THE USE AND EVALUATION OF COMPUTER TECHNOLOGIES TO INFORM CHILDREN AND ADULTS ABOUT RANGELANDS

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Jennifer Louise Peterson

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Major Professor: Karen L. Launchbaugh, Ph.D.

AUTHORIZATION TO SUBMIT THESIS

This thesis of Jennifer Louise Peterson, submitted for the degree of Master of Science with a major in Rangeland Ecology and Management and titled "The use and evaluation of computer technologies to inform children and adults about rangelands," has been reviewed in final form. Permission, as indicated by the signatures and dates given below, is now granted to submit final copies to the College of Graduate Studies for approval.

Major Professor ______________________________ Date____________
Karen L. Launchbaugh

Committee Members ______________________________ Date____________
Steven J. Hollenhorst

______________________________ Date____________
Ronald Robberecht

Department Administrator ______________________________ Date____________
Karen L. Launchbaugh

Discipline's College Dean ______________________________ Date____________
Steven Daley Laursen

Final Approval and Acceptance by the College of Graduate Studies

______________________________ Date____________
Margrit von Braun

ABSTRACT

This thesis focuses on the use of educational technologies for informing children and adults about rangelands and is separated into research and outreach components. The purpose of the research component was to compare the efficacy of a field- and computer-based module for youth rangeland education. This comparison was conducted by examining knowledge gain regarding rangelands and rangeland plants for students engaged in a field-based rangeland education activity at the McCall Outdoor Science School (MOSS), a computer-based version of the activity in public school classrooms, and a no-treatment control group. In addition, grade level (5^{th} and 6^{th}), gender, previous computer use, and experience with nature were examined for their impact on knowledge gain. Data from pre- and post-tests were analyzed to determine whether student knowledge gain differed among treatment groups. My findings indicated that both the field- and computer-based experiences effectively improved student knowledge gain regarding rangelands and rangeland plants and that each were more effective for 5^{th} grade students. No gender differences were observed between treatments. Prior levels of computer use inversely affected knowledge gain for students in the computer treatment group. Experience in nature had no detectable influence on knowledge gain for students in the field treatment group. My results suggest that both modalities of rangeland education were effective in promoting knowledge of rangelands and that computer-assisted instruction can be used as an effective alternative to traditional field-based rangeland education.

The purpose of the outreach component was to assist in informing Idaho’s citizens about the state’s vast rangeland resources. A website, entitled, “Virtual Tour of Idaho’s Rangelands,” was created as a joint effort among the Department of Rangeland Ecology and

Management, University of Idaho, the Idaho Rangeland Resource Commission (IRRC), and the Bureau of Land Management (BLM). The website focuses on Idaho's five rangeland regions (sagebrush grassland, pacific bunchgrass, juniper woodland, salt-desert shrubland, and coniferous forest and mountain meadow) and employs extensive use of photography and videography to help facilitate a unique online learning experience about Idaho's rangeland resources. The website will be hosted by the Idaho Rangeland Resource Commission, the Department of Rangeland Ecology and Management at the University of Idaho, and Rangelands West.

[Keywords: environmental education, rangeland education, residential science education, outdoor science education, early adolescents, computer-assisted instruction, computer technologies, rangeland ecology and management]

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DEDICATION

I dedicate this work to my wonderful parents, Bill and Dorothy, and to my siblings, Justin, Erin, and Meredith. Their patience, support, and unconditional love are why this thesis is a reality today.

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CHAPTER 1: INTRODUCTION

My project evaluates the outcomes of a computer-based rangeland education module and investigates the differences between traditional field instruction and computer-assisted instruction. It also details the steps involved in the creation of an online interactive tour of Idaho's rangelands to inform residents about their surrounding environment. The thesis concludes with some final recommendations and conclusions about the study.

The second chapter of this thesis titled, "Literature Review", outlines the use of computer-assisted instruction in education. It also details the need, importance, and potential benefits of computer-assisted rangeland education for Idaho's youth.

