EVALUATING THE IMPACT OF ANIMATED TOPOGRAPHIC FLY-THROUGHS ON STUDENTS' GEOGRAPHIC NOVELTY SPACE DURING A GEOLOGY FIELD TRIP

James C. Hayes

A Thesis
Submitted to the Graduate College of Bowling Green State University in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

August 2008

Committee:
Margaret M. Yacobucci, Advisor
Paul Cesarini
Enrique Gomezdelcampo
This research measures the effect of viewing electronic course materials such as educational documentaries, images, and animations on students’ geographic novelty space pertaining to upcoming field stops on field trips. Specifically, the research evaluates the impact of topographic animated fly-throughs created with Google Earth Pro™ on student geographic novelty space during GeoJourney. GeoJourney is a field program at Bowling Green State University during which students embark on a 14,500 mile field trip that takes them around the United States while they learn key introductory concepts in geology, Native American studies, and environmental science. The program is nine weeks long and involved 25 undergraduate students in 2007.

This project comprised ten topographic animated fly-throughs, which are a compilation of various geologically significant field sites from Yosemite National Park, Glacier National Park, Mount St. Helens, Death Valley National Park, Badlands National Park, Grand Canyon National Park, Zion National Park, Bryce Canyon National Park, Yellowstone National Park, and the Great Smokey Mountains National Park. The animations were saved as movies and placed on video iPods for viewing while traveling to the field sites on GeoJourney. A mixed-method assessment, using both quantitative Novelty Space Survey data and video-taped interviews, was performed to measure the effectiveness of the animations in decreasing geographic novelty space.

Results from this study indicated a decrease in geographic novelty space. The quantitative analysis of the Novelty Space Survey results using a Repeated Measures ANOVA
yielded a p-value of 0.0026 with an F-value of 11.40. The results of the video-taped interviews provided supporting evidence to the quantitative analysis portion of the study, showing that students used the animated fly-throughs to better understand the geographic context of sites before they arrived at them. Hence, the fly-throughs played a role in the overall decrease of geographic novelty space.
Dedicated to the late James D. Hayes (1948-2001)
ACKNOWLEDGMENTS

I would like to personally thank my family for always believing in me even when the road seemed to be a dead end. To my committee members, I want to say thank you for your wisdom, guidance, and mentorship. A special thank you goes to Dr. Peg Yacobucci who took me under her wing and gave me the opportunity to complete my thesis research. I would like to personally thank Dr. Paul Cesarini and Dr. Enrique Gomezdelcampo for serving on my thesis committee as they are both outstanding professors and leaders in their respective fields. I would also like to say a special thank you to my girlfriend, Kelsey Garner. You have always been there for me through good times and bad. I would like to thank all my friends without you I would have gone insane. Lastly, I would like to thank Dr. Joe Elkins and Nikki Elkins for all their help in making this research possible.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Scope of Research</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Background</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Project Description</td>
<td>5</td>
</tr>
<tr>
<td>II</td>
<td>METHODS</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Context</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Participants</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Intervention</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Mixed-method Design</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Quantitative Instrument</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Qualitative Instrument</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Electronic Research Dissemination</td>
<td>17</td>
</tr>
<tr>
<td>III</td>
<td>DATA ANALYSIS and RESULTS</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Novelty Space Survey Results</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Student Interview Results</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Synthesis of Quantitative and Qualitative Results</td>
<td>29</td>
</tr>
<tr>
<td>IV</td>
<td>DISCUSSION and CONCLUSION</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>Summary of Results</td>
<td>31</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>Limitations</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Future Research</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Conclusion</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>REFERENCES</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>APPENDIX A. GEOGRAPHIC NOVELTY SPACE SURVEY DATA</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>APPENDIX B. VIDEO-TAPED INTERVIEW TRANSCRIPTIONS</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>APPENDIX C. HSRB APPROVAL</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>APPENDIX D. CONSENT LETTER</td>
<td>65</td>
<td></td>
</tr>
</tbody>
</table>
LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figures</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Novelty Space Survey Pre &amp; Post-Test Mean Scores</td>
<td>20</td>
</tr>
</tbody>
</table>

## LIST OF TABLES

<table>
<thead>
<tr>
<th>Tables</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Student Demographics</td>
<td>8</td>
</tr>
<tr>
<td>2 Geographic Novelty Space Survey Questions</td>
<td>12</td>
</tr>
<tr>
<td>3 Geographic Novelty Results</td>
<td>21</td>
</tr>
<tr>
<td>4 Repeated Measures ANOVA</td>
<td>21</td>
</tr>
</tbody>
</table>
CHAPTER I
INTRODUCTION

Scope of Research

The purpose of this research is to study the effect of viewing electronic course materials such as educational documentaries, images, and animations on students’ geographic novelty space pertaining to up-coming field stops on geology field trips. I am specifically interested in evaluating the impact of topographic animated fly-throughs created using Google Earth Pro™ on student geographic novelty space during GeoJourney. GeoJourney is a field program at Bowling Green State University during which students embark on a 14,500 mile field trip that takes them around the United States while they study introductory concepts in physical geology and historical geology, Native American studies, environmental science, and critical thinking (Elkins and Elkins, 2008a). The program is nine weeks long and typically involves 20-30 undergraduate students.

Background

A goal for a geoscience educator is to help students develop a geoscientist mind-set. Having a geoscientist mind-set means being able to understand nature and the processes of science along with the evidence and theory that support those processes (Manduca et al., 2002). Creating this mind-set is especially important when learning in natural settings. In order for students to have meaningful learning experiences in field settings, they must overcome mental obstacles such as distracting thoughts that can hinder learning. These mental obstacles comprise “novelty space”. Novelty space is defined as the compilation of factors that distract students and inhibit their ability to learn.
in natural settings (Orion and Hofstein, 1994). Novelty space is comprised of three
domains: psychological, cognitive, and geographic. Psychological novelty refers to the
concerns of the students regarding their role in a field activity, their safety, their
preparedness in terms of equipment, the itinerary, and their uncertainty about amenities
and facilities at field stops. Cognitive novelty deals with students’ understanding and the
degree of expertise in the subject that they are going to be learning in the field.
Geographic novelty deals with students’ understanding of and familiarity with the
locations on a field trip. Students can only reach a point of complete preparation,
personal comfort, and maximum learning in the field when these three elements of
novelty space are minimized (Orion and Hofstein, 1994). Recognizing uncertainty and
exploratory drives of students is also an important aspect so we may excite those
emotions or calm them as needed (Falk et al., 1978). Understanding the student’s state of
mind is important because it helps us to understand what drives the student. Knowing
these drives helps us to control them in a manner that also controls their novelty space.

When students participate in field-based programs such as GeoJourney, they are
constantly changing location every few days. Educators must look for ways to overcome
the elements of novelty space that can be problematic due to the nature of this type of
itinerary. The element with which I am concerned most is geographic novelty space. A
possible solution to this problem would be the use of an electronic visual aid. An
electronic visualization aid would allow students to view files that depict upcoming
changes in scenery and could help to reduce geographic novelty space.

Educators are tasked to find ways to use visualization tools to create positive
influences on student learning (Libarkin and Brick, 2002). Electronic visualization tools
are emerging teaching aids in the geosciences and include simulators, hand-held computers, and portable audio/video systems to capture natural settings and assist in students’ understanding of field geology. All of these emerging teaching aids have produced a new field of research that reports on the uses of hardware and software to aid students in the learning and understanding in the geosciences. Kelly and Riggs (2006) made use of a GeoWall system that uses binocular vision to help students with spatial relationships between physical objects. Elkins and Elkins (2006) used a portable audio/video system to present relevant material on upcoming field stops to students while traveling in a van on field trips. This delivery method decreased wasted travel time and kept the students’ attention focused on upcoming geologic features that were to be observed. Guertin (2006) reported on the use of handheld computers to assist students in data collection and as a reference guide to allow the students to be actively involved in the field experience. Hesthammer et al. (2002) and Saether et al. (2004) used flight simulators as a teaching aid to improve student observation of geologic units and structures while on field trips. One student commented saying, “The field simulator was very useful to get the big picture. And if you missed something you could just fly back and see it again” (Hesthammer et al., 2002).

The use of technology to further students’ understanding of geologic phenomena is spreading and continues to spur new research ideas on maximizing student ability to recognize and familiarize themselves with geologic features and geographic surroundings. The ability to capture a geographic location visually and reproduce it using hardware and software technology introduces a way for students to familiarize themselves with a certain environment, regardless of their current location (Thompson et
al., 2006). These recent trends in pedagogy are making use of hardware and software technology to create systems that enhance geologic understanding through visualization. “Students find the combination of captioning, visualization, and narration particularly useful in understanding concepts and associating them with the scientific language” (Urbano, 2006). It is possible to combine the use of information technology and field trips to further enhance learning using sound pedagogic principles (Saether et al., 2004).

Handheld computers, GeoWall, laptop computers, and video iPods are devices that allow instructors to give students a more authentic field experience by using electronic visual aids to prepare them for work in novel locations (Hesthammer et al., 2002; Saether et al., 2004; Elkins and Lyle-Elkins, 2006; Guertin, 2006; Kelly and Riggs, 2006). An advantage of using handheld computers and video iPods is their ability to store a variety of materials, data collection forms, segments of educational videos, music, and podcasts (Elkins and Lyle-Elkins, 2006; Guertin, 2006). The iPod is one of the newest teaching tools being used in both the classroom and field setting (Elkins and Lyle-Elkins, 2006; Thomas and Nelson, 2006; Duke University, 2007; Georgia College & State University, 2007). The iPod is a portable media player that has up to 80 gigabytes of memory and is compatible with a variety of file types (Apple, 2007). Audio-intensive courses reported that the iPod increased the frequency and depth of student interaction with audio course content because it allowed them to access the materials when they wanted and as frequently as they wanted. The iPod’s portability has allowed students to access electronic course materials in study environments of their own choosing. Ultimately, the flexibility and utility of the iPods to increase study-time with electronic course materials facilitated the use of higher-order thinking skills in the classroom.
The ability to maximize the use of hardware and software technology has been shown to be crucial in creating new direction for spatial understanding of geographic and geologic locations. Electronic visualization tools allow students to preview the geomorphic and geologic features found in new environments, thus becoming familiar with specific locations before visiting them in person (Hesthammer et al., 2002; Saether et al., 2004; Elkins and Elkins, 2006; Guertin, 2006; Kelly and Riggs, 2006; Thompson et al., 2006). Since geographic novelty deals with the familiarity of a location, it is the purpose of this research to evaluate the impact of electronic visual aids delivered on iPods at reducing geographic novelty space. If effective at reducing geographic novelty space, the combination of electronic visual aids and portable electronic devices that allow students unrestricted access to course materials could improve the potential for students to learn in field environments.

**Project Description**

I have created animated fly-throughs of relevant field stops on GeoJourney using Google Earth Pro™. Google Earth is a virtual globe program that used to be known as Earth Viewer and works by using superimposition of images obtained from GIS, satellite imagery, aerial photography, and a 3-D globe to map the Earth (Google Earth, 2007). Not all of the imagery is in real time but it is usually current to within three years. The use of Digital Elevation Models (DEM) from NASA and supplement DEMs from other sources make it possible to see the imagery in 3-D rather than 2-D, like most maps (Google Earth, 2007). The fly-throughs serve a similar pedagogical function to the
GeoWall (Kelly and Riggs, 2006) and flight simulators (Hesthammer et al., 2002; Saether et al., 2004) by giving students a 3-D topographic preview of up-coming terrains. The fly-throughs were then loaded onto the students’ iPods so they would be readily available throughout the duration of the Fall 2007 GeoJourney program. The iPod is important to this research because GeoJourney students have access to iPods at all times and, hence, also have unrestricted access to the animated fly-throughs (Elkins and Elkins, 2008c). GeoJourney has previously utilized video iPods with great success as a delivery method for electronic course materials including educational documentaries, photos, music, and podcasts (Elkins and Lyle-Elkins, 2006).

