

The Impact of Audio Technology on Undergraduate Instruction in a Study Abroad Course on English Gardens¹

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Abstract

This study investigated the effectiveness of audio podcasts as a means of disseminating course content to students in informal learning environments like public gardens and parks. The investigation was organized into three major areas: (a) student's utilization of audio podcasts; (b) the effects of audio podcast on knowledge gain; and (c) students' perceptions of audio podcasts.

Twenty-two undergraduate students participated in a 21-day study abroad course on the history of the English landscape, garden design, and horticulture. This course included instruction in both the classroom and on-site at public garden locations throughout southern England. All 22 students were provided with two to four pages of written text describing key historic and horticultural information regarding 12 English gardens. Instructional audio narratives for iPod of 20-30 minute duration were developed for each of the 12 historic gardens. Written exam scores differed little between audio users and non-users. However, students with the audio narratives scored significantly higher on two of the three oral exams. Rather than multiple choice questions as in the written exams, the oral exams utilized more open-ended questions that required the students to integrate course content in order to demonstrate a higher level of overall meaning. In a subsequent survey, the audio users expressed positive reactions to this learning technology, and these reactions, together with the positive learning outcomes, suggest that audio can enhance teaching effectiveness in informal learning environments like public gardens and parks.

Introduction

The study of historic gardens can increase the sensitivity of landscape design and horticulture professionals to the range of meaning and values associated with gardens and landscapes, enhancing their ability to appreciate new ideas about aesthetic theory. One of the principal reasons for landscape designers and horticulturists to visit gardens and parks of other countries, especially historic gardens, is to find works that inspire them and that can serve

as models for their own creative endeavors. Most educators in landscape design encourage their students to learn from and be inspired by successes of the past, but this fuller appreciation is effectively obtained only when the student understands the historical and cultural context for what they are observing.

Through collaboration among instructors in the Department of Horticulture and Landscape Architecture and Department of History at Purdue University, a new senior level study abroad course was developed titled, *In the English Landscape*. In this course, students visit between 12 and 15 major historic gardens in southern England, and receive instruction from professors of both history and landscape architecture-horticulture. The principal aim of this course is to encourage students to look deeper into the meaning of historic English gardens and to understand how certain elements and aspects of gardens are tied to particular moments in history. Temporarily removed from their familiar home environments and relocated in the English countryside, students are taught to read the sites and landscapes for horticultural particulars, design elements, and reflections of historical and aesthetic traditions. The instructors of this course began with the idea that on-site instruction at historically important gardens in England would create an enriching and more effective learning experience than the traditional classroom.

As a part of this new course, written instructional materials for each garden were developed to complement the on-site oral instruction. To create a more effective communication medium for teaching in outdoor environments, a series of instructional audio podcast narratives were newly developed by the instructors and incorporated into the course. In part, the need for this alternate delivery method was driven by limitations in oral communication due to the large size of the group (being too dispersed within a populated public venue often with physical limitations to close association) combined with environmental factors (wind, precipitation) that often made note taking on site prohibitive. The podcast type method of delivery provides an alternate form of direct communication between the educator and the

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learner (Evans, 2007). The term “podcast” originates from the combination of the brand name “iPod®,” Apple Inc.’s popular media player with “broadcast.” First introduced as a medium for the dissemination of audio and video content in music, entertainment, and news, podcasts have become a popular mechanism for delivering supplementary learning materials to students at all levels of education. Schlosser (2006) pointed out that the use of audio in education is not new, but is experiencing a renaissance fuelled by the ubiquity of portable audio players, broadband internet, and software tools that allow the relatively easy creation and distribution of audio files. Most existing uses of podcasting in higher education focus on the use of the technology to deliver instructional content such as lectures (Lee, et al., 2007). The podcasts created for this course were specifically designed to overcome the physical limitations of delivering course content and to supplement the material presented in lecture and assigned readings with the goal to improve student learning.

The audio podcasts were developed for use with site maps/garden plans. Throughout each garden, major elements are discussed at individual audio stops of 2-3 minute duration when cued by the user on their iPod or MP3 instrument, with each garden narrative lasting approximately 30 minutes. The stopping points are organized based on proximity, as a chronological or designer intended itinerary would be impractical based on the limited time of class visit.