Chapter 3, titled, "A Comparison of Computer-Assisted Instruction and Field-Based Learning for Youth Rangeland Education", compares a computer-based module titled, "Home on the Range" to a field-based version of the module delivered at the McCall Outdoor Science School (MOSS). Student's knowledge about rangelands, pre- and post-treatments, was compared for the field- and computer-based versions of the module. A control group, comprised of students who did not attend MOSS or receive the computer-based version of the module, was also included in the analysis. This article will be submitted to the *Journal of Natural Resources and Life Sciences Education* for review for publication.

Chapter 4 of this thesis, titled, "Virtual Tour of Idaho's Rangelands," details the steps involved in the development of an educational website and the overall scope, need, use, and benefit of an interactive look into Idaho's most dominant land resource. The findings of this project present some valuable recommendations for the use of multimedia applications to capture and explore the vastness and beauty of Idaho's diverse rangelands.

CHAPTER 2: LITERATURE REVIEW

INTRODUCTION

The use of computers in education has resulted in a new paradigm for teaching America's youth (Tapscott, 1998; Mai and Neo, 2001). In Idaho, nearly $442 million of public and private funds have been allocated to school districts for the improvement and integration of technology into public schools (Office of Performance Evaluations, 2005). The Idaho State Board of Education reports that Idaho's schools now have more than 80,000 computers; 60% in instructional classrooms and 29% in computer labs (compare this to only 8,500 school computers in 1990). Integrating educational technology into the school curriculum is the state's primary technological goal in ensuring the effectiveness and relevance of instruction and learning for Idaho's youth (Connections 2004 Statewide Plan for Technology in Idaho, 2004).

Educational computer use, also referred to as computer-assisted instruction or computer-aided instruction (both abbreviated as CAI), has been primarily implemented and researched in the subject areas of mathematics, reading, and language arts (Reininger, 1996; Skinner, 1997; Graves et al., 2003). While the effectiveness of CAI in these subject areas has proven rather promising (Bangert-Drowns et al., 1985; Nordstrom, 1988; Cotton, 1991; Steinberg, 1991; Reininger, 1996; Soe et al., 2000), little is known about the potential effectiveness of CAI in the realm of science and environmental education (Chang, 2001; Rohwedder, R. and Alm, A, 1994). Despite the lack of research, the use of CAI in youth environmental education may prove to be very useful. In Idaho, where nearly half of the land (48%) is classified as rangeland (U.S. Geological Survey, 2003), CAI may be applicable in helping students understand their surrounding environment. Furthermore, CAI may play an important role in environmental education as new pressures and mandates are being placed on public schools as a result of the *No Child Left Behind Act* and the implementation of the anxiously awaited Idaho Standards Achievement Test (ISAT). Beginning in the spring of 2005, the ISAT series will grow to include a science assessment portion for grades 5, 7, and 10 (Idaho State Department of Education, 2004) meaning that Idaho teachers will have no choice but to increase science content in their classroom curricula.

THE USE OF COMPUTERS IN EDUCATION

Over the past two decades, computers have become integrated into school curricula nationwide (Vrasidas and McIsaac, 2001). Schools are increasing their use of information technology for teaching, from computer-aided reading instruction to mathematics preparation programs. Students are now being encouraged to use computers as learning tools in ways that were unexpected just a few short years ago.

Computers are an integral part of education and future trends indicate that education will largely be organized around the computer (Gardner, 1999). It is anticipated that educators will experience more change in educational technology in the next five years than they have in the past 50 years (Vogel and Klassen, 2001). The potential use of computers for educational learning has not yet been realized (Druger, 2000).

EFFECTIVENESS OF COMPUTER-ASSISTED INSTRUCTION IN EDUCATION

A wide array of terminology exists to describe educational computer use (i.e., computer-aided education [CAE], guided independent learning [GIL], computer-assisted learning [CAL], etc.), however, computer-assisted instruction (CAI) is the most commonly used and most frequently researched (Cotton, 1991). There is no established definition for

CAI (Bangert-Drowns et al., 1985), but its usage refers to computer-presented instruction that is individualized, interactive, and guided (Steinberg, 1991).