The goal of this research is to further the understanding of geographic novelty space and whether technology can be used to lessen it. Specifically, this research measures the effect of viewing animated topographic fly-throughs on students’ geographic novelty space pertaining to up-coming field stops on GeoJourney. The hypothesis tested is that the use of animated topographic fly-throughs reduces geographic novelty space.
CHAPTER II

METHODS

Context

The research done on the evaluation of students’ geographic novelty space was conducted on GeoJourney over a nine week period (65 days) in the fall of 2007. The courses covered on this field-based program were introductory physical geology, historical geology, environmental science, Native American culture studies, and critical thinking. The study was approved by the Human Subjects Research Board at Bowling Green State University. The HSRB project number for this study is H04E254FFB. See Appendices C and D for HSRB approval document and student consent letter.

Participants

The participants for this study consisted of 25 undergraduate students from Bowling Green State University who were hand selected from a pool of 44 applicants to enroll on GeoJourney (Table 1). The students were hand selected in an attempt to pick the 25 best prepared students. Each student went through an application process during which they were interviewed by the program directors. The students also had to provide references, which were contacted and used in the determination process. Many students that attended GeoJourney are in the Honors program. They range from freshmen to seniors, and represent a range of majors.
Table 1: Student Demographics. Demographics for students attending GeoJourney in Fall 2007.

<table>
<thead>
<tr>
<th>Student Characteristics</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>13</td>
</tr>
<tr>
<td>Male</td>
<td>12</td>
</tr>
<tr>
<td>Year In School</td>
<td></td>
</tr>
<tr>
<td>1st year</td>
<td>12</td>
</tr>
<tr>
<td>2nd year</td>
<td>7</td>
</tr>
<tr>
<td>3rd year</td>
<td>5</td>
</tr>
<tr>
<td>4th year</td>
<td>1</td>
</tr>
<tr>
<td>Major</td>
<td></td>
</tr>
<tr>
<td>Biology</td>
<td>2</td>
</tr>
<tr>
<td>Environmental Health</td>
<td>1</td>
</tr>
<tr>
<td>Environmental Policy</td>
<td>1</td>
</tr>
<tr>
<td>Environmental Science</td>
<td>2</td>
</tr>
<tr>
<td>Geology</td>
<td>1</td>
</tr>
<tr>
<td>International Studies</td>
<td>1</td>
</tr>
<tr>
<td>Journalism</td>
<td>1</td>
</tr>
<tr>
<td>Life/Environmental Edu</td>
<td>1</td>
</tr>
<tr>
<td>Nursing</td>
<td>2</td>
</tr>
<tr>
<td>Political Science</td>
<td>1</td>
</tr>
<tr>
<td>Sports Management</td>
<td>1</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>1</td>
</tr>
<tr>
<td>Visual Communication Technology</td>
<td>3</td>
</tr>
<tr>
<td>Undecided</td>
<td>4</td>
</tr>
<tr>
<td>Unknown</td>
<td>3</td>
</tr>
</tbody>
</table>

*Intervention*

The students were each given an intervention while participating on GeoJourney in an attempt to lessen their geographic novelty. The intervention that was given to the students on the trip was a set of animated topographic fly-throughs. The fly-throughs were made using the software Google Earth Pro™. Google Earth Pro™ allows the user to employ a combination of various tools to produce a clear geographic representation of an area. The software uses satellite imagery, maps, topography, and various other features. Google Earth Pro™ was chosen for this research because it is accessible from any computer with an internet connection. The software is also very user friendly and inexpensive. The standard Google Earth™ software can be downloaded for free from the
internet and will support most Google Earth Pro™ creations. The fly-throughs were created by first identifying areas that had a high resolution for picture clarity purposes. The identification of areas with high resolution was done by looking on Google Earth™ at various field stops on the GeoJourney itinerary and deciding on the best areas for viewing. Another consideration factor was the amount of information available on the area. The decision was then made to use ten national parks and monuments as our fly-throughs based on available information and resolution clarity of the areas. The parks chosen were Yosemite National Park, Glacier National Park, Mount St. Helens, Death Valley National Park, Badlands National Park, Grand Canyon National Park, Zion National Park, Bryce Canyon National Park, Yellowstone National Park, and the Great Smokey Mountains National Park.

Once the national parks were determined, then the actual fly-through of each park was created based on field stops as well as important geological landmarks in each of the parks. The idea behind doing additional points in the park was to allow students not only to view their field area but also have a grasp of the park as a whole. The creation of the fly-throughs entailed manually adding each of the stops to the Places section in Google Earth Pro™. Each of the places were marked using the placemark tool. This tool then places a pushpin on the area which is later removed. Once all of the places were identified, then a folder was created under the Places section for each national park. Inside each of the folders were all of the placemarks for that particular park. The placemarks were then ordered for the fly-through. There was not a particular order except for placing North America, United States, and the geomorphic province first. Those three were standard for all of the fly-throughs so students could help locate
themselves on a map. Once all of the locations were ordered then a tour was made using
the Play tour function. The fly to speed was set at 0.1190 seconds with a camera range of
1000 meters and a camera tilt of 45 degrees. Those settings were determined to be the
best for the computers being used to make the fly-throughs, based on the quality of the
fly-throughs as well as how much time was needed for each of the places to load
completely.

The next step was to add an introduction to each of the fly-throughs. Still photos
of the fly-through areas were collected from the National Park Service and the United
States Geological Survey websites. An audio introduction was created using information
from the websites along with the Geology of National Parks textbook. The audio
description includes the geomorphic province in which the park lies, the date of creation
of the park, size of the park, some historical information, as well as some overview of
features seen in the fly-through. The reason for the audio portion of the fly-throughs was
to give the students some background to the park as well as what they would be seeing.
The audio was placed as a voice-over for the still photos. Lastly, music was added to
each of the fly-throughs as a way to keep the students’ attention. A random selection of
songs were selected from my iTunes and added to the fly-throughs. Some of the music
was selected purposely for certain national parks. Two examples would be “Eye of the
Tiger” (Survivor) and “Highway to Hell” (AC/DC). “Eye of the Tiger” was chosen for
Mount St. Helens as a motivation for the students’ climb. “Highway to Hell” was chosen
for Death Valley based on that park being the hottest and driest place in North America.

The Creator 9™ software by Roxio was then used to transfer the fly-throughs
from Google Earth Pro™ to an mp4 format supported by Apple’s video iPod. Each
student was provided with a video iPod that contained various learning materials, including the fly-throughs intervention.

**Mixed-method Design**

A mixed-method case study approach was used in this research to measure the experience of using the animated fly-throughs and its impact on geographic novelty space. A mixed-method study is one that includes both a quantifiable assessment as well as a qualitative assessment. The study therefore allows a statistical analysis to be done on a topic along with the qualitative analysis. A mixed method approach to a study allows the researcher to gain direct experience with the field setting of the research as well as quantifying any occurrences from the field setting (Libarkin and Kurdziel, 2002a).

GeoJourney will be treated as a whole case using all participants and not individual cases. The reason behind this approach is because we want to look at the program as a whole, which will allow us to see how novelty space changes in the program. This will allow us to do similar studies over the life of the program and correlate them and their effectiveness on novelty space. For the purpose of this study, the quantitative analysis will show whether geographic novelty space is reduced over the course of the GeoJourney program across all students pooled together, not by individual student. The qualitative analysis will then be used to determine whether the animated fly-throughs played a significant role in producing this decrease in geographic novelty space.

**Quantitative Instrument**

Quantitative data allow us to look at broad trends in the responses of students by gathering data using a set of standard survey questions created well in advance of the
program start. The instrument that was used to quantify the results in this study was the Novelty Space Survey, a pre-existing Likert scale survey that is a valid and reliable instrument developed by Dr. Joe Elkins and Nikki Elkins (Elkins and Elkins, 2008b). A Likert scale survey is one that measures the feelings and attitudes of the subjects. It is used to test how much a subject agrees or disagrees with the question. The survey is made up of 32 questions. There are eight questions pertaining to each novelty space domain (psychological, cognitive, geographic, as well as an added category, social, recognized by Dr. Joe Elkins). The survey questions relevant to geographic novelty space are found in Table 2.

**Table 2**: Geographic Novelty Space Survey Questions. This table contains a list of the geographic novelty space survey questions used in the quantitative analysis.

<table>
<thead>
<tr>
<th>Geographic Novelty Space Survey Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3) Most of the places on this field trip are unfamiliar to me.</td>
</tr>
<tr>
<td>7) I have visited most of the places on this field trip before.</td>
</tr>
<tr>
<td>11) I know where we are going on this field trip.</td>
</tr>
<tr>
<td>15) I could find the places we visited on this field trip on a map.</td>
</tr>
<tr>
<td>19) I have never seen places like the ones visited on this field trip before.</td>
</tr>
<tr>
<td>23) I understand how the places visited on this field trip relate to the subjects I am learning on this field trip.</td>
</tr>
<tr>
<td>27) I know where north is when I am outside.</td>
</tr>
<tr>
<td>31) I am disoriented when I am in new places.</td>
</tr>
</tbody>
</table>

The survey questions were in Likert form, that is, the answers are scaled using the terminology as “Strongly Disagree”, “Disagree”, “Somewhat”, “Agree”, “Strongly
Agree”. These answers are then assigned a numerical value from 1 to 5 for statistical analysis purposes. Depending on the wording of the statement a score of 1 may indicate “Strongly Agree” or “Strongly Disagree”. In each case, a score of 1 indicates low novelty space and a score of 5 indicates high novelty space.

The Novelty Space Survey was used to quantify the level of geographic novelty space that the students possess at various times throughout the trip as well as identify possible changes in their geographic novelty space over time (Elkins and Elkins, 2008b). The students were asked to take the Novelty Space Survey on the first night of GeoJourney, and then on the next to last night of the trip. The survey was conducted in an outdoor setting at night. The survey was conducted at the end of a full day of activities and/or travelling. On the first night, students were given a brief description of the survey and what novelty space was by Dr. Joe Elkins. The students were not given detailed information about the survey nor any depth into what novelty space is, what novelty space measure, and how each student is affected by novelty space. The purpose of not going into any detail about novelty space is to keep the data reliable and from being purposely skewed. The survey addresses questions in regards to all aspects of novelty space, but for the purposes of this study only the questions regarding geographical novelty space were examined.

The data were analyzed using both a total mean score comparison and a Repeated Measures ANOVA. The total mean score comparison was found by using all of the students’ total scores and getting an average for the group. A Repeated Measures ANOVA was used because, while the responses from the pre-course and post-course surveys were not paired by individual student, the responses from the two survey
administrations are still correlated (i.e., not independent), a violation of the assumptions required for a standard ANOVA. The Repeated Measures ANOVA technique is an analysis of variance that uses all the responses from the survey to identify significant correlations amongst the various measures included. The Repeated Measures ANOVA tests the equality of means. This test is done when a sample is measured under several different conditions. This statistical analysis is important to the research because it shows whether there was a significant change in the total score between the pre-course and post-course surveys. The result from the ANOVA is given as an F value. The further the F value is from 1, then the more significant the change, that is, the smaller the p-value. The expectation from this test is that there will be a significant change in the scores, indicating a quantifiable decrease in novelty space. The qualitative results will then provide evidence that the animated fly-throughs helped to cause the decrease in geographic novelty space.