Advocates of podcasting believe that it can offer unique educational benefits to students, but evaluation is needed to determine whether podcasts can help improve student learning. The effects of podcasts toward reaching desired outcomes for learning have been explored in previous studies. The research examining educational outcomes for podcasts has mixed results. Hew (2009) cited two major approaches. The first analyzed podcast effectiveness using participant’s self-reports. Data sources in this approach typically include students’ retrospective self-perception data acquired using questionnaires or interviews. The second approach explores podcast effectiveness using experimental, quasi-experimental, or ex-post facto designs. Data sources in this approach typically include test or quiz scores. In a review conducted by Hew of eight studies utilizing the first approach of self-reporting, the use of podcast significantly enhanced student learning. Hew (2009) noted that other researchers who used student test and quiz scores, rather than relying on student self-reporting, often showed no effect of the podcast technology. For example, Apt and Barry (2007) showed that physiology students compared by written examination after six weeks of the course showed no significant differences in test scores between groups provided with podcast lectures and those given an exact transcript of the podcast in printed form. These results raised questions about the use of podcasts to improve student achievement.

In an evaluation combining traditional methods of assessing knowledge in the form of multiple choice questions with a constructivist component in the form of open-ended questions, Novey and Hall (2006) reported that auditory communications that combine sounds and an audio recorded narrative can also have a positive effect on cognition. For example, their findings indicate that most visitors to Carlsbad Cavern National Park who used the audio tour gained substantial knowledge about the park and were more likely to understand the parks interpretive themes. While the pedagogical aims between our garden study program and this museum/exhibit tour are different, the positive learning outcome in this study indicates that the use of podcasts as an innovative learning tool may have significant benefits for adult learners.

Hew (2009) cited a study by Brittain et al. (2006) that examined which types or characteristics of courses, if podcasted, would most benefit students. In a survey of 70 first-year, dental students, they found that information dense course content with heavy reliance on visuals benefited learning significantly if podcasted. For example, the course indicated by most students that would benefit them to have podcasts was histology, which involves a greater amount of details and diagrams. These authors suggested that students could concentrate better on what was being said during the lecture rather than attempting to capture via note taking all of the presented material. The audio podcasts allowed students to listen to the lecture repeatedly for specific information they missed during the class.

This study investigated improving learning outcomes in a study abroad course on English gardens through using audio technology in real time association with garden sites. Presented is an examination of (1) practical considerations for student utilization of audio podcasts; (2) the effects of audio podcast on knowledge gain; and (3) students’ perceptions of audio podcasts.

Materials and Methods

Participants in the study (N=22) were primarily horticulture and landscape architecture students enrolled in the course *In the English Landscape* taught by professors in the Department of Horticulture and Landscape Architecture, and the Department of History at Purdue University. The subject matter provides coverage of the broad historical background relating to the gardens, including historical events, artistic and cultural trends, changing social and economic conditions and horticultural developments.

At the beginning of the course in May 2008 students were randomly assigned to two treatment groups, Group A and Group B. Three gardens were selected for the study. Each of the three gardens were given a rating by the teaching faculty of high, medium, or low complexity based on its size, the depth of historical context, the extent of symbolic

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content, and horticultural richness. Garden 1, Westbury Court, was assigned a low complexity rating. Garden 2, Sissinghurst Castle, was assigned a medium complexity rating, and Garden 3, Stourhead, was assigned a high complexity rating.

All students in the course received a course reading packet that included a brief (2-3 page) introduction to each of the gardens visited. In addition, all students attended introductory lectures during the first week of the course that introduced foundation concepts to be explored during the four week course of study. During the first week of the course, prior to garden visits, the eleven students assigned to Group A received audio podcast narratives for each of the three gardens included in the study. These audio narratives were downloaded on each student's iPod or MP3 player. An earlier verbal survey of students enrolled in the course revealed that 100% of them possessed an iPod or MP3 player. Students were provided with guidance by the instructors on how to access the podcast narratives, but were not otherwise given significant assistance. The eleven students assigned to Group B did not receive audio podcasts for these three gardens; however they did receive audios for the other gardens studied in the course.

