesson #2: Reiman Gardens

Materials:
- Computer with access to the internet
- Butcher paper or chalk board

Set-up:
- Bookmark the Reiman Gardens website: http://www.teaching.ag.iastate.edu/hort_ageds282

Go to the Reiman Gardens Website and look at the garden. (Hyperlink Reiman Gardens homepage.) Ask your students if they have been to the garden before. What do they remember about the garden? Give students some time to explore the website. What questions do they have about the garden? Do they have questions about sod homes or dugouts? Write these questions on butcher paper or the board.

Show them pictures of the Mahlstede Building. (Hyperlink to Facilities Rental page with pictures of the inside and outside of the building.) This is where the bathrooms are located. We will meet your group outside the Mahlstede Building.

From the Mahlstede Building, your tour guide will take your group to the Children's Garden. Ask your students what they think should be in a garden for children. Inside the Children's Garden is the sod house. (Hyperlink to a picture of the sod house on Sarah's page.) What do you want to know about it? Write these on the butcher paper.

Spend time playing with the “clickable map” (Hyperlink to the clickable map) of the Reiman Gardens. Here you can click on an area of the garden to access photos of that particular garden. Have your students find the following garden photos:

Bridge Garden
Herb Garden
Rose Garden
Campanile Garden
Children’s Garden

What other areas of the garden are students looking forward to seeing? Have them find these areas during garden free time as allotted in your agenda.
Sod Houses of Iowa: Visit Script

Have students meet in the Mahlstede Building Courtyard. Give them a very brief introduction to the history of Reiman Gardens while those who need to use the restrooms do so. After the group is finished using the restrooms, divide students into groups of ten. Each tour guide should have ten students and an adult chaperone.

Stop #1
Welcome to the Reiman Gardens! Today we will be talking about sod houses of early Iowa. What have you learned about sod houses so far in your classroom? You will have a chance to see a modern sod house in the children’s garden and even have a chance to learn how the settlers built sod houses. Since sod homes were built with grass and grass roots, we will also talk about the grass family.

How important grasses are in our world
How important do you think grass is in our lives? Give me examples of ways that we use grass. Think about where you play soccer, the park you play in, where your dad or mom plays golf? Grasses are for more than just playing on though. Grasses are more important than we think.

Dump out garbage can with various grass product wrappers/containers. Have students each pick up something they think came from a grass. Included in the can will be a rice wrapper, a cheese-ball container, various popular breakfast cereal boxes, a macaroni and cheese box, a bread bag, a tortilla bag, a sugar bag, a garden bamboo stake, a clarinet reed, flour bag, rice cake bag, corn syrup bottle, etc.

What did you have for breakfast this morning? I bet it included some type of grain. Did you know that grains such as wheat, oats, barley, corn and rye are members of the grass family? Did you know that sugar is too? How does your product wrapper or container relate to grass?

Have students look at ingredient labels and share with each other how their wrapper relates to grass. Allow them four or five minutes to share their products. Now have them share with the group.

Give me examples of other things we use that come from grasses? What makes a plant a grass? Do all grasses look like the grass in our front lawns?

Hold up laminated grain diagrams for students to look at. What is similar about these plants? What is different?

Grass Identification
Hand out a grass plant and hand lens to each student. Allow a couple of minutes for them to investigate the plant.
What do you see? How is this different from other plants?

*Use a corn stalk as a model to show the different parts of grass plants. Be sure to talk about parts that are unique to members of the grass family such as the parallel veins and the dense root system.*

What do you notice about the **roots** on your grass plant? Do they seem dense or long for a plant this small? The roots of some grasses can grow to be 20 feet deep. *(show students the root depth chart included in your information packet)* This is why prairie grass roots made such a great building material. Since the prairie could be very dry in the summertime, roots had to grow deep into the soil to find moisture. What else do roots do besides find moisture? *(Roots anchor the plant to the ground and absorb water and nutrients).*

Think of other roots. Perhaps roots that we buy at the grocery store. Give me examples of roots we buy for food. (Carrots, turnips, beets, radishes, ginger) What is different about these roots compared to a grass root? These roots are **tap roots**, unlike the **dense fibrous roots** of grasses and some other plants.

**Stop #2 Tour Children’s Garden**

*Give students a brief overview of the children’s garden. Try to keep grasses and Iowa History the focus of the tour. Some ideas might be:*

- **The Alphabet Garden:** Have children look for members of the grass family.
- **Horse Topiary:** Horses eat grasses; notice what plant is on the tail of the horse?
- **Corn Crib:** Did you know that Iowa grows more corn than any other state in the U.S.? Notice the slats on the corncrib? This is how the early Iowans dried their corn.
- **The Sod House:** This is what some of the early Iowan settlers built for homes.