**Qualitative Instrument**

Qualitative data are typically divided into interviews, direct observations, and written documents (Libarkin and Kurdziel, 2002b). The benefit of using the qualitative data in this study was the ability to gain a more detailed response on each of the participants’ personal experiences. As the trip progressed, I was able to engage in informal conversations with the students in order to get insight into what the students were experiencing day-to-day using the fly-throughs as well as trying to get some sense of their experiences and emotions as they were happening versus hearing about them in interviews weeks later. The qualitative instrument that was used to gather data on those personal experiences involved video-taped interviews as modeled after Elkins and Elkins
The student interviews were video-taped toward the end of GeoJourney, during which they were asked a series of ten questions that reflected their experiences on the use of the animated fly-throughs. Interview questions used for the study include:

1. Did fly-throughs help familiarize or introduce you to the parks aside from topography?
2. Did you like the fly-throughs? Why?
3. Were they useful academically? How so?
4. Were they useful in other ways? How so?
5. Are the fly-throughs a useful resource for familiarizing yourself with the type of terrain/topography at upcoming field stops?
6. Did the fly-throughs help you identify different types of terrain seen within the different geomorphic provinces?
7. Do you feel after viewing the fly-throughs that you were more familiar with your geographic location within the United States?
8. How does your fly-through experience relate to your real life experience at each of the national parks?
9. Do you feel the fly-throughs added or took away from that experience by allowing you to preview the national park?
10. Do you feel like the fly-throughs may have answered any questions you may have had about the types of terrain or other features that you would be seeing?

The first set of interviews took place at a KOA in Shreveport, Louisiana on day 55 of the trip. A total of three groups were interviewed at this site, with five students making up each group. The next and final set of interviews took place on day 61 at Jekyll Island,
Georgia with the final two groups being interviewed here. Again each group was made up of five students. The interviews had to be conducted over a two night period due to the amount of time needed for each group to be completed. There were six days in between interview nights due to the GeoJourney schedule. The interviews were conducted in an outdoor setting at night. Each group gathered around a picnic table away from the main camp area. A propane lantern was used to light the area. The camera was placed at the end of the picnic table in an attempt to view the group as a whole. The interviews were conducted after a full day of activities. The questions were asked to the group with no individual being singled out. Each of the participants was encouraged to share their experiences and answers but none were made to speak. All of the interviews conducted as well as answers given were voluntary.

After returning from GeoJourney, the video-taped interviews were transcribed and thematic content analysis was conducted on the transcriptions. The advantage to using a thematic content analysis is that the researcher can study a large amount of text. In a thematic content analysis, the researcher codes his or her interview data in an attempt to identify themes. The codes are usually keywords or phrases that allow a researcher to see similarities or differences in the responses and are usually only known by the person conducting the research. The coding techniques are unique to each researcher, rather than shared or standardized items. The similarities and differences identified in the data are known as themes. The themes then are used to interpret the interview data and draw conclusions on whether the researcher’s hypothesis was supported or not. Another factor that must be included when using video-taped interviews is an assessment of emotional reactions to the questions because they can be themes as well. These emotional reactions
include things such as facial expressions and body gestures. Recording the emotional
reactions is important because a student may use them to agree or disagree with an
answer being given instead of doing it verbally. From this, the researcher will be able to
interpret the themes and decide whether or not the fly-throughs were instrumental in the
overall decrease of geographical novelty space. The expectation is that the use of
animated topographic fly-throughs will indeed be instrumental in the overall decrease in
geographic novelty space. If this is true, then my hypothesis will be supported.

**Electronic Research Dissemination**

The final stage of my research is to develop a PDF file of my work. The PDF file
will be placed online for other researchers to use at their discretion. My thesis as well as
the fly-throughs will be made readily available for any person with an interest in this field
of study. The method for dissemination of this research will be to submit my finished
research and fly-throughs online to the Science Education Resource Center hosted by
Carleton College at http://serc.carleton.edu/research_education.
CHAPTER III
DATA ANALYSIS and RESULTS

The results and analysis of the quantitative and qualitative instruments described in the Methods portion will be presented in this chapter. The quantitative results and analysis will be discussed first, focusing on the findings of the Novelty Space Survey. The qualitative results and analysis will then be discussed using the determined themes and interpretations from the interview data. Correlation results of both methods along with interpretations of these findings will be presented as a final result.

Novelty Space Survey Results

The Novelty Space Survey was used to measure quantitatively the change in overall novelty space. The survey measured all domains of novelty, but for this project, I only used the results of the eight questions pertaining to geographical novelty as discussed in the Methods chapter. Survey data are presented in Appendix A.

The questions overall were not analyzed individually as they were not paired by student in the pre and post-course surveys. A few of the questions, however, were explored based on the way they were written on the survey. Questions 7, 19, and 31 all read in a way that would make the researcher suspect that there would be no noticeable change between pre and post scores. For instance, Question 19 asks whether the student has seen places like the ones visited on GeoJourney before. One would presume that the student’s experiences prior to the trip are fixed and unchanging. While considering this idea, all three questions were examined and the findings were rather interesting. Questions 7 and 31 of the survey showed an actual decrease from pre to post scoring (mean score 4.4-4.0, 2.7-2.3, respectively). This is synonymous with a decrease in
geographic novelty space. Question 19 was rather different as it showed an increase between pre and post scores (mean score 3.4-3.6). This would actually indicate as an increase in geographic novelty space. Perhaps students initially underestimated how different-looking the GeoJourney locations would be to their prior experiences. However, because this finding was only noticed after the trip and since the responses were not paired by individual student, it is difficult to determine the actual reason for this outcome. It would have been helpful to probe during the video-taped interviews to see what students were really thinking when they read these questions.

Two mean scores were calculated, one for the pre-test and one for the post-test scores. Each mean score was found by first summing each student’s (n=24) answers from the Novelty Space Survey. One student did not fill out the post-test survey; therefore the sample size (n) is 24 instead of 25. The score distribution was 1 to 5 for each answer. The total possible score, then, ranged from a minimum of 8 to a maximum of 40 for each student. The closer the total score is to 8, the lower the degree of novelty.

Mean scores were then calculated by adding all of the students’ total scores together and dividing by the sample size (n=24). The pre-test mean score was determined to be 22.8 and the post-test mean was 20.3 (Figure 1/Table 2). The mean scores then allow us very quickly to see whether or not there is a change in novelty space and in what direction.
The comparison of pre and post-test mean scores shows there is a decrease of 2.5 or 7.8%. The decrease tells us that there was a reduction in geographic novelty over the course of the trip. The comparison of scores alone, however, does not conclude that the change is significant. Another test must be used to determine the level of significance.

The level of significance was measured using a Repeated Measures ANOVA. The ANOVA used every individual score from both the pre and post-test. The results from the ANOVA test were based on a $p \leq 0.05$ or a 95% confidence level. The numerical findings for the test are shown in Table 3 below. The ANOVA shows that there was a statistically significant decrease in mean score for geographic novelty space. Using the quantitative results only, though, we can only speculate on what might have caused this change in geographical novelty. This is why we must also include qualitative data as evidence for the cause of geographic novelty change.
Table 3: Geographic Novelty Results. This table shows results collected from the Novelty Space Survey.

<table>
<thead>
<tr>
<th>Novelty Domain</th>
<th>Mean for Eight Questions Pooled</th>
<th>Mean Score for Individual Questions</th>
<th>Std Dev for Individual Questions</th>
<th>Sample Size (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographical Novelty Pre-Test Results</td>
<td>22.8</td>
<td>2.874</td>
<td>0.427</td>
<td>24</td>
</tr>
<tr>
<td>Geographical Novelty Post-Test Results</td>
<td>20.3</td>
<td>2.534</td>
<td>0.448</td>
<td>24</td>
</tr>
</tbody>
</table>

Table 4: Repeated Measures ANOVA. This table shows results from the Repeated Measures Analysis of Variance test computed using data collected from the Novelty Space Survey.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographical Novelty Pre and Post-Test</td>
<td>1</td>
<td>1.379</td>
<td>1.379</td>
<td>11.40</td>
<td>0.0026</td>
</tr>
<tr>
<td>Error</td>
<td>23</td>
<td>2.783</td>
<td>0.121</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Student Interview Results

The results in this section are based on student responses during video-taped interviews as part of a thematic content analysis (Appendix B). The qualitative results stem from the coding of video-taped interview data and the interpretation of themes as discussed in the Methods chapter. The video-taped interviews allow us a more in-depth look at the effects of the animated topographic fly-throughs on each individual student as
well as the group as a whole. Results are presented separately for each of the ten interview questions.

1. Did fly-throughs help familiarize or introduce you to the parks aside from topography?

The consensus among the students was that the information given on each of the national parks at the beginning of the fly-throughs was a good introduction to the park. One student said

It also gave not just topography but background history of the park like when it was founded. It also gave an overview of just what landmarks were in it and which ones were famous. A lot of the famous landmarks from the fly-throughs and hikes I had heard of before but I did not necessarily realize that they were in that particular national park. So, that was really cool to just realize that and know we were going to see that. That’s cool.

This particular quote is interpreted as indicating that the student had a positive experience and was intrigued by what s/he saw on the animated topographic fly-throughs. Many students agreed with this statement using gestures such as nodding their heads. The interpretation of the responses to this question is that the fly-throughs did familiarize the students with the national parks by providing an overall introduction into the history of the park as well as what landmarks could be expected. The interpretation is an important factor when looking at geographical novelty space because it tells us that students were more prepared on what to expect at the national parks after viewing the fly-throughs. Being prepared lessens the distracting factors that might hinder the student’s overall learning experience at each of the national parks. The distracting factors here would be the unknown information about the national parks. The responses to this question give us a direct correlation between students’ thought process and the causes of the observed decrease in geographic novelty space. As a student becomes more prepared for a task, the less likely that student is to worry or become distracted by it.
2. *Did you like the fly-throughs? Why?*

Every student liked the fly-throughs overall based on the responses given to this question. The only negative responses to the fly-throughs were that some of the text was hard to read on the iPod. The rest of the remarks were positive. There were various reasons, though, for liking them. Some of the reasons given were that they helped me in locating myself while on the trip, the fly-throughs gave us a preview of what we were going to see, and the aerial shots allowed us to get a better overall picture of the terrain in the area that is not possible from the ground. One student replied,

> I just thought it was like really educational. I mean we would go to these parks and know about all the geology of them and stuff. I thought it was really cool to know when they were established and exactly where the parks were in the country. Because I could think of Yellowstone before I got on this trip and I would be like it’s in the west and now I know where it is exactly situated.

The answers from this question allow us to say with confidence that the fly-throughs were liked and useful in providing an additional tool for the students to use on the trip. I was able to conclude from this question that the fly-throughs played a crucial role in decreasing the unknown factor that the students had about the national parks.