All teaching methods were designed to teach the same material. The course reading packet contained brief descriptions of each garden studied in the course, highlighting their unique features and describing the distinctive character of each. It was distributed to all students on the first day of the course. Traditional PowerPoint slide-based lectures were conducted during scheduled class hours during the first week of the course. These lectures presented a broad outline of England's political, economic, and cultural history that has had a significant influence on the development of garden design styles and theories. Historical facts about the gardens investigated during the course and in-depth explanation about these gardens' interpretive themes were also presented in lecture. The audio podcast narratives covered the same material as in classroom lecture and textbook reading assignments. These podcast; however, were produced as a series of garden tours to be used by the students to access information about the gardens in real time association during site visits. Abt and Barry (2007) described the benefits of making the process of learning more active and engaging by including multimedia. In using podcasts we aimed to make the content relevant in context to individual learners as they experienced each of the sites. The podcasts allowed students to repeatedly listen to the discussion while simultaneously viewing garden elements associated with those concepts.

Both written quizzes and oral interviews were used to assess the effect of the audio podcast narratives on the knowledge gained by participants. Participation in this study was voluntary, but all students chose to participate. They were informed that neither the quizzes nor the oral interviews for

the three study gardens would contribute to their course grade. They were told that they were participating in an evaluation of a new teaching technique and were given no other information.

Written Quizzes and Oral Interviews

Immediately after each garden visit the participants completed written quizzes. Each of the quizzes for the three gardens in the study assessed students' recall of historical facts and design techniques associated with the gardens. Each quiz contained three sections composed of multiple-choice, true or false, and matching questions. The first section included five questions related to background and tradition focusing on cultural, economic, moral, and political factors that influenced the making of the garden; section two contained two questions related to design techniques; and section three included five questions related to amenities and components of the garden. The correct answers to the questions were available from various course media and were not exclusive to the audio tour.

After completing the quizzes the participants were interviewed individually. These interviews were designed to test the students' depth of understanding beyond the basic level of factual recall assessed in the written quizzes. Students were asked to discuss three fundamental ideas related to the making of the gardens including (1) the design philosophies held by garden makers of the associated period, (2) the symbolism employed in the garden that conveys the ways in which the garden addresses human concerns, and (3) the horticultural aspect of the garden—identifying the role of ornamental plants in shaping gardens and landscape plans (see Table 1). Each participant was given three minutes to respond to each of the three questions for a total of nine minutes for each interview conducted. All interviews were conducted and scored by the same researcher. The student responses to each interview question were assessed on a 4-point scale based on rubric scores (see Table 2). The rubric scores were assigned in ½ unit intervals so performance between two response values could be recognized as intermediate. The overall responses to the three questions were examined collectively and an average score was assigned.

Finally, after all other data were collected, study participants were asked to complete a 12-question survey to help quantify their actual use of, and assess their reactions to the audio podcasts. The first eight questions on their reactions to the podcast narratives were a 5 point agree/disagree response scale: 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree. The remaining four questions requested that students estimate the actual duration of their use of the podcast narratives. The possible responses were: 0=did not use, 1=0-25%, 2=26-50%, 3=51-75%, 4=76-100%.

Table 1. Oral Interviews were conducted to Test the Students' Depth of Understanding beyond the Basic Level of Factual Recall assessed in the Written Quizzes. Students were asked to Discuss three Fundamental Ideas Related to the Making of Gardens.

Design Fundamentals	Questions
Design Philosophy/Approach	Please discuss the design techniques employed in the garden in the context of the historical period/periods that relate to it.
Symbolism	Please discuss any symbolism employed in the garden – relate it to a possible theme (meaning or idea of the garden) that can be derived from its inclusion.
Horticultural Aspect	Please discuss the horticultural aspects of the garden. What types of plants were used and how? Discuss how the plantings were arranged and how the planting concept may have been altered over the life of the garden.