**Storybook**

*Have students gather inside the sod house. If dry, have them all sit down.*

This is about the size of a typical sod house. Can you imagine what it would have been like to live with your family in a house this size? How big is your home today? Probably bigger than this? Imagine how crowded it would be to live in an area this size with your parents, your brothers, and sisters and maybe even your aunt and uncle, cousins and grandparents!

*Read Sod Houses on the Great Plains by Glen Rounds. Explain to students that the author grew up in a sod house. Talk about what it was like to live in a sod home.*

Imagine you are living in a sod house. Imagine that there is a dirt ceiling above your head. What would you do if dirt fell on your head at night or if a snake fell through the roof and landed on your dinner table? How would you cook food on the stove after a rain when the ceiling leaked?
Breaking sod
How do you think settlers built sod homes? It usually took a half-acre to an acre of land to build a sod home 16X20 feet. A settler looked for a low spot nearby. Low spots usually had the thickest sod since they collected moisture after rain. Next, he would cut the grass with a scythe. Do you know what a scythe is? It is a huge knife used for cutting weeds or grass. (Show scythe) Next, he would use a sod-breaking plow to cut strips of sod 18 inches wide. The best time to cut sod was after a rain or snow melt. This moisture helped hold the sod together. The settlers called the plow a “grasshopper” because it looked like it had wings. (Show picture of plow) Some settlers say the plow sounded like it was tearing through fabric as it cut furrows of the prairie. Oxen were chosen to pull the plow since they walked slowly and straight. This created uniform strips of sod, usually 3-4 inches thick. Next, the long strips of sod were cut into three-foot lengths with a spade. Because of the building pattern it was important that the sod bricks were twice as long as they were wide.

Building up
Settlers waited until it was dark to stake out the foundation. This is because they would use the North Star to help them orient their home north, south, east, and west. By doing so, they could use their home as a compass. After the site was staked out, a layer of sod bricks was placed around the perimeter, except where the door was to be. Settlers always laid the bricks green side down. The bricks were laid side by side lengthwise. This means that the walls were 36 inches thick! (Have students look at yardstick to see thickness of walls) After each layer, the cracks were filled with dirt to even the walls out. By doing this, the walls rose evenly on all sides. Every third or fourth layer, the bricks were laid crosswise to help strengthen the walls. Each home typically had two windows. Windows were set in and sod bricks were built up around them. (Show diagram of sod construction)

The roof
The roof was the tricky part of building a sod home. The type of roof a settler built depended on how much money he had. Most settlers laid poles over the top of the walls. Hay was placed on top of the poles and then sod was placed on top of the hay. (Show hay) The sod roof flowered all spring, summer and fall! A sod roof did have its drawbacks though. Imagine what would happen after a heavy rainstorm! Because the roof leaked so badly after a storm, settlers tacked cheesecloth up over the stove to keep mud from falling onto their food.

In the 1860's after the railroad moved through Iowa, building supplies were more easily available. Settlers who could afford to do so bought tarpaper (show tarpaper) to be placed under the sod. This helped keep water from entering the house. Still others had money enough for wooden boards or wood shingles. (Show wood boards and wood shingles)
Dugout vs. Sod house
Sometimes we hear a sod house called a dugout. Do you know what the difference between a sod house and a dugout is? A dugout is a home dug into the side of a hill. Our “sod homes” in Iowa were typically dugouts. Usually dugouts were built in Northwest Iowa where there were very few trees for timber and more hills than in central Iowa. A dugout still used sod bricks for the front wall though. For this reason, we hear them called sod homes.

Dugout homes came in many shapes. Some of them were in the shape of a “T”, an “L”, a square, a rectangle and rarely circular. What shape is this sod home? Dugouts were small; they were usually no larger than 20 feet long and 16 feet wide. Thinking about how a sod home and a dugout are constructed, do you think the sod structure at Reiman Gardens is a sod house or a dugout?

Have students use a measuring tape to mark out the typical size of a sod house. Use stakes to mark the corners of the house.

Activity: Building a sod house
Using carpet squares or wooden blocks, have students build a sod house according to the building instructions described above.