3. *Were they useful academically? How so?*

The answers seemed to vary more as to the usefulness of the fly-throughs for academic information. Most of the students agreed that the fly-throughs were useful to some degree. They mainly felt the fly-throughs were helpful academically by providing them a sense of scale for the field areas, an overview of the terrain and topography, and good historical background information about the parks. One student went as far as to say

> I’m actually thinking these might help me study for the final. They give you an idea of what went on in those parks and remind you of what we were looking at weeks ago.
Some students thought the fly-throughs were more of an overview to prepare them for the actual academics to be taught by the professor. The overall determination from the answers given was that the fly-throughs were more of a preparation for the academics. This tells us that the students did not use the fly-throughs on an everyday basis but more sporadically when general information was needed. The fact that the students used the fly-throughs only periodically for general information on the national parks and their location tells us that they were able to focus more on their assignments in the vehicles and worry less about what was coming up on the trip.

4. *Were they useful in other ways? How so?*

There was not a whole lot of feedback from this question. The majority of the students responded by saying they were only useful in other ways for general interest and to listen to the music included with the fly-throughs. This question did not have any direct correlation to whether or not the fly-throughs helped decrease geographical novelty space. The only conclusion drawn from this question was that the students did occasionally look to the fly-throughs for something besides national park information and location, specifically to listen to the music included during the actual fly-through of the national parks. One student even commented on how s/he did not bring any music listening device, therefore s/he used the fly-throughs as a means to listen to music.

5. *Are the fly-throughs a useful resource for familiarizing yourself with the type of terrain/topography at upcoming field stops?*

The reasoning for this question was to understand whether students used the fly-throughs to identify the terrain in which they would be working. The students felt the fly-throughs were a useful resource, especially when dealing with a national park that
may have various types of terrain. An example given in the interviews was Death Valley. Death Valley has a variety of terrains such as mountains, sand dunes, and salt flats. A student said the fly-through was very helpful in identifying those terrains. Knowing this showed that the fly-throughs were also used during the actual visit to the national parks and not just as a preview before arriving. The students obviously saw something in the preview and were able to go back to the fly-through to help understand what was going on in the national park. An important factor interpreted here was that students identified a possible distracting factor and minimized it through use of the fly-through. Hence, not only did the intervention work directly as a preview resource, but also in a way in which students were able to proactively self-eliminate geographic novelty space by using the fly-throughs while in the national parks and monuments. The importance of this finding is that, in addition to animated topographic fly-throughs working directly as a preview resource, as proposed in the study, there now is evidence that the students used them as a resource while in the national parks. Why is this important? The purpose behind the fly-throughs was to show the students a preview in hopes of reducing distracting factors directly or before reaching the field stops. There was no indication initially that the fly-throughs could be used to eliminate distracting factors once arriving at the national parks. This finding provides more evidence as to how animated topographic fly-throughs were instrumental in the decrease of geographic novelty space in this study.

6. **Did the fly-throughs help you identify different types of terrain seen within the different geomorphic provinces?**

The purpose, then, of this question was to see if the students used the fly-throughs as a way to correlate certain terrains within different geomorphic provinces. From the
responses, an interpretation could be made that the students did not pay much attention to
the outline of the geomorphic provinces on the fly-throughs. The reason for this is
because the students did not make a connection between the geomorphic provinces and
the national parks. There was no indication from this question that having the
geomorphic provinces on the fly-throughs actually contributed to the decrease in
geographic novelty space.

7. *Do you feel after viewing the fly-throughs that you were more familiar with your
geographic location within the United States?*

A student not knowing their location on a field trip can be a major distraction. When
asking the students if the fly-throughs were useful in helping them understand their exact
location, I received an overwhelming response of “yes”. The students all seem to agree
that they can become very disoriented in the field for reasons such as long drives between
stops and lack of information from faculty as to their destination. One student replied,

> I have no natural sense of direction. So, it really helps to see how the fly-through zooms in
> from world then to the United States. I mean I know where the United States is and I know
generally where the states are. If you told me that Yosemite was in California, I wouldn’t know
> which part of California and I actually had it in the wrong area in my mind until I saw it.

Based on the pattern of answers, the fly-throughs did make the students more
familiar with their location causing them not to have to worry about where they were
while riding in the vans. Eliminating this distraction is important because so much of the
coursework is completed in the vans between field stops. This decrease in geographical
novelty was instrumental in increasing the amount of work that was getting done in the
beginning of the trip versus the amount that was being completed in the vans towards the
end of the trip.
8. How does your fly-through experience relate to your real life experience at each of the national parks?

Here the students were asked to connect the fly-throughs to their experience of what they actually saw in the national parks. The answers here were diverse but seem to follow the same pattern, namely that the fly-throughs gave you the broad picture of the national park while the actual visit to the park was a lot more specific. Students did comment, however, on how they saw more of the national parks in the fly-throughs. Looking at the responses for this question allowed me to understand what students were looking for as they viewed the fly-throughs. It was obvious that as the trip progressed, students were looking for what large scale features were in the park and not trying to focus on an individual field stop. Trying to focus on an individual field stop on the fly-through would have been impossible due to the fact that they were continuous and there was no additional zoom-in feature for the students to use. As one student commented, “the fly-throughs and real-life experience are like a layering effect”. I interpreted the response from this quote as s/he saw a blueprint of the area in the fly-through and when s/he arrived, there was the finished project. The responses to this question made it evident that there is still geographic novelty among the students but to a lesser degree than if no intervention would had been given. The reality, then, is that fly-throughs do not completely remove geographic novelty space but work to limit the amount each student will endure. The students know what to expect at the national parks but still have a little novelty as to what the finished picture will be.
9. Do you feel the fly-throughs added or took away from that experience by allowing you to preview the national park?

The students were all in agreement that the fly-throughs added to their overall experience, rather than taking away from the students’ experience due to previewing the national parks before actually visiting them. Instead, the responses were interpreted as being helpful in the sense that the students were able to develop an idea of what to expect in the park. The development then allowed the students to look for certain park features that were discussed on the fly-throughs, producing an excitement that added to their experience. This result is important because if the intervention was to take away from their experience, then the students would stop using the fly-throughs. If the students were to stop using the fly-throughs, then they would have no idea about what to expect at each of the national parks. This could cause the students to spend time wondering about the national parks instead of being focused on the academic tasks assigned to them. This was not the case, however, as the students did continue to use the fly-throughs throughout the course of the trip.

10. Do you feel like the fly-throughs may have answered any questions you may have had about the types of terrain or other features that you would be seeing?

When students were asked if the fly-throughs answered any questions they had about the terrain and features, there seem to be a trend in the answers. Most students felt that the fly-throughs answered their questions dealing with large-scale terrain features. The students did not feel the fly-throughs addressed small scale terrain features. This reaction was expected; the use of Google Earth Pro™ to make the fly-throughs was meant for a large scale introduction, as it was known that the software would not be able to zoom in
enough to see small scale features while maintaining clarity. This result lets us know, though, that the students were not trying to use the fly-throughs as a means to see specific sites in the field but more as a way to see an overall picture of the area. This observation supports earlier statements that the fly-throughs were used more as an introduction and overview to the areas that were going to be visited. That is important because it gives us a sense of how the students were thinking when deciding to use the fly-throughs.

The vast majority of themes interpreted are positive responses. The positive responses tell us that the students were impacted by the animated fly-throughs in a way that would reduce geographical novelty. From the interpretations, we know that students used the fly-throughs as a way of identifying where they were and where they were heading. The students also used the fly-throughs as a way to familiarize themselves with the national parks before arriving there. As a result of this we know that the students were eliminating distracting factors they may have had by using the fly-throughs as a way to see what lies ahead instead of just wondering. It is the wondering that causes students to lose focus on the tasks at hand, therefore increasing their novelty space. The fly-throughs were able to reduce this wondering and at the same time decrease the students’ geographic novelty space.

**Synthesis of Quantitative and Qualitative Results**

The results found in both the quantitative and qualitative analyses clearly show an impact of the animated fly-throughs on geographical novelty space. The quantitative results from the Novelty Space Survey indicate a significant decrease in novelty space (decrease of 2.5 in mean scores; significant ANOVA of p= 0.0026). The qualitative interpretations demonstrate that fly-throughs were instrumental in decreasing students’
geographical novelty space. Hence, we can conclude that animated topographic fly-throughs were a significant resource for decreasing geographic novelty space.
CHAPTER IV
DISCUSSION and CONCLUSION

Summary of Results

By using Google Earth Pro™ to create 10 animated topographic fly-throughs, students on GeoJourney were provided with a visual aid that enabled them to preview certain national parks before arriving at them. The students were able to do this through the use of their video iPods that were equipped with the fly-through downloads. The effectiveness of the fly-throughs was assessed using the Novelty Space Survey that was administered as a pre and post-test. The students were also assessed through a set of questions asked during video-taped interviews. The assessments allowed me to test on the idea that using animated topographic fly-throughs will reduce geographic novelty space.

The overall results using both the Novelty Space Survey and the video-taped interviews were conclusive in determining that the use of animated topographic fly-throughs did reduce students’ geographic novelty space. The evidence for the conclusion was shown through statistical analysis of student responses to the Novelty Space Survey as well as the interpretation of responses gathered in video-taped interviews.

The quantitative analysis conducted on the Novelty Space Survey determined there was a change in geographical novelty space by comparing mean scores from pre- and post-test surveys. The statistical analysis showed that the change was negative, which would be consistent with a decrease in geographic novelty space. A Repeated Measures ANOVA was then used to determine the level of significance of the change. The test found that the change was significant with a p-value of 0.0026. This result
supports the initial hypothesis that there will be a negative change or decrease in geographic novelty space over the duration of GeoJourney.

The qualitative results found in this study allowed us to gain an understanding of why there was a significant change in geographic novelty space. The video-taped interviews provided insight into what the students were thinking while viewing the fly-throughs. By knowing these thoughts, an interpretation can be made as to whether the fly-throughs played a role in the decrease of geographical novelty space seen in the statistical analysis. Based on the interpretation of student answers, the fly-throughs did contribute to the decrease in geographic novelty space. The qualitative results were crucial to understanding what caused the decrease in geographic novelty space. Without the qualitative analysis, the research would only be able to conclude a decrease in geographic novelty space had occurred, but not whether animated topographic fly-throughs played a role. The correlation between quantitative results and the interpretation of students’ interview responses was instrumental in confirming that the fly-throughs did contribute to the decrease in geographical novelty space.

Limitations

Since this research is a mixed-method study, there are limitations to the project. The qualitative research done during this study cannot be generalized to a larger population. There are several reasons for this. One reason the study cannot be generalized is because the participant sample was not randomly selected. The size of the research sample also is a limitation because it is too small to accurately represent a larger population of college students. Another limitation in this study is the quality of data collected. Since the interview data relies on the skills of the interviewer, some data may
not get collected or be left out. This can be a direct result of how a question is asked or the demeanor in which the question is asked. These limitations do not mean that the collected data is invalid but rather that the amount of data and how in-depth the answers are might be reduced. Although there are techniques to help against losing data, such as asking well-rounded questions and questions that draw on each other, not being well trained in interviewing is still a limitation in any qualitative study. The Novelty Space Survey was also a limitation in the study. The survey was written in a way where some of the questions could be ambiguous, making it unclear how accurately novelty space was being measured. Lastly, the duration of the program could be a limitation. Because the students are put through an intense nine weeks of studying, factors such as fatigue, homesickness, and stress can lead to a lack of caring when completing end of course critiques. This study is transferable, meaning similar studies may be conducted, but due to the scope and size of the study, no larger generalizations should be drawn from it by itself.