Table 2. Grading Rubric for Oral Interview Responses

Assigned Value of Responses	Content	Completeness
	Importance of answer, relevance, accuracy of facts, overall treatment of topic	Level of detail, depth, development of ideas, appropriate length.
1	Lacks focus or relevance, contains multiple fact errors or omissions.	Does not provide adequate depth. Important details or facts are omitted, unclear or undeveloped. Answer is too short.
2	Answer would benefit from more focus, contains some fact errors or omissions.	Additional depth needed in places, important details or facts sometimes omitted or not fully developed. Answer may be too short.
3	Answer is adequately focused, information is generally relevant and accurate.	Provides adequate depth, few needed details or facts are omitted, major ideas adequately developed. Answer is proper length.
4	Tightly focused, contains relevant information with no fact errors.	Provides good depth and detail, ideas well developed, facts have adequate background. Answer is proper length.

Data Analysis and Results

Written and oral quiz score data were analyzed using SAS (SAS Institute, Cary, NC). Data were subjected to two-way analysis of variance (ANOVA) and the separation of means was tested with student's t-tests. A level of $\alpha = 0.05$ was selected a priori to indicate significantly different mean values. Statistical analysis of survey data were generated in Excel (Microsoft Corp., Redmond, WA).

Twenty of the 22 participants responded to the survey, including all 11 of the students from Group A (received podcast narratives for the three study

gardens). Over all responders, 65% (13 of 20) indicated that they had listened to the audio in the 76-100% range of duration. Of the 11 students in Group A, 54.5% (6 of 11) indicated they had used the podcasts 76-100% of the time, while another 27% (3 of 11) were in the 51-75% range.

Knowledge Gain

The written quiz scores were only minimally impacted by the use of podcast narratives (Figure 1). For Garden 1 (Westbury Court) the difference in mean scores between Group A ($\bar{x}=9.91$) and

Table 3. Student Audio Users' Responses to Statements about the Audio Podcast Narratives

Survey Item	Mean ^x	SD	Percent ^y		
			Strongly Agree or Agree	Neither Agree nor Disagree	Disagree or Strongly Disagree
• The audio podcast narratives were informative.	4.5	0.51	100	0	0
• The audio podcast technology was easy to use.	4.1	0.72	90	5	5
• My professor's use of the audio podcast narratives increased his teaching effectiveness.	3.95	0.60	90	5	5
♦ My professor's use of the audio podcast narratives promoted student learning.	3.9	0.55	80	20	0
♦ Having access to these audio podcast narratives throughout the course was an advantage to student learning.	4.1	0.72	90	5	5
♦ I enjoyed using the audio podcast narratives.	3.55	0.76	60	30	10
♦ Should audio podcast narratives be used, when possible, in other classes?	3.8	0.62	70	30	0
♦ Using the audio podcast narratives caused me to communicate less with my classmates while in the gardens.	3.45	1.32	55	20	25

^xResponse scores were based on the scale: 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree
^yBased on 20 students responding to the survey.

B (\bar{x} =8.45) was statistically significant at $p=0.003$. However, there were no differences observed between written exam scores for either Garden 2 (Sissinghurst Castle) or 3 (Stourhead).

Compared to the written quiz scores, oral interview scores were positively impacted to a greater extent by use of the podcast narratives (Figure 2). For Garden 2 (Sissinghurst Castle) the Group A mean score (\bar{x} = 3.14) exceeded the Group B score (\bar{x} =2.45) ($p=0.037$) and for Garden 3 (Stourhead) the Group A mean (\bar{x} =3.14) was also significantly higher than the Group B mean (\bar{x} =2.41) ($p=0.011$). The use of narratives failed to positively impact oral interview-assessed learning for Garden 1 (Westbury Court).

Student Perceptions

Most of the audio users found the podcasts to be informative and a helpful learning tool (Table 3). Ninety percent agreed that the podcasts had a positive effect on the instructor's teaching effectiveness. More than half of users enjoyed using them and 70% of students agreed that this technology should be used in other classes where applicable.