Stop #3 Station Carts

The Diversity of Grasses
This station exhibits different grasses and discusses their uses. Among the grasses exhibited will be Big Blue Stem, Little Bluestem, Switch grass, Prairie Drop Seed, Bluegrass, Bent grass, corn, wheat, and bamboo. Have students touch the plants and describe their similarities and differences. This station will also show off various grass seeds. During the fall, laminated cards will be provided for children to carry into the garden to match up with a plant. The pioneers used grass to build homes. Probe students to think about ways we use grasses today.

A Look at Roots
Have students look at prairie grass roots and carrot roots through the root viewer. Have them discuss the difference between a taproot and a fibrous root system. Display typical Iowa soil and soils from other states. Ask students to describe the soils and how soil type might determine which plants it produces.

Sod Houses Through Time
This station exhibits photographs of both old and modern sod homes. Students will be asked to write down a comment about sod house...what it might be like to live in one today? Or during pioneer times? What is neat about them? Suggestions on how to improve them, etc... These comments will be displayed for others to look at.
**Hands on activity: Grass Man**

Distribute the materials below to each student.

**Materials:**
- 1 knee-high nylon stocking
- 1 handful of annual rye grass seed
- 2-3 cups moist potting soil mix
- Small plastic cup
- Wiggle eyes
- Pieces of felt
- Scissors
- Glue (preferably a water-resistant glue such as hot glue)

1. Have students drop a handful of annual rye grass seed into the toe of the stocking.
2. Next, pack soil on top of the seed. Make sure it is packed tightly to keep the seed from shifting.
3. Pull the stocking tightly around the soil and tie it off as close to the soil as possible. (Have students pretend they are tying a balloon) Do not cut off the extra stocking.
4. Flip the ball over so that it is sitting on the knot and the seed is on top.
5. Have students put eyes, mouth, etc on their “grass man”.
6. Set on top of plastic cup full of water. Allow the extra stocking to absorb water and act as a wick. Students will be surprised to see how much water their grass man will absorb.
7. Set in sunny window and water as needed.

Have students observe their grass men daily and make notes in their journals. How long do they think it will take the seeds to sprout? When grass is several inches tall, students can give their grass men haircuts.
Sod Houses of Iowa: Post-Visit Activities

Many thanks to you and your students for participating in our Sod Houses of Iowa field trip program at the Reiman Gardens. The following is a set of post-trip activities to “tie” the field trip to your classroom. If short on time, we recommend doing lessons 1 and 2 with your students.

Goal of Lessons:
Introduce students to sod houses, talk about why sod made such a good building material, and discuss the diversity of grasses and their importance in our daily lives.

National Science Standards lessons can help you meet:
• “Structures and function in living systems”
  Grass morphology
• “Diversity and adaptations of organisms”
  Number of plants in grass family
  Diversity of size, seeds, etc.
  Deep roots, ability to tolerate fire, grazing, mowing, etc.

Overview of Lessons:
• Lesson #1: Build a miniature sod home
• Lesson #2: The Survival of the Grass
• Lesson #3: Sod House Wrap-Up
Lesson #1: Build a miniature sod home

Objective: Have students construct a miniature sod home (as a class) the way early settlers did.

Materials:
- 2 Plastic greenhouse flats with drainage holes
- Loose potting soil (enough to fill each greenhouse flat half full)
- Plastic knife
- Annual Rye grass seed (about a cup)
- Sunny window space or grow lamp
- Watering can
- Plastic tray
- Ruler
- Popsicle sticks
- Hot glue
- Scissors

This activity takes two weeks to complete.

Week 1: Fill each plastic greenhouse flat half full with loose potting soil mixture. On each flat, spread half-cup Annual Rye grass seed evenly over the top of the soil. Do not cover seed with soil. Lightly water, being careful not to “wash away” grass seed. Set near sunny window or under a grow lamp. Watch daily and water as needed.

Week 2: Lightly trim the grass with scissors after it is 3 inches tall. Trimming the grass blades will encourage root growth. Trim about an inch of growth. After a few days, trim again. Now, trim grass so that it is about a half inch tall. Now, using a plastic knife and a ruler, cut 1 ½ x 3 inch “bricks”. Let students help to construct a miniature sod home on a plastic tray. Remember, settlers laid the bricks “green side down”. Use wooden Popsicle sticks and glue to make a doorframe and window frames.

The following drawing is one suggestion for the house foundation. However, it is not the only way to build your miniature sod house. Be creative! Using this, or a similar, foundation you should have enough sod to build your house roughly five layers tall and still have enough bricks for a sod roof. Students may choose to build a traditional or modern roof. Be creative!
Door
Lesson #2: The Survival of the Grass

Objective: To show how a grass plant grows in comparison to other plants.