**Future Research**

Future research on novelty space reductions using technology as an intervention should be very promising, given the results of this study. As technology continues to advance, so will the ability to provide an even better intervention to evaluate and reduce not just geographic novelty space but all domains of novelty.

Future research related specifically to this study should include a longevity study. This would mean conducting the same methods each year over a time frame of at least five years. By repeating similar research every year, the longevity study will allow for more data on which to do comparison studies. The purpose of comparison studies would be to see whether similar results are found each year using the animated topographic fly-
throughs as well as to build validity and reliability to the results found in the current study. The feasibility of repeating this research is great because the study is transferable. Validity and reliability are crucial to the success and foundation of any research. These future studies will allow the foundation of the current research to grow stronger and more attractive to other researchers doing studies on similar topics.

Conclusion

The results from this research showed how valuable visual aid technology can be when applied in a field setting. Visual aid technology proved instrumental in providing a means with which students were able to make a connection with upcoming field stops. The connection was the key to the decrease seen in geographic novelty space.

Geographic novelty space can be limited using animated topographic fly-throughs as an intervention. The fly-throughs allowed the students to view the national parks before ever arriving at them. By providing this resource, students never had to worry where they were in the United States or what they would be seeing. The elimination of worry helped in keeping the students focused on their assigned tasks. In doing so, animated topographic fly-throughs reduced geographic novelty space during this geology field trip.
REFERENCES


Elkins, J., Elkins, N.M.L. 2008c, Using the iPod to reduce geographic and cognitive novelty space on GeoJourney in prep to Journal of Geoscience Education.


APPENDIX A

GEOGRAPHIC NOVELTY SPACE SURVEY DATA
The data tables seen on the following page are the results of the Novelty Space Survey. The tables include only the survey questions pertaining to Geographic Novelty Space. The questions are:

- 3.) Most of the places on this field trip are unfamiliar to me.
- 7.) I have visited most of the places on this field trip before.
- 11.) I know where we are going on this field trip.
- 15.) I could find the places we visited on this field trip on a map.
- 19.) I have never seen places like the ones visited on this field trip before.
- 23.) I understand how the places visited on this field trip relate to the subjects I am learning on this field trip.
- 27.) I know where north is when I am outside.
- 31.) I am disoriented when I am in new places.

The survey questions were in Likert form, that is the answers are scaled using the terminology as “Strongly Disagree”, “Disagree”, “Somewhat”, “Agree”, “Strongly Agree”. Values were applied to these answers as follows: A=1, B=2, C=3, D=4, E=5. A value of 1 always indicates a low degree of novelty. This can be either a “Strongly Agree” or “Strongly Disagree” depending on the wording of the question.

In the data tables, there are answers that are blank. The blanks represent questions that the students did not answer. There were three blanks in the pre-course survey and one in the post-course survey. One student had two blanks in the pre-course so that student was thrown out as an outlier. The reason for this was also to create an even number of samples for both pre- and post-course surveys. The blanks were even
between pre- and post-tests after disposal of the outlier. Therefore the error was eliminated as well and the blanks were calculated as zeros.

<table>
<thead>
<tr>
<th>GeoJourney 2007 Novelty Space Survey PRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>student1</td>
</tr>
<tr>
<td>student2</td>
</tr>
<tr>
<td>student3</td>
</tr>
<tr>
<td>student4</td>
</tr>
<tr>
<td>student5</td>
</tr>
<tr>
<td>student6</td>
</tr>
<tr>
<td>student7</td>
</tr>
<tr>
<td>student8</td>
</tr>
<tr>
<td>student9</td>
</tr>
<tr>
<td>student10</td>
</tr>
<tr>
<td>student11</td>
</tr>
<tr>
<td>student12</td>
</tr>
<tr>
<td>student13</td>
</tr>
<tr>
<td>student14</td>
</tr>
<tr>
<td>student15</td>
</tr>
<tr>
<td>student16</td>
</tr>
<tr>
<td>student17</td>
</tr>
<tr>
<td>student18</td>
</tr>
<tr>
<td>student19</td>
</tr>
<tr>
<td>student20</td>
</tr>
<tr>
<td>student21</td>
</tr>
<tr>
<td>student22</td>
</tr>
<tr>
<td>student23</td>
</tr>
<tr>
<td>student24</td>
</tr>
<tr>
<td>student25</td>
</tr>
<tr>
<td>Domain</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Q#</td>
</tr>
<tr>
<td>student1</td>
</tr>
<tr>
<td>student2</td>
</tr>
<tr>
<td>student3</td>
</tr>
<tr>
<td>student4</td>
</tr>
<tr>
<td>student5</td>
</tr>
<tr>
<td>student6</td>
</tr>
<tr>
<td>student7</td>
</tr>
<tr>
<td>student8</td>
</tr>
<tr>
<td>student9</td>
</tr>
<tr>
<td>student10</td>
</tr>
<tr>
<td>student11</td>
</tr>
<tr>
<td>student12</td>
</tr>
<tr>
<td>student13</td>
</tr>
<tr>
<td>student14</td>
</tr>
<tr>
<td>student15</td>
</tr>
<tr>
<td>student16</td>
</tr>
<tr>
<td>student17</td>
</tr>
<tr>
<td>student18</td>
</tr>
<tr>
<td>student19</td>
</tr>
<tr>
<td>student20</td>
</tr>
<tr>
<td>student21</td>
</tr>
<tr>
<td>student22</td>
</tr>
<tr>
<td>student23</td>
</tr>
<tr>
<td>student24</td>
</tr>
</tbody>
</table>
APPENDIX B

VIDEO-TAPED INTERVIEW TRANSCRIPTIONS
1. Did fly-throughs help familiarize or introduce you to the parks aside from topography?

Student 1: I like the information we got.

(*Everyone agrees with Student 1 by nodding heads and saying yeah*)

Student 2: Yes, I knew where they were established, where in the country they were and all that stuff. And I knew all the really cool things too see in them like half dome, Yosemite and all that was highlighted so.

Student 6: I agree, to hear the name and see a picture with it.

(*Others agree with them by shaking their heads.*)

Student 7: It’s a good introduction being in a van. So I’m like you’re in the van and right before you are about to head in to it. You get a general real base idea on what you are about to see. Short quick and to the point.

Student 4: Short and sweet.

Student 9: They were pretty nice. The beginning parts where you are actually explaining it I think I got more information out of it. Because you saying it to me and its like to the point.

Student 3: It also gave not just topography but background history of like the park of like when it was founded and like all of that. And it also gave an overview of just what landmarks were in it and famous landmarks were in it. Because like a lot of those for the fly throughs, a lot of the famous landmarks and hikes I had heard of before but I did not necessarily realize that it was in that particular national park. So that was really cool to just realize that and oh we are going to see that. That’s cool.

Student 5: Umm, it was nice because you know, you start off by saying where we were and then and especially how you said what geomorphic province we were in. I think that really helps. You know when you are going through it and especially if I wanted to review for a test or something it was nice to go back and see like oh this are you know because it’s hard to remember a lot of the times and then trying to sort through your notes is hard. So that was nice. Then you just gave a little intro of everything we were going to see before you know. You didn’t just slap us with a video we actually got to figure out what was going to happen before so we could make more sense of it.

Student 8: I thought like umm some of the little intros, like when you would talk about like you know the park was established when and you gave like a little background information. I thought those were really good.
Student 10: Definitely agree with that. And I also found myself looking for some features that were around like with Yosemite, I was looking for El Capitan and some of those other features that were maybe not a part of our field site or field stops during the day but were in the fly throughs.

Student 11: I think it pointed out a lot of the things we were going to see.

Student 12: I did not know like where all the national parks were so it showed me in the state where it is.

Student 9: Yeah. I think they helped. When you go through all the pictures of the big attractions that helped.

*Other students were agreeing by nodding* their heads.

Student 14: I didn’t know what to expect so when you said what something was then that really helped.

Student 13: They really didn’t help me because I have been to most of the parks before. I still watched them and they were still awesome. They maybe helped a little by helping me remember what the stuff looked like.

2. *Did you like the fly-throughs? Why?*

Student 4: Short and sweet

Student 9: I like them. They were short; you never fell asleep during the fly throughs. They had some pretty awesome music. The only thing I didn’t like is that there were no words to the music and also it was kind of hard to sometimes when it was zooming around it kind of hard to keep track of where it was going. I like it though.

Student 15: I like them.

Student 17: Like me, sometimes I would listen to them but if there was a park that I didn’t know then I didn’t want to see the pictures yet because I wanted to be surprised. I did like to hear about them.

Student 16: I liked the stuff like the lowest point and the basin and range area. It helped knowing like when Joe was saying we were going there like oh that’s the lowest point.

Student 5: I liked them because it was just a nice introduction, you got to see exactly what you were going to experience for the most part. You kind of got oriented. And the music is sweet.

*Everybody says they like the music.*
Student 18: Agrees with what has been said so far.

Student 10: I liked the initial facts.

Student 8: I liked it too also because you got to see where you were going to go like. When you said you were going to watch a fly through of this place like you knew you were going to go there. So that helped a lot. And I also like uh just like the orientation on the map too. Like of the United States cause as you are going along you get lost within a state and then you get this outside perspective and you’re like oh yeah, okay.

Student 19: Yeah we never really knew where we were going so like (Student 8: yeah it always helped).

Everyone says yeah.

Everyone says especially the music.

Student 2: I just thought it was like really educational. I mean we go to these parks and we know about all the geology of them and stuff. And I thought it was really cool like know when they were established and like exactly where they were in the country. Because I could think of Yellowstone before I got on this trip and I would be like west and now I know where it is situated.

Student 11: I thought they helped because I did not know where a lot of them were. I liked how you could see where they were. I did have trouble reading the writing.

3. Were they useful academically? How so?

Student 18: The first half was really helpful with like all the information and then the second half was helpful on the large scale. But when you got really, really close and you couldn’t read the little words and stuff sometimes I got really confused.

Student 19: I’m actually thinking these might help for like studying for the final stuff. Give you an idea of what went on in those parks and remind of you of what we were looking at there ’cause that was weeks ago.

Student 7: I’d say after the last question, it prepared me for the hard core academics you are about to learn. So it was more preparation.

Student 3: Useful in any other way. I don’t know how much this will help you in your project but I don’t have a personal iPod with me so when I want to listen to music that’s probably the best music that I thought he gave us.

Student 9: I did the Smoky Mountains one already even though we weren’t supposed to do it just to hear what song was on it.
Student 15: I did that a couple times. Wonder what he has on this one.

Student 20: It helped me just because it familiarized me with what we were going to talk about first off and then I would already have a kind of connection to it before the lecture. It helps to remember stuff and I could go back and review it.

Student 2: I agree with that especially regarding like Death Valley and all that. Because you went through all the coolest parts of Death Valley so like in the van we could talk about. So like after I saw it, I could be like are we going to see this and you could be like yeah and I would be like oh cool.

Student 12: It was helpful because you knew what you would be talking about in the park.

Student 11: It was a good introduction.

4. *Were they useful in other ways? How so?*

Student 10: You get a sense of scale umm of what some of these places were. Like especially for you know like if this formation you see it all over like how big it was. How big these areas were in relation to each other and like this mountain was a certain type and this mountain was another type. Give you a sense how far a part these formations were.