Discussion

Utilization of the Narratives

Nearly all audio users in this study found the audio podcasts to be informative and easy to use. A majority of students utilized the audios to a significant degree, reporting that they listened to approximately 75-100% of each podcast recording. Audio podcast users were observed listening to the recordings in real time association with highlighted features throughout the garden. The results indicate, as evidenced by the duration of listening reported, that students spent sufficient time in the garden to explore areas as directed by the audio. Although the time spent in the garden by non-users was not measured it appeared to the instructors that audio users spent more total time in the gardens than non-users. More study is needed to determine if a correlation exists between student knowledge gain and duration of time spent in the gardens. In principle, if the audio increases the time one spends in the space, the greater the potential is for learning (Borun, 1996; Falk, 1983). Educators may judge this as a favorable outcome.

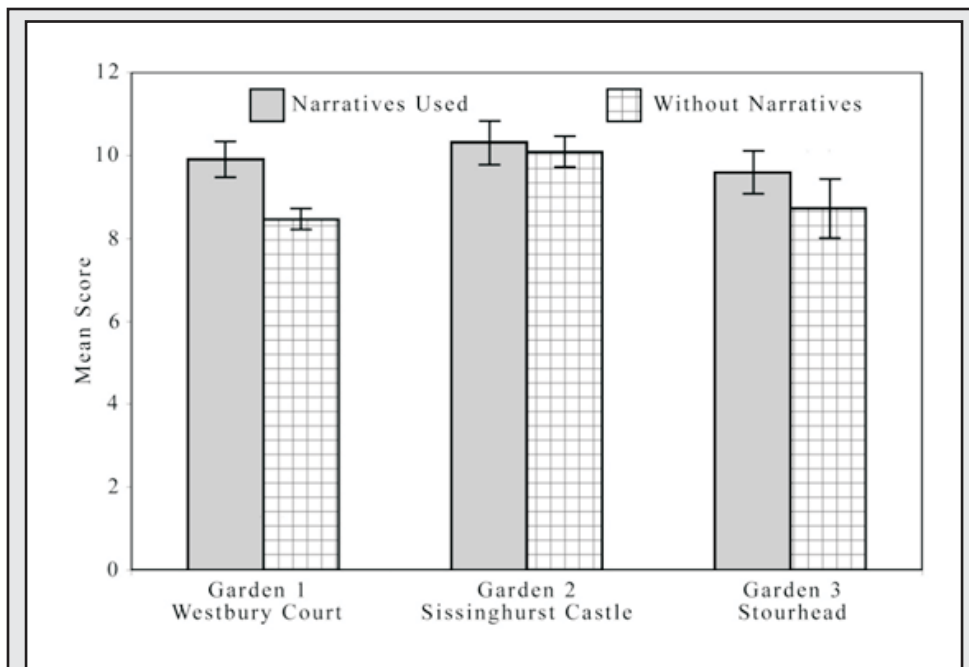


Figure 1. Comparison of written test scores indicate minimal impact by the use of podcast narratives