Since the inception of CAI in the early 1960s, several studies have examined its effectiveness for educational purposes. The Stanford Project, one of the earliest studies of CAI, examined the use of computers for reading and mathematics education for students in grades 3-8 at a central California public school (Suppes et al., 1968). The majority of the students questioned in the study thought that learning with computers was fun and that the lessons helped them better understand mathematics and reading concepts. Overall, 71% of the students said they liked the computer lessons, 23% said they were “okay”, and only 2% said they did not like them at all (Suppes et al., 1968). These initial promising results paved the way for a host of other projects and research on CAI.

Subsequent research on the effectiveness of CAI has continued to focus mainly on the subjects of mathematics and reading (Reininger, 1996; Skinner, 1997; Graves et al., 2003). Several studies support CAI’s effectiveness in these subject areas. Griswold (1984) found that students from a large, urban school district in Iowa, who received CAI, scored significantly higher than students not receiving any CAI on both the Iowa Test of Basic Skills (ITBS) and the Comprehensive Test of Basic Skills (CTBS). Gibbons (1991) used CAI to supplement the curriculum of students exhibiting low achievement in mathematics in the Columbus, Ohio public school system. Overall, 70% of the students receiving CAI scored substantially higher than those students solely receiving traditional classroom instruction. The effectiveness of CAI on spelling development was tested by Teague (1984), who found that students receiving CAI improved their spelling skills at a more rapid pace than those not receiving CAI. Norton (1986) tested the effectiveness of CAI on reading comprehension. He found that CAI was effective in teaching students to read with integrated software technology.

Meta-analyses conducted on CAI research also support the effectiveness of educational computer use. Hartley (1977) concluded that the average effect of CAI was to raise student math achievement from the 50th percentile to the 66th percentile, equivalent to a 0.41 standard deviations. A meta-analysis conducted by Kulik et al. (1983), found that education through CAI improved student achievement by 0.47 standard deviations, or raised a typical students' scores from the 50th percentile to the 68th percentile. Ryan (1991) concluded that, on average, CAI raised academic achievement by a standard deviation of 0.309. Students exposed to CAI could raise their scores from the 50th percentile to the 62nd percentile. Christmann et al. (1997) reported that students receiving traditional instruction supplemented by CAI achieved higher academic success than those just receiving traditional instruction alone. Soe et al. (2000) examined the effect of CAI on student reading achievement in grades K-12. They found that CAI had a positive impact on student reading development and that computers do, in fact, present an efficient and cost-effective mode of educational instruction.

The use of computers in education has continued to gain acceptance and popularity because computers have the intrinsic ability to emulate what many teachers are unable to do (Skinner, 1997). In comparison to traditional classroom instruction, computers provide a substitute for the time and the patience that many teachers cannot afford to offer (Castleberry, 1970), while also relieving the burdens of routine classroom testing and grading (Okey, 1982). Students learning through computers are given the capacity to intervene in the flow of information (Levin, 1985). In this respect, computer-assisted learning becomes much more individualized and, therefore, allows the teacher to match each student's needs with a particular portion or level in a computer-based module (Castleberry, 1970; Wintrob, 1991). Because the computer acts as a tutor for one individual rather than as an instructor for a group, the learning process becomes much more interactive and exciting (Suppes, 1968; Steinberg, 1991). In addition, educational computer use has been shown to increase self-esteem in students and foster their motivation to learn (Levin, 1985). Tinzmann et al. (1990) showed that technology use also tends to foster collaboration among students. Specifically in science education, computers have the ability to enrich instructional presentations, encourage students to become more active in their surrounding environments, and enable students to practice science and technology in ways similar to professionals in the field (Carin and Bass, 2001).