Student 3: Umm because it was aerial shots and satellite images of the stuff you were able to get a better view of the topography and the geographical features and the geology of it. That you would not necessarily see just being flat on the ground. So you can kind of like for example Sheep Mountain this was not a fly through but like just using that as an example. We were walking through like the formations and seeing them and climbing up stuff but everything we saw was from like on the ground, flat kind of perception. But when you get an aerial view you can see the fold and what it actually looks like. You can’t see that when you are the ground and the fly-throughs really helped in that way. To see an aerial picture of what is going on geologically.

Student 9: The information in the very beginning was very helpful since it was like to the point. And also when it shows you zooming in from the very, from viewing the entire United States. You can kind of see what region you are actually going into like oh it’s in the basin and range. But yeah you can kind of see what culture region you are in.

*(So do you think it was helpful to go from North America, United States, geomorphic province, into the park, and then back out?)*

Student 3: Oh yeah, definitely.
Student 15: Yeah.

Student 21: Definitely, or least showing some state line or something.

Student 22: I liked them but I had a trouble staying awake to them just because I would always just sleep in the van. So the second the music hit it was (sleeping gesture). But I listen to the beginning but that was it. *Do you think the music caused you to lose focus of the fly through?* Not necessarily, I think it’s just my lack of interest of the geology stuff because I figure I am going to see it.

Student 1: I liked it in the beginning. Whenever I am there I don’t relate it to the video. Whenever I watch I can see what it looks like but in relation to everything else it doesn’t (hand gestures)???

Student 17: Like the first time I saw it that I really didn’t get it. I was really confused but I think it’s kind of cool that you can like use that kind of technology now like Google Earth because I like using it at home but I think it was kind of hard sometimes because you really couldn’t see the words very well. Maybe if there was like maybe someone that said maybe what it was?

Student 8: The music was fun to listen to.

Student 5: Also like when we had to do an actual hike you got an idea of what the hike might be like. Like when were doing Half Dome and I started watching the fly through and I started crapping my pants.

Everyone else agrees by nodding their heads.

5. *Are the fly-throughs a useful resource for familiarizing yourself with the type of terrain/topography at upcoming field stops?*

Student 5: Absolutely.

Student 8: Yeah.

Student 10: I think there could be more to it. *(In what way?)* Like it’s one thing to see uhh like these satellite images from Google Earth and to look oh you know oh that looks like that but if you had like a photo of el Capitan or a photo of Half Dome and I don’t know if you had them but some of them were like you’re going to stop here and you had pictures of them.

Everyone says more still photos before fly throughs.

Student 18: More photos for everything you mention because sometimes there won’t be a photo.
Student 8: I think there was one of Half Dome where there was like a still picture of Half Dome and then you went through the fly through and you could actually see like how it would be 3 dimensional. Which was really helpful.

Student 10: That’s how I really relate with it.

Student 5: Definitely. Because there were so many different parts to it. Ones that were really complicated like say Death Valley there were dunes and there were Badwater and you had those several different parts to it. So it really helped.

Student 8: There was another one like that too that showed you like many different aspects and that one I thought was really helpful too. *(Do you remember which one?)* Umm, no but you made like four different stops and you showed the still pictures with it. It might have been Yosemite.

Student 15: Umm I would have to say yes. As you are zooming in and everything and then actually going from one feature to the next. It actually shows you what you’re actually going to see I mean you can see even though it gives and elevation and everything. There’ve been times when I have been like okay this is what was going to see. Then I look at the surrounding area and it lets me know this is going to be a semi easy hike or you know this is going to be a little more moderate. It did help.

Student 3: It was also really cool see like to watch the fly through before you get to the park because when you’re looking at the fly through and it’s going through the topography you really get a better sense at what it all looks like but also when your looking at the fly through it’s the satellite image so its like all like kind of mopey, like attack of the gray kind of for the satellite image. And then when you get out there you not only have a general sense of what the terrain kind of looks like but then you get to see like the vegetation and the lush colors and all of that. So you just add, it’s like a layering effect.

Student 21: I would say definitely.

*Everyone agrees by saying yeah and shaking their heads.*

Student 14: I did get kind of lost with them rotating around. I had to use the compass a lot.

6. *Did the fly-throughs help you identify different types of terrain seen within the different geomorphic provinces?*

*Everyone says yes.*

Student 6: Maybe having a picture at the bottom.

Student 23: I had trouble seeing some of the pictures. So if you say that’s there then sure.
Student 7: I think you had to make the connection by yourself. So I mean if you (Student 5: each person is going to be unique) yeah, if you made the connection or not it would be different by the person I guess.

Student 5: Definitely. Because there were so many different parts to it. Ones that were really complicated like say Death Valley there were dunes and there were Badwater and you had those several different parts to it. So it really helped.

Student 8: There was another one like that too that showed you like many different aspects and that one I thought was really helpful too. (Do you remember which one?) Umm know but you made like four different stops and you showed the still pictures with it. It might have been Yosemite.

Student 2: If I paid attention and memorized the geomorphic provinces, probably. And I know you did mention the geomorphic provinces and all that stuff. I think if I went back and look at them again then yeah. I think the first time I was just looking at the big stuff though.

Student 15: It did help. When I was watching the fly throughs and stuff you could see the different terrain and stuff and then when you actually would get out there was times where I would see something like I don’t really know what that is on the movie then when I actually get out there it kind of clicks then I would be like ok that’s what that would stand for while watching it. So it will actually help later on to if I happen to see something like that.

7. Do you feel after viewing the fly-throughs that you were more familiar with your geographic location within the United States?

Everyone unison says yes.

Student 5: Yeah, I mean you are driving and they don’t really tell you where you are going. And you ask them how long to get there and they are like “I don’t know”. So you don’t have no scale of how far you have gotten into the state or where exactly or what direction you are going.

Student 10: Also with location and places that you went to because then you could kind of triangulate yourself in the park. So you could say I am going to see this next and be looking in this direction.

Student 5: It gave you a scale of the park too.

Everyone says yeah!
Student 9: We lose track of where we are pretty quickly. I mean everything kind of molds together as you lose your sense of time and they kind of show, we are here and this is what is here.

Student 3: I have no natural sense of direction. So, it really helps to see how it zooms in from world then to the United States because, I mean I know where the United States is and I know generally where the states are. Like if you told me the Yosemite was in California, I wouldn’t know which part of California. I actually had it in the wrong area in my mind until I saw it.

8. How does your fly-through experience relate to your real life experience at each of the national parks?

Everyone agrees out loud.

Student 2: I like that a lot.

Student 10: We definitely saw more in the fly throughs than we did in the parks. In terms of large scale objects. I mean we couldn’t go to every mountain top and peak and glacier water fall and everything like that. So to see them in the fly throughs kind of give you a sense of what you could possibly see.

Everyone agrees.

Student 5: You got more of an idea geomorphologically to on what was going on because it was more bare bones like when we were looking at the waterfall in Yosemite it was hard to tell what it was because you are looking straight up at it and ok I see water trickling down. But whenever you actually got to see it in the fly through, you got to see how through alluvial processes how it got cut.

Student 7: I would say the fly through was really broad and the stops were really specific.

Everyone agrees.

Student 21: I guess it kind of, trying to describe it.

Student 3: It’s pretty much like you are going broad to specific.

Student 9: Like, like literally flying through it. It’s pretty self explanatory but I mean as opposed to the real life experience. Umm I guess its kind of quicker, you know I mean sometimes I wasn’t always able to identify every feature that was in the fly through when we actually got there but obviously it looks different, slightly but I wasn’t sweaty and stinking from sweat from the fly through like I was after the Grand Canyon hike.
Student 11: It gave me an idea of what I was going to see. Then you get there and see it in more detail.

9. Do you feel the fly-throughs added or took away from that experience by allowing you to preview the national park?

Student 7: I think the fly through gives you a taste of what you were going to see. And when you’re there you actually get to see what is there.

Student 2: I agree once you get there. The fly through is like the bare bones of everything and then once you get there you’re like wow.

Student 23: Sometimes the fly through shows you a lot more than you actually see.

Student 20: Yeah.

Student 2: Like Death Valley. The fly through showed you a lot more a lot more of what I wanted to see.

Everyone says added.

Student 15: I think it kind of set like a base of what were going to learn and what we were going to see. And then when we actually got there it built upon that.

Student 7: It’s just like any class in college, you read before you go to class so you have a general idea of what the lecture is going to be about.

Student 3: A general idea of what parks you are going into and umm, it also helps I guess in a way build anticipation too because you get to see it and you’re sometimes get excited. Like I got excited when I saw Mount St Helens and kind of dreaded it too because you showed which path we were going to climb up. I was like oh no.

Student 9: I’m kind of anticipating the Smokies now. I have been there before so I kind of want to go there again anyway but after seeing the flythrough it’s like wow. I don’t remember like where everything was from the last time I visited it.

Student 3: It also really helps with national parks that you have never heard of in your entire life like Bryce Canyon. Yeah, okay. I had no idea about that one until I saw the fly through.

Everyone says added.

Student 8: I think it definitely added. I would definitely say it didn’t take away. The more you know sometimes the more it helps.
Student 18: The parks you knew the least about were the ones that were least exciting to go to.

Student 10: Sometimes I was bummed on actually in the park because I couldn’t see some of the actual things that were on the fly throughs.

Student 12: I think it added. I think by just being able to see picture of what was in there and then actually seeing it in real life. Then saying oh yeah that’s what it really looks like.

Student 11: It was one thing to see it on the computer and then another to see it up close.

10. Do you feel like the fly-throughs may have answered any questions you may have had about the types of terrain or other features that you would be seeing?

Student 20: I think it added to my experience just because like I said before it kind of gave me a connection to it.

Student 10: Gave you a sense of large scale for sure. It definitely doesn’t give you small scale. Like uh these are the types of rocks like you are going to walking on. These are the types of trees that you are going to see, these are the animals.

Student 8: I think like you could probably add like more uhh.

Student 5: It would be nice to have an actual overview of the park. And you did give a pretty good historical overview but a lot of times there are some things like from a naturalist’s point of view you want to know what you are going to see.

Student 3: It does a little bit but like again its satellite so it doesn’t really, I mean you get the shape but it doesn’t really look a lot like it but it definitely helps.

Student 15: I thought it did. For when we would go and actually go to the parks and stuff and we get out there. We would focus on one specific feature and I always had the feeling when I was watching the fly through you could see the feature we were going to go see and then you could see it in relation to the rest of the area. And like when we went to Glacier National Park, we saw specific points and then you watch the fly-throughs and you see ok well here’s the lake and then you can actually see you know the valleys in a broader spectrum like how they were carved and everything.

Student 3: It also helped with like in your intro with all your little fluffy intro stuff uhm with like the mineralogy and the like just really, really general like these are mostly volcanic rocks. That helped a lot too because usually…

Student 7: I think it depended on the park too. Like Death Valley it’s all desert everybody knows it and then the Cascades obviously is a lot more diverse so you weren’t too sure and like this would give you a good idea.
Student 14: Yeah, like knowing that Yellowstone is geysers and Glacier is glaciers.

Student 12: Yeah, because I did not know what every national park is known for. I had no idea, so it really helped.
APPENDIX C

HSRB APPROVAL
April 9, 2008

TO: Kelsey Garner / James Hayes
    GEOL

FROM: Richard Rowlands
    HSRB Administrator

RE: Continuing HSRB Review for Project H04E254FFB

TITLE: Making Efficient Use of Travel Time to the Next Outcrop: Development of Mobile Education Technology for Instructional Use In Route on Field Excursions

This is to inform you that your research study indicated above has received continuing Human Subjects Review Board (HSRB) review and approval. This approval is effective May 7, 2008 for a period of 12 months and will expire on May 6, 2009. You may continue with the project.