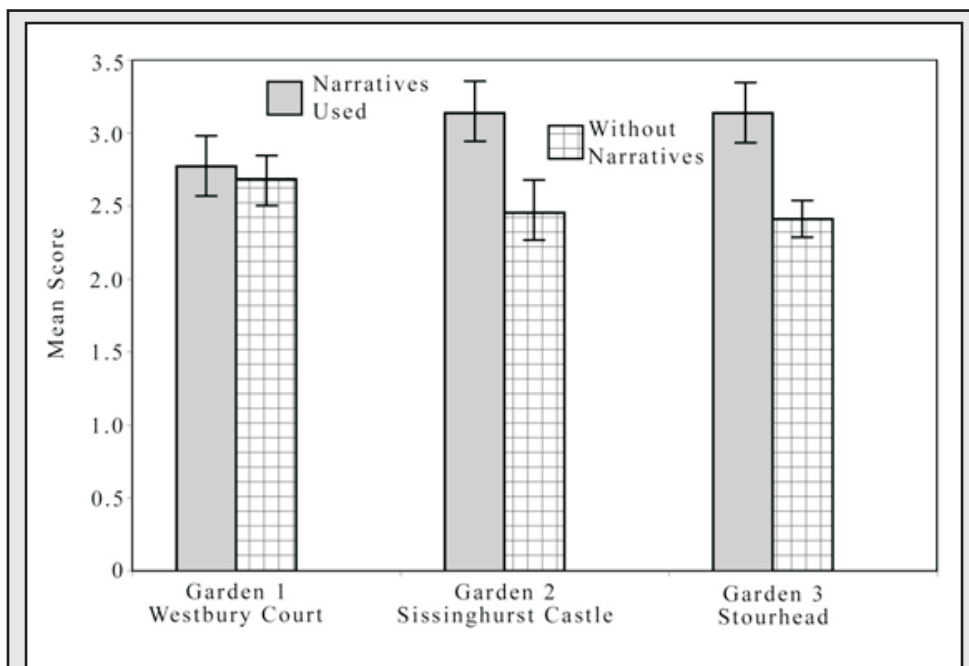


Figure 2. Comparisons of oral test scores indicate a significantly positive impact by the use of podcast narratives.

Knowledge Gain

The use of audio podcasts appeared to have little impact on the learning of historical facts and design techniques as measured by performance on the written quiz. There was an improvement in performance by Group A (narratives used) for Westbury Court, the garden of lowest complexity. These results suggest that the written instructional resources provided to all the students were adequate to convey this type of information. Hew (2009) cited similar results in a study conducted on students in a first year

undergraduate exercise physiology module. Apt and Barry (2007) utilized an experimental research design to examine the effect of podcasts on student learning. Fifty students were randomly assigned to either a podcast group or a control group. The podcast group listened to six podcasts over six weeks, while the control group was given the exact transcript of the podcasts in printed form. After six weeks, both groups were examined using a 32-question multiple-choice test. The control group improved their test performance by 43%, whereas the podcast group improved by 46%. The difference between the groups was a mean effect size of 0.19. This suggested that the use of podcasts might not result in a worthwhile improvement in student achievement over-and-above the use of written material.

Our study revealed, however, a notable increase in learning and apparent greater depth of understanding of garden context and interpretive themes for student Group A with audio narratives when measured by the oral interview scores. For both the Sissinghurst Castle and Stourhead sites, a significant increase in mean oral interview scores was observed associated with audio narrative usage. These two sites were rated at the intermediate and high level of complexity.

This suggests that the greatest value of audio narrative usage is likely to be derived by students in situations where greater explanation is needed to foster understanding.

Student Perceptions

Results of this study were encouraging with respect to students' attitudes toward the audio podcast narratives. Overall, students embraced this new technology as a beneficial learning tool and

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indicated that this type of learning supplement should be used, when appropriate, in other classes. Hew (2009) cited several student-self report studies that suggest similar results. For example, in a study conducted by Bongey et al. (2006), 246 college biology students were surveyed regarding their experience in using podcasts. They found that most students perceived that podcasts were a useful tool in helping them increase their understanding of materials covered in lectures. Another study by Clark et al. (2007) surveyed 30 post graduate marketing students on their experience of using podcasts to improve learning. They found that 96% of the students felt they had gained learning benefits from using podcasts. Students surveyed by Lane (2006) reported that podcasts were helpful when preparing for examinations.

In addition to the 12 specific questions included in the survey reported here, students were asked to provide general comments about the audio podcasts. Of particular interest was the students' creative use of the audios. Several commented that they used the audios to review material for quizzes and also in the preparation for their final class project, which was a written journal documenting their study abroad experience. One student remarked that he would listen to the audios prior to visiting each garden to become familiar with the garden layout in order to take full advantage of the visit. The following are comments (in their own words) from those students who responded.

Student #1

For me I found [the audios] to be quite helpful especially at the gardens where there was so much to see and understand. Personally I found it real effective to sit down the night before we were to visit the garden and listen to the audio casts. While listening I liked to examine the map so I was able to get a sense of how I should move through the site. Because I had gone through the notes the night before I was able to walk through the site and know the areas that I needed to visit to become more familiar with and take any additional notes.

Student #2

In having this information in a convenient and easy-to-use way made it very beneficial to learning more detailed information we were not able to acquire during the preparatory classes.