While the above research shows rather promising results, several others disagree with the successes of educational computer use. Many argue that the effective use of computers is not necessarily increasing at the same rate as educational technology being placed in the classroom (Amos, 1998; D'Ignazio, 1993; Hodas, 1993; Kerr, 1991; Peck and Dorricott, 1994). This fact poses a problem for teachers who lack the training and the technical skills necessary to use computers effectively as educational tools (Monahan, 1996; Saye, 1998). Therefore, the mere presence of the computer does not ensure that it will enhance learning (Kozma and Croninger, 1992; Roschelle et al., 2000). In addition, many believe that educational computer use contributes to creating inattentive and distracted youth who lack both interest in other people and social responsibility (Setzer, 2000).

Nonetheless, computers are undoubtedly revolutionizing the world of education (Pommereau, 1996; Farenga, 2000). The advances of technology make constructing new and richer contexts for teaching and learning ever more tenable and more necessary (Kinnaman, 1995). Since 1991, the United States alone has spent an estimated $9.5 billion to bring technology into the classroom (Pommereau, 1996). Idaho teachers are required to integrate educational technology into their classrooms through the Basic Educational Technology Standards for Continuing Educators, the creation of the Information Technology Resource Management Council (House Bill No. 661), and the incentives resulting from the Idaho Educational Technology Initiative (Mergendoller and Moriarty, 1999). In addition, Idaho teachers are in a new and exciting position to use computer-assisted instruction in areas other than mathematics and reading comprehension (i.e., youth science education). The implementation of the new science portion on the upcoming 2005 ISAT has opened the window for this to occur. Several factors are currently acting in the state of Idaho which favor the implementation of CAI in science curricula and the investigation of the natural resources and the environments in which Idaho schools reside.

THE IMPORTANCE OF RANGELAND EDUCATION IN IDAHO

Nearly 40% of the landmass of the United States is comprised of rangelands, a land classification of natural vegetation dominated by grasses, forbs, and shrubs, and managed as a natural ecosystem (Frank et al. 1998; Glossary Update Task Group 1998; Rangelands West, 2004). In Idaho, nearly 48% of the state (approximately 9.5 million acres) is classified as rangeland (U.S. Geological Survey, 2003) which makes up the largest single natural resource in the state (Hart, 1994). Despite the vast abundance of rangelands, both nationwide and statewide, they are relatively unknown to most Americans, especially in comparison to forests, agricultural lands, and urban areas (Sustainable Rangelands Roundtable, 2003).

Rangelands provide an abundance of resources including habitat for game and non-game animal species, habitat for native plant species, sequestration of carbon to prevent global warming, spiritual values, high quality water, clean air, open space, a setting for an abundance of recreational opportunities, and the foundation for grazing operations and industry (Mitchell, 2000; Shields et al., 2002). It is estimated that roughly 800 million acres of rangelands form the total grazing land base for the United States alone (Mitchell, 2000).

It is important for people to understand the ecology and management of rangelands (Harp and Hyde, 1999) because they are critical in the structure and function of all biotic and abiotic components of natural systems. Rangelands are vital to the continued well-being of local communities, counties, regions, and the United States as a whole (Sustainable Rangelands Roundtable, 2003). In Idaho, rangeland education should be paramount because so many of the state's residents live in rangelands and depend on rangelands for their survival and well-being. Knowledge and wise use of rangelands are inherently linked to sustaining social and economic infrastructures in the state (Sustainable Rangelands Roundtable, 2003).

Rangeland education in Idaho's schools is complementary with the integration of information technology into schools (Idaho State Department of Education, 2000), the rising pressures to incorporate more science and environmental curricula into schools (as a result of the new science portion on the ISAT), and a responsibility to educate Idaho's youth about their surrounding environment (i.e., rangelands). In this regard, rangeland education follows the environment as an integrating context (EIC) model for learning (State Education and Environment Roundtable, 2005), which focuses on developing localized programs unique to each school and community. This type of environmental education examines the influences of economic, cultural, political, and social equity within the framework of natural processes and systems. Environmental education and consequently, rangeland education, should begin close to home, encouraging learners to obtain awareness, knowledge, and skills useful in forging connections with their immediate surroundings (North American Association for Environmental Education [NAAEE], 2004).