Please communicate any proposed changes in your project procedures or activities involving human subjects, including consent form changes or increases in the number of participants, to the HSRB via this office. Please notify me at 372-7716 or hsrb@bgsu.edu, upon completion of your project.

Good luck with your work. Let me know if this office or the HSRB can be of assistance as your project proceeds.

Comments:
Stamped original consent documents are coming to you via campus mail.

C: Dr. Peg Yacobucci and Dr. Sheila Roberts
December 20, 2007

TO: Kelsey Garner / James Hayes
    GEOL

FROM: Richard Rowlands*  
    HSRB Administrator

RE: HSRB Project #: HO4E254FFB

TITLE: Making Efficient Use of Travel Time to the Next Outcrop: Development of Mobile Education Technology for Instructional Use In Route on Field Excursions

The Human Subjects Review Board (HSRB) has reviewed the requested modifications you submitted for your project involving human subjects. Effective December 20, 2007 the following modifications have been approved:

1. Change PI from Dr. Joe Elkins to Kelsey Garner and James Hayes as co-PI’s.
2. Add Dr. Peg Yacobucci and Dr. Sheila Roberts as project advisors for Ms. Garner and Mr. Hayes, respectively.

If you seek to make any additional changes in your project activities, complete the Request for Modifications/Addendum application and submit it to the HSRB via this office. Please notify me in writing upon completion of your project (fax: 419-372-6916 or email: hsrb@bgsu.edu).

Good luck with your work. Let me know if this office or the HSRB can be of assistance as your project proceeds.

COMMENTS:

C. Dr. Peg Yacobucci and Dr. Sheila Roberts
HUMAN SUBJECTS REVIEW BOARD

Application for Approval of Research Involving Human Subjects – As of November, 2003
(The most current version of this application is available online at www.bgsu.edu/offices/spar/orc/hsrb.)

Please answer all applicable questions and provide the material identified. Please complete electronically.

- Applications judged to be illegible, incomplete, or vague will be returned to the Principal Investigator (PI) for revision.
- All boxes are expandable so be sure to include complete information, attaching continuation sheets as necessary.
- Submit the original, signed, hard copy application and necessary supporting documentation to the Human Subjects Review Board (HSRB), 201 South Hall.
- IMPORTANT NOTE: This application will not be reviewed unless Human Subjects training has been completed by the PI (and the Advisor, if the PI is a student) – see the HSRB web page for scheduled training dates.

I. General Information:

Name of applicant (Principal Investigator): Joe T. Elkins, Ph.D.

The Principal Investigator is (check one):

☑ Faculty □ BGSU Staff □ Undergraduate Student □ Graduate Student

☑ Off-campus applicant (check this box if you are not affiliated with BGSU but propose to conduct research involving BGSU Faculty, Staff, or Students)

Department or Division: GEOLOGY

Campus Phone: 419-372-7374

E-mail: jelkins@bignet.bgsu.edu

Fax: 419-372-7205

Have You Completed BGSU Human Subjects Training? ☑ Yes/☐ No

☒ Yes (Office of Research Compliance will confirm training date)

☐ No (Please see IMPORTANT NOTE above)

The HSRB will send all correspondence to your campus address unless otherwise indicated below.

Title of the Proposed Research Project:

"Making Efficient Use of Travel Time to the Next Outcrop: Development of Mobile Education Technology for Instructional Use In Route on Field Excursions"

Names of Other Students or Staff Associated with the Project (Student PI’s note – Do not include your advisor for this research project here): Nichole M. Elkins, Part-time Faculty, Geology

Have you requested external support for this project? ☑ Yes ☐ No

If yes, external Funding Agency or Source: National Science Foundation

(Note: If the funding source requires human subjects approval or if federal funding is requested, this application will go to the full Board for review. Please submit the original plus 12 copies of the application.)

IF YOU ARE A BGSU STUDENT, PLEASE PROVIDE THE FOLLOWING:
This research is for: ☐ Thesis ☐ Dissertation ☐ Class Project ☐ Other

(Note: If the class project box is checked and the PI is a student no continuing review form will be sent. The PI will receive an expiration notice at the end of the approval period. The Office of Research Compliance must be notified in writing, before the end of the approval period, of intent to continue the project.)

Advisor's Name (This is the advisor for this research project): ___

Department or Division: ___ Phone: ___ Fax: ___ E-mail: ___

Has Advisor Completed BGSU Human Subjects Training?
☐ Yes (Office of Research Compliance will confirm training date)
☐ No (Please see IMPORTANT NOTE, page 1)

II. Information on Projects Using Existing Data (Skip to Section III if this project does NOT use existing data. Existing data includes retrospective chart reviews, public data sets, etc. Sometimes it is referred to as secondary data or archival data.)

a. Name of existing data set(s):

b. Source of existing data set(s):

c. Please provide a brief description of the content of the data set(s):

d. Are the data from a public data set? (A public data set is data available to any member of the public through a library, public archive or the Freedom of Information Act. Data obtained from private companies, hospital records, agency membership lists or similar sources are not usually public data).

☐ Yes Are you requesting permission to conduct multiple research projects with these data?
☐ Yes ☐ No
(Please go to and complete sections VIIa, VIIb and IX.)

☐ No (If no, please answer the following questions)

e. If you are obtaining access to protected information, please explain how you will obtain access to the information (e.g., permission from the CEO, permission from the Board of Education). Note: a condition for approval will be written documentation of this permission – this can be hard copy or an email from the relevant authority.

f. Before the data were collected, did respondents give their permission for the information to be used for research purposes? ☐ Yes ☐ No

g. When you obtain the data, will the individual records be anonymous or will they have identifiers attached? ☐ anonymous ☐ identifiers attached

If the records will have identifiers attached, please explain in the box below how you will protect the confidentiality of subjects. The Human Subjects Review Board is concerned about 2 dimensions
of confidentiality: (1) that the researcher has legitimate access to the records, i.e., the records are not protected by any special confidentiality conditions, and (2) that the researcher will not reveal individual identities unless permission has been granted to do so.

h. Please go to and complete sections VII.a, VII.b, and IX.

III: Does the research involve any of the following? (If the response to any of the following is "yes," provide a justification and/or rationale in the box provided below)

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Deception of subjects (if &quot;yes,&quot; please submit the original plus 12 copies of this application).</td>
<td></td>
</tr>
<tr>
<td>b. Shock or other forms of punishment</td>
<td></td>
</tr>
<tr>
<td>c. Sexually explicit materials or questions</td>
<td></td>
</tr>
<tr>
<td>d. Handling of money or other valuable commodities</td>
<td></td>
</tr>
<tr>
<td>e. Extraction of blood or other bodily fluids</td>
<td></td>
</tr>
<tr>
<td>f. Questions about drug and/or alcohol use</td>
<td></td>
</tr>
<tr>
<td>g. Questions about sexual orientation, sexual experience, or sexual abuse</td>
<td></td>
</tr>
<tr>
<td>h. Purposeful creation of anxiety</td>
<td></td>
</tr>
<tr>
<td>i. Any procedure that might be viewed as an invasion of privacy</td>
<td></td>
</tr>
<tr>
<td>j. Physical exercise or stress</td>
<td></td>
</tr>
<tr>
<td>k. Administration of substances (food, drugs, etc.) to subjects</td>
<td></td>
</tr>
<tr>
<td>l. Any procedure that might place subjects at risk (e.g., disclosure of criminal activity).</td>
<td></td>
</tr>
<tr>
<td>m. Systematic selection or exclusion of any group. This includes the selection or exclusion of any group based on age, gender, race, ethnicity, etc.</td>
<td></td>
</tr>
</tbody>
</table>

IV. HIPAA: If you answer "Yes" to any of the following questions, your project is subject to HIPAA and you must complete the HIPAA Supplement (available online at www.bgsu.edu/offices/spar/orchsr) and attach it to the application.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Will health information be obtained from a covered entity (a health plan, health care clearinghouse or a health care provider who bills health insurers — e.g., hospitals, doctor’s offices, dentists, the BGSU Student Health Service, the BGSU Speech and Hearing Clinic, the BGSU Psychological Services Center)?</td>
<td></td>
</tr>
<tr>
<td>b. Will the study involve the provision of health care in a covered entity?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>b.2 If the study involves the provision of health care, will a health insurer or billing agency be contacted for billing or eligibility?</td>
<td></td>
</tr>
</tbody>
</table>

V. Subject Information: (If the response to any of the following is "yes," the researcher should be sure to address any special needs of the potential subjects in the informed consent process. For example, if subjects are over the age of 65, then it may be appropriate to use a larger font in all correspondence with subjects to ensure readability.)

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Does the research involve subjects from any of the following categories?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Under 18 years of age</td>
<td></td>
</tr>
<tr>
<td>b. Over 65 years of age as the target population</td>
<td></td>
</tr>
</tbody>
</table>

http://www.bgsu.edu/offices/spar/orchsr
c. Persons with a physical or mental disability as the target population (if "yes," please submit the original plus 12 copies of this application).
d. Economically or educationally disadvantaged as the target population.
e. Unable to provide their own legal informed consent (if "yes," and the subjects are not children, please submit the original plus 12 copies of this application).
f. Pregnant females as the target population (if "yes," please submit the original plus 12 copies of this application).
g. Victims of crimes or other traumatic experiences as the target population
h. Individuals in institutions (e.g., prisons, nursing homes, halfway houses) (if "yes," please submit the original plus 12 copies).

VI. Risks and Benefits: (Note: the HSRB retains final authority for determining risk status of a project)

Yes ☒ ☐ No ☐ Please answer the following questions about the research.

a. In your opinion, does the research involve more than minimal risk to subjects? ("Minimal risk" means that "the risks of harm anticipated in the proposed research are not greater, considering probability and magnitude, than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.") If the answer is "yes," explain in the box below and provide an explanation of the benefits of the research to the subjects and to society.)

b. Are any emergencies or adverse reactions (physical, psychological, social, legal, or emotional) probable as a result of the research? (If "yes," then explain the measures to be taken in case of emergency in the box below.)

c. Will participation in this research result in an appreciable negative change in the subject's emotional state? (If "yes," explain the nature of the change and the process for assisting subjects in the box provided.)

VII. Project Description: (Please provide as much information as you feel will adequately answer the following questions. Attach additional sheets if necessary.)

a. What are you going to study? What is (are) the research question(s)?
The effects of using instructional media while in-route to geologic field stops on student learning of or attitudes towards concepts and principles covered in introductory geology courses.