While at each destination I could just put on my headphones and get an audio tour of each section of the gardens and each design feature that was implemented. With the audio narrative I was able to get specifics that were pertinent to each garden and each garden feature.

These podcasts were also beneficial for review during the trips to and from our destination gardens. We were able to review some of the critical information to help us further with answering the questions

in our study guide or to ready ourselves for the quizzes that were conducted periodically throughout the trip.

The podcasts offered during the study abroad trip were an incredibly useful asset. Not only did they provide valuable information for the class, it was done in a way that we, as students, can utilize very effectively. (I still listen to the narratives every now and then to refresh the information). It is easy to say that everyone has an MP3 player nowadays and by relating a way of teaching with this technology that is used every day, one can have the greatest impact.

Student #3

I was able to walk around the garden listening to information about the section I was in. Although I had previously learned about some of the gardens, it was very helpful to be able to hear and recall more information on the garden. After we explored the garden we were given worksheets to see how much we learned about the garden we just visited. I feel without the podcast I would not have been able to recall certain information from the particular garden. Also at the end of the class we had to do a final project talking about all the gardens we visited. Having the podcast to reflect on was a lot of help. I was able to go back and listen to the podcast and hear information that I could not remember off the top of my head. I feel that this is a great tool for anyone viewing the garden.

Conclusions

Our findings suggest that the use of instructional audio podcast narratives as a supplemental learning device can be effective in informal learning environments like gardens and parks. The following implications are drawn from the study results.

Audio podcast technology can be used effectively to supplement or change the structure of traditional methods of delivering course content outside the classroom. Tools of technology, such as podcasting, allow instructors to construct a teaching and learning environment that can foster learning among students with diverse learning styles (Lyles et al., 2007). Facts and fundamental concepts can be introduced through audio narration providing students with independent learning at their own preferred pace, as students have full control over the rate at which information is presented to them. Podcasts also allow students to gain exposure to the audio information multiple times at their own convenience. Previous studies in e-learning (Evans, 2008; Evans and Gibbons, 2007; Evans et al., 2004) have suggested that well-designed virtual learning materials, by increasing the amount of control learners have over the learning process, can be more efficient and effective than traditional alternatives.

Results of this research indicate that student learning is improved significantly by using the audio podcast narrative in the study of historic gardens. Whereas most students in the course utilized the

audios, there was some variation in the total amount of time students spent with this technology. Although modern students are accustomed to digital technologies in many areas of their life (e.g. computers, entertainment, and communication media, etc.), the use of audio technology as a learning tool is still unfamiliar to many students. It was apparent from discussions with students that some additional time was required to become accustomed to use of these audio tools. Notwithstanding, for those students who utilized this technology, the audios had a positive effect on their learning. Although our results did not demonstrate that audio podcasts greatly improved student retention of historical facts, audios did help students score higher when examined on their ability to integrate new facts about gardens into an overall meaning.

The educational benefits of audio podcast technology were supported by a student survey, as well as student testimonials that shed light on the role that audio podcasting played in their approach to learning the course material. Student testimonials provided insight on how audio podcasting allowed them to employ their own particular learning styles to succeed. Students indicated that they utilized the audio podcasts outside of class, re-listening to the podcast narratives to prepare for testing and complete the final course project. The audio podcasts allowed them to review material to gain better understanding. In addition, students commented that being able to hear about garden elements as they experienced them was highly conducive to learning. They were able to set an appropriate pace for themselves as they traveled through the gardens, having full control over broadcast timing of podcast content, which allowed for better control over supplemental note taking and personal reflection time.

The audio-recorded narratives can easily be transmitted with technology familiar to most students, and the audio podcasts offer an effective medium for communicating information in an outdoor (or out of classroom) setting to large student groups. The increasing popularity of personal digital devices for popular entertainment provides a means of delivery of instructional course content with a technology already embraced by, and familiar to, most students.

Audio podcasts can be an effective tool to engage students, to support multiple learning approaches, and to enable students to conveniently access information about gardens, parks, museums, and similar venues in real time association during site visits. This methodology has the potential to provide students with significantly enhanced understanding of these sites by allowing them to integrate meanings and the intellectual background of sites with their physical and sensory realities.

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