Materials:
- Milk carton or other small pot
- Loose potting soil mixture
- Grass Man from field trip and bean seeds
- Sunny window space or grow lamp
- Scissors
- Journals (optional)

Set-up:
- If using a milk carton, collect from lunchroom and rinse thoroughly ahead of time.
- Teacher should plant 3-5 bean seeds about a half-inch deep in the milk carton. Water and set on sunny windowsill.

Grass plants grow differently from other plants. Most plants grow from the tips of branches (think about how an oak tree grows). But grass plants grow from the crown, which hugs the soil surface. This allows grass plants to be mowed. What happens when your mom or dad mows your backyard? Does it kill the grass plant or does it make it grow stronger and thicker? What do you think would happen if we mowed a bean plant like we mow grass? Let’s find out!

A few days after returning from your field trip to the Reiman Gardens you should see some growth on your grass men. Keep track of how much he grows each day and take notes about him in your journal. When his “hair” is about 2-3 inches tall, it is time to give him a haircut. Using scissors, cut no more than half the height of the grass plant. Cutting off more than half the height of the grass is stressful on the plants. What happens a few days after you cut his hair?

Your teachers has potted up some bean seeds. When these are 2-3 inches tall, you will need to cut them just like you cut your grass mans hair. Cut about half the height of the plant. What happens when you cut the bean seeds back? Why is this happening? Cut plants once a week and keep track of their progression. How many times can you mow the grass plant? How many times can you mow the bean plant?

Have students observe the plants daily, take notes in their journals and make a hypothesis as to what they think will happen to each of the plants.

Digging Deeper:
After your grass man has died, let him dry out. Then peel off the nylon stocking. What do you see? What happens when you pour water over the soil and roots? Do the roots hold onto the soil? How does this relate to sod houses?
Lesson #3: Sod House Wrap-up

Now, have students go back to the list of questions they generated about sod houses (in pre-visit activities). See what they can answer now. If they still have unanswered questions, have them research them in the media center. Websites listed in the resources are a good place for them to start.
APPENDIX B. CORRESPONDENCE TO SCHOOLS AND PARENTS

Parent Consent Letter

Parent/Guardian and Student Release Form

Teacher Guidelines For Giving Assessment

Student Assessment

Scoring Guidelines

Sample Student Assessment Answers
Date

Dear parent/guardian:

I am a graduate student in the Department of Horticulture at Iowa State University. I am conducting a research project to learn what fifth grade students learn during a “Sod Houses of Iowa” field trip to the Reiman Gardens.

As Reiman Gardens continues to grow, we would like to offer students educational field trips. Our goal for this research is to determine whether or not pre and post-trip activities help students learn from a field trip experience to Reiman Gardens.

A total of nine fifth grade classes in the Ames Community Schools will be participating in my research. These nine classrooms will be assigned to one of three types of field trip: a control, an organized field trip with hands-on activities, or an organized field trip with hands-on activities as well as pre and post-trip activities in the classroom. The field trip will last approximately two hours.

Students will not undergo any physical risk during this research project. In fact, we hope they will have fun! During the field trip we are recommending that teachers bring one chaperone for every 8-10 students. As always, safety is a priority of the staff and tour guides at the Reiman Gardens. The only emotional risk they may undergo is the fear of test-taking.

Students will be knowledge assessed with a paper and pencil test back in the classroom following the field trip experience. This assessment will take about 15-30 minutes to complete. Your student’s teacher will be administering this assessment approximately one week after the field trip. Your child’s name will not appear on the assessment.

Since my work involves minor children, I need to obtain permission from their parent or guardian before they may participate. If you will allow your child to participate, please fill out the attached form. Participation in this research project is completely voluntary.

Thank you for considering your child to participate in my field trip program. If you have any further questions, please contact me or my major professor, Dr. Cynthia Haynes.

Sincerely,

Sarah Jane Gross
Graduate Student
Iowa State University

Dr. Cynthia Haynes
Assistant Professor
Iowa State University
Parent/Guardian and Student Release Form

Parent/Guardian Consent
After reading the attached letter explaining this research project and the potential benefits and possible risks of participation, please check one of the following.

____ I grant permission for my child to participate in the research described.

____ I do NOT grant permission for my child to participate in the research described.

Print name ___________________________ Date____________________

Signature____________________________ Phone____________________

Student Consent
Please fill out one of the following:

____ I agree to participate in the research study described in the attached letter. The study has been explained to me and I have been informed of the potential benefits and possible risks of participation. I further understand that I will remain anonymous in any report of the research findings. My name will be removed from any in class assessment given by the teacher.