Place-based education (PBE) is a teaching paradigm that has emerged as a result of a growing divide between schools and the communities and environments that surround them. Today, it seems that children are disconnected from the world outside their doors and are more connected with endangered animals and ecosystems in other parts of the globe (Sobel, 1996). Place-based education uses the local community and environment as a starting point to teach concepts in language arts, mathematics, social studies, science, and other subjects across the curriculum (Sobel, 2004). The Communities Creating Connections (CCC) program is the only organized place-based education effort in Idaho (The Rural School and Community Trust, 2003).

Place-based education might hold the answer in helping bridge the gap that seemingly exists between Idaho's youth and their surrounding rangeland environment. Education based in the local community and environment will help students see the relevance of what they are learning and, therefore, will engage the student in the learning process (Powers, 2004).

TARGETING YOUTH FOR COMPUTER-ASSISTED RANGELAND EDUCATION

It is important to focus on children between the ages of 7 and 11 (typically 5^{th} and 6^{th} grades) for computer-assisted rangeland education because it is at this stage when the desire to explore and understand the surrounding landscape and environment is at its highest (Sobel, 1996). Students at this age do not know a world without computer technology (Kirby, 2004) and thus possess the necessary technical skills required to effectively use a computer. In addition, students in this age group still find computer technology novel and exciting to use (Okey, 1985; Nordstrom, 1988). In general, this age group also does not fear computer technology (Kirby, 2004). Students at this age intrigued by video game technology and go first to the computer to research topics before going to their school library (Personal Observation). In addition, students in grades 5-8 are expected to use computers to access, gather, store, retrieve, and organize data using hardware and software designed for these purposes (National Research Council, 1996). Learning about, from, and with technology provides an ideal framework for implementing educational technology into a middle school science classroom (Carin and Bass, 2001). Students in Idaho of this age group are an ideal population for rangeland education because they may one day determine policy and manage rangelands in the state.

SUMMARY

The effectiveness of computer-assisted rangeland education should be studied as a potential educational tool for Idaho's youth. The opportunity currently exists to include more educational technology into classrooms because of the requirement for teachers to include more science content in their curricula (as a result of the new science portion on the 2005 ISAT). In addition, a place-based educational approach will provide students with a personal connection to the curriculum content while making learning interactive and exciting. Students in grades 5 and 6 (ages 8 to 11) form an ideal population for computer-assisted rangeland education because at this age, the computer is still novel, students possess adequate technological skills to effectively use a computer to learn, and the desire to explore their surrounding environment is at its highest. Results from previous studies concerning the efficacy of computer-assisted instruction are promising. However, the majority of those studies have focused on mathematics and reading comprehension. More research is needed to determine the effectiveness of computers in science education, specifically, the extent to which computers can be used in educating Idaho's youth about rangelands.

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CHAPTER 3: A COMPARISON OF COMPUTER-ASSISTED INSTRUCTION AND FIELD-BASED LEARNING FOR YOUTH RANGELAND EDUCATION

ABSTRACT

The rangeland ecology and management discipline has traditionally been grounded in field-based learning experiences. However, time and financial limitations in public schools often hinder a teachers' ability to bring their students into the field for learning, despite increased demands to incorporate more science content into their curricula. In addition, federal mandates are placing more pressure on teachers to integrate educational technologies in their classrooms. Our objective was to compare a computer-based rangeland education module titled, "Home on the Range", to a field-based version of the module delivered at the McCall Outdoor Science School (MOSS) in Idaho. Data from pre- and post-tests were analyzed to determine whether student knowledge gain differed among treatment groups. In addition, grade level (5th and 6th), gender, prior levels of computer use, and experience in nature were examined for their impact on knowledge gain. Findings indicated that both the field- and computer-based experiences significantly improved student knowledge gain regarding rangelands and rangeland plants and that each were more effective for 5th grade students. No significant gender differences were observed between treatments. Prior levels of computer use inversely affected knowledge gain for students in the computer treatment group. Experience in nature had no detectable influence on knowledge gain for students in the field treatment group. Our results suggest that both modalities of rangeland education were effective in promoting knowledge of rangelands and that computer-assisted instruction can be used as an effective alternative to traditional field-based rangeland