Research Questions Relevant to this Study:
1. Does the use of instructional media while in route to geologic field stops address student misconceptions in the geosciences?
2. Does the use of instructional media while in route to geologic field stops affect the amount of time students spend studying while not in the field?
3. Does the use of instructional media while in route to geologic field stops affect student attitudes about geology as field of study?
4. Does the use of instructional media while in route to geologic field stops affect student attitudes about the use of instructional media with regard to the subject of geology?
5. Does the use of instructional media while in route to geologic field stops affect knowledge content gains regarding concepts and principals in geology?
6. Which pedagogical methods do student prefer in studying geology?
7. Which pedagogical methods are most effective in affecting student misconceptions in the geosciences?
8. Which pedagogical methods are most effective in affecting student content gains in geosciences?
9. Which pedagogical methods are most effective in affecting student perceptions of geology as a field of study?

b. Discuss the benefits of this study. Why is this study important? (provide scholarly support) Include a discussion of benefits to individual participants as well as to society as a whole.
This study will examine the effectiveness of delivering prepared introductions to the subject of geology (lectures and videos) by using instructional media to aid in teaching students while in route to field stops. Lectures and instructional videos typically comprise the bulk of instruction students receive introductory-level college geology courses. The time constraints of most classroom-based geology courses do not accommodate field excursions (Thomas and Roberts, 2003). However, the benefit of field excursions in geology is that they provide the opportunity to study, observe and experience geology in its natural context (Cartier, 1993). Without field experience, a student's perceptions of geology are largely a result of their exposure to text and the bias of the lecturer (Kern and Carpenter, 1986). The first-hand experience gained by the student while making observations in the field allows the student to use all their senses and develop a more complete understanding of the subject than what they would without the field experience (Hunter et al., 2001). However, in order for the student to be able to efficiently communicate that understanding, they must have some basic common established terminology. Therefore, development of this common vocabulary is necessary (Fuller et al., 2000). Developing that knowledge is done through the student's exposure to a prepared synthesis such as an assigned text, lecture, demonstration, or instructional video. As a result of class scheduling and time constraints, field excursions are increasingly being excluded as a primary pedagogical method in teaching introductory-level geology courses.

Time spent in vehicles in route to field stops is unavoidable when participating in field trips. Depending on the itinerary, the distance the field stop is from the departure point, and the duration of the excursion, the amount of time spent traveling to field stops can be hours or days. As a result of the time spent in vehicles, introductions to the subject (e.g., lectures, instructional videos) are done at the field stop upon arrival, at a campsite prior to the day's departure, or upon returning from the field in the evening. Like the travel time, these introductions take up a large portion of the excursion itinerary and reduces the total time spent at the field stop thereby reducing the total time available for the student to make observations or complete field projects. The time on field trips spent traveling to field stops is the primary deterrent in the frequent use of field excursions as a key pedagogical element in instruction (Jenkins, 1994). The argument is that too much time is 'wasted' traveling to and from the field stop leaving proportionally less time at the field stop for students to make observations.

Recently, entirely field-based introductory geology courses have been approved here at BGSSU. These course comprise a program collectively called "GeoJourney" (see attached). This program is a nine-week long field program that will travel by van to 29 national parks and 24 states across the United States. The itinerary is designed to use field stops as the basis for teaching introductory-level geology courses. The total time the students will spend in the vehicles will be equivalent to or exceed the total number of contact hours a student spends in a classroom, attending class with a full-time course load on a college campus during a sixteen week semester (13000 miles/60mph = 215.07 hrs).

Historically, the time spent transporting students from departure point to the academic setting has rarely been used for formalized instruction. Field excursions that have used travel time have done so by using two-way radios in a sporadic "tour guide" format (Deen et al., 2003). As a result, students frequently engage in activities irrelevant to the excursion's over-all academic objective to pass time. Rather than sleeping, listening to headphones or participating in some activity not related to the academic objectives of the field excursion, students on GeoJourney will be taught some of their lessons that have electronic audio and visual aids in route to the field stop using vehicle-mounted LCD screens. In previous cases where instructional media has been used to engage students in route, the literature does not indicate any assessment was performed and was otherwise merely descriptive of the techniques (Vaughn, 1972; Saka, 1991; Deen et al., 2003). This will be the first time a scientific approach will be taken to study the effects of using instructional media in route to field stops has on student learning in the geosciences.

Potential benefits of this study to the student are: improved focus on the subject, increased comprehension, better performance on exams and evaluations. Benefits of this study to society is improved student focus which will allow students to better understand of using instruction while in route on field trips. This better understanding could foster increased use of field trips in learning geosciences. Which would result in better understanding of earth systems science to society and higher quality training of geoscience.
c. Are there any risks associated with this study? If so, explain how you will minimize the risks to subjects.

Aside from the risks inherent in automobile travel, there are no additional risks to the participants.

d. Who will be your subjects?

Students participating on the GeoJourney field program at Bowling Green State University. See attached description.

e. Approximately how many subjects do you plan to enroll? Please provide a realistic estimate. (Don't forget to factor in the possibility of withdrawals, which may require enrolling of additional subjects in order to achieve your desired sample size. If, during the course of the project, you need to increase the number of subjects, you should request Board approval for the increase — in many cases the Office of Research Compliance can handle this administratively.)

24

f. How will you recruit your subjects? Please describe the method(s) you will use to recruit (examples include via telephone, mailings, sign-up sheets, etc.). Please include recruitment letters, scripts, sign-up sheets as appropriate with the application.

I will give them each a letter that will be mailed to them prior to beginning of the field trip. Please see attached.

g. Describe the process you will use to seek informed consent from the subjects (example — provide information sheet to potential participants, allow them to read over the information, ask them if they have any questions, answer questions to their satisfaction, then request them to sign the consent form). If you are using an information sheet please include that with the application. (See www.bgsu.edu/offices/aspatriarchs/informed_consent_check_list.doc for relevant elements of consent, sample wording, and a suggested outline of a consent form.)

I will provide the information sheet, allow them to read over the information, ask them if they have any questions, answer questions to their satisfaction, then request that they sign the consent form. Please see attached.

Yes ☒ No ☐

g.1. Are you seeking consent from all relevant parties? (If "No", explain why in the box provided below.)

Yes ☒ No ☐

g.2. Are you obtaining written consent from your participants? (If "Yes," include a copy of the consent form. If "No," explain why not [the rationale for requesting a waiver of written consent] in the box below.)

http://www.bgsu.edu/offices/aspatriarchs/human_subjects_review_board
h. If deception or emotional or physical stress is involved, subjects must be debriefed about the purposes, consequences, and benefits of the research and given information on procedures they can follow or resources that are available to them to help them handle the stress. Please attach a copy of all debriefing materials, if applicable.

Debriefing form attached:  ☐ Yes  ☒ No

i. Explain in the box below the procedures you will follow to protect the confidentiality of your subjects. Explain whether or not the study is anonymous. (It is not always necessary to protect the confidentiality of your subjects, but they must be informed if you plan to quote them directly or reveal their identities in any way.)

Students will be given a random number of 1-24 for identification on the multiple choice exam dealing with misconceptions in the geoscience. Results of the pre-test/post-test multiple choice exam will not be traced back to the student. Students being video taped will not share their last names.

j. Describe what subjects will be asked to do or have done to them from the time they are first contacted about the study until their participation in the study ends. Note — a summary of this information should be included in information provided to the subjects as part of the consent process.

As a student participating in a field-based course in geology that requires they spend many hours in a van traveling to field stops your participation is very important. If they decide to participate in this study they will be asked to watch instructional videos while in route to some field stops and to listen to lectures that will use electronic audio and visual aids while in route to some field stops during the nine-week GeoJourney field trip. They will also complete a multiple choice exam before the course begins and after it is over. They will also be video taped while being asked some questions regarding their general knowledge of geology and some specific geologic concepts before the course begins and after the course is over. During the field trip there will be no more than 20 lessons given in route. Each lesson will last no longer than 2 hours. Video taped interviews will last approximately 30 minutes each. The multiple choice exams will last no longer than one hour each. The study will provide them more time exposed to the content in the course in route to field stops resulting in their having more unstructured time on their own once we get to camp. Anticipated risks in completing this research are no greater than those encountered in daily life.

VIII. Supplemental Materials:

Attach a copy of the following:
1. All materials (including scripts, advertisements, etc.) that will be used to recruit subjects.
2. The consent form, if applicable (see the Informed Consent Checklist, which can be found at www.bgsu.edu/offices/epar/orh/hsrb, for guidance in developing consent documents).
3. Survey instruments, interview questions, etc.
4. If your project is subject to HIPAA, the HIPAA Supplement.

IX. Assurance by Principal Investigator (PI) and Advisor (if applicable):

The information provided in this application is accurate and complete. I agree to conduct this research project in accordance with Federal Policy for the Protection of Human Subjects, effective August 19, 1991, and with the Bowling Green State University Assurance of Compliance with HHS Regulations.
for Protection of Human Research Subjects." I will not implement changes in my research protocol without prior review and approval of the Human Subjects Review Board.

Signature ___________________________ Date 4-28-2004

Required for student applicants:

Advisor Signature (if applicable) ___________________________ Date ________________

Submit the application to the Human Subjects Review Board, 201 South Hall.
APPENDIX D

CONSENT LETTER
RESEARCH PARTICIPANT CONSENT FORM

You are being asked to participate in a research study by Joe Elkins, an assistant professor in the
Geology department at Bowling Green State University. This research examines the effectiveness of the use
of electronic instructional media (for example, instructional videos) while in route to field stops on field trips
on student learning of concepts in, student perceptions of, and student attitudes toward geology. This
research also examines the relationship between photographs students take on field trips and factors that
distract them from learning.

As a student participating in a field-based course in geology that requires you spend many hours in a van
traveling to field stops your participation is very important. If you decide to participate in this study you will
be asked to watch instructional videos while in route to some field stops and to listen to lectures that will use
electronic audio and visual aids while in route to some field stops during the nine-week field trip. You will
also complete multiple choice exams before the course begins and after it is over. You will also be asked to
complete a survey about the course on the first night and the last night of the course. You will also be video
taped while being asked some questions regarding your general knowledge of geology, your motivation for
taking photographs, and some specific geologic concepts before the course begins and after the course is over.
During the field trip there will be no more than 30 lessons given in route. Each lesson will last no longer than
2 hours. Video taped interviews will last approximately 30 minutes each. The surveys will take no longer
than 20 minutes to complete. The multiple choice exams will last no longer than one hour each. Participation
in the study will provide you more time exposed to the content in the course in route to field stops resulting in
your not having to attend 20 additional one hour long lectures on the subjects that are covered using the
instructional media in route own once we get to camp. Participation in the study will give you up to 20 hours
of unstructured time on your own in the camp setting. You may use that time as you see fit. You will also be
encouraged to take as many photographs as you like when on a field trip. At the end of the field trip I will ask
you to group you pictures based on the reason you took the photographs. I might also ask you to provide a
few pictures that you think best represent the types of photos you take. This will involve filling out a spread
sheet, grouping the photographs and indicating the total number for that group. Advantages of having this
time include additional time for study, completion of reading assignments, taking extracurricular hikes, or
attending to personal tasks such a laundry, phone calls, and written correspondence. Anticipated risks in
completing this research are no greater than those encountered in daily life. Advantages of grouping your
photographs will result in you looking at you photographs, and considering why you took them. This
reflection might be helpful to you in organizing your photographs for a scrapbook project or for posting on the
internet.

Your responses on the multiple choice exam and the survey will remain anonymous and you will not be
asked to share your last name during your video taped interview. Your performance on the multiple choice
exams, the survey, and in the interview will not impact your grade in the course nor will they impact your
relationship to BGSU. Any photos you choose to share will not be posted or made public. You name will not
appear in any connection to your photographs nor will the be used for any purposes without additional
consent by you. You do not have to participate in this research project. If you do agree to participate you can
stop your participation at anytime. If you have any questions about the project you can contact Joe Elkins
(419-372-7774);jelkins@bgsu.edu. If you have concerns about your treatment as a research participant,
contact the Chair, Human Subjects Review Board (419-372-7716).