____ I would prefer not to participate in the research described.

Print name ___________________________ Date____________________

Signature____________________________
Teacher guidelines for giving assessment:

We are interested in knowing what your students learned during the “Sod Houses of Iowa” field trip at Reiman Gardens. The data gathered from your students’ field trip will be used for a Masters thesis at Iowa State University. Therefore, it is very important that this assessment be performed in a timely matter. It is also important that all students participate and the following guidelines are used. If you have any questions please do not hesitate to call Sarah Gross at 268-9665 or Cindy Haynes at 294-4006. Thank you very much for your cooperation and interest in our project!

1. Assessment should be given one week after completion of post-trip activities. If your class did not participate in the post-trip activities, assessment should be given one week after the field trip.

2. Make sure each test has a student identification number on it for your grading purposes. By assigning each student an identification number, we will be able to maintain student anonymity. Only you, the teacher, will be able to see who each assessment belongs to. The researcher does not need to know which assessment belongs to which student.

3. Allow students enough time to complete ALL questions. It is important that there are no blank answers!

4. For students with limited reading or writing ability, we request that an adult assist with reading and writing student responses to these questions.

Thanks for following these guidelines. I will be picking these assessment forms up on ________________________.

Sincerely,

Sarah Jane Gross
Graduate Student
Iowa State University
sjgross@iastate.edu
(515) 268-9665
Student Assessment

1. Why did early Iowans build sod homes?

2. Describe three good things about living in a sod home.
   a. 
   b. 
   c. 

3. Describe three bad things about living in a sod home.
   a. 
   b. 
   c. 

4. Describe why sod was a good building material.

5. How are prairie grasses different from other plants?

6. How are grasses used by people today?
Student Assessment Scoring Guidelines

1. Why did early Iowans build sod homes?

Exemplary answers included the notion of there not being trees to build with, but sod was plentiful. Partially correct answers might include less specific ideas such as “for survival” or “to live in”.

2. Describe three good things about living in a sod home.

Parts 2a., 2b., 2c. each worth 2 points. Anything discussed in the field trip program is considered to be correct. Anything which the program did not cover, but could be correct was scored as partially correct.

3. Describe three bad things about living in a sod home.

Parts 3a., 3b., and 3c. each worth 2 points. Anything discussed in the field trip program is considered to be correct. Anything which the program did not cover, but could be correct was scored as partially correct.

4. Describe why sod was a good building material.

Correct responses to this answer are based on the book Sod Houses on the Great Plains by Glen Rounds. This book was read during the field trip followed by a discussion on why sod is/was a good building material. Ideal responses include thermal properties of sod, that sod was plentiful or that it was a sturdy material.

5. How are prairie grasses different from other plants?

Answers to this question based on displays set up at the field trip site. Ideal responses include that grass has long roots, can be very tall, and can withstand prairie fires. For this question, the answer “taller” was not accepted for full credit.

6. How are grasses used by people today?

1 point was given (up to 2 points total) for each correct response. Correct responses included the following: used for food, modern sod homes, crops, sports fields, and lawns/appearance.
Sample Student Assessment Answers

1. Why did early Iowans build sod homes?

"because there weren’t any trees to build a log cabin” (2 points)
"there weren’t a lot of trees around but there was a lot of sod” (2 points)
"because they were cheap and easy to build” (1 point)
"for protection and warmth” (1 point)

2. Describe three good things about living in a sod home.

The following are 2-point answers:

“warm in winter”  “no chopping trees”
“not easily burned down”  “stayed together because of the roots”
“cheap”  “cool in summer”

3. Describe three bad things about living in a sod home.

The following are 2-point answers:

“snakes could fall down”  “no way to escape your family”
“mice make nests in the roof”  “it was tiny and dirty”
“there was dirt everywhere”  “water could drip in”

4. Describe why sod was a good building material.

“there was a lot of it and the roots help the dirt stay in place” (2 points)
“doesn’t burn in prairie fires” (2 points)
“it was a good insulator” (2 points)

5. How are prairie grasses different from other plants?

“prairie grasses have long fibrous roots” (2 points)
“when burned, can grow back” (2 points)
“unlike tap roots, grass roots hold the soil together” (2 points)
“taller” (1 point)

6. How are grasses used by people today?

“grasses are used by people in foods, medicines, and on sports fields (2 points)
“grasses are used on lawns and in some countries they still have sod homes” (2 points)
“for food” (1 point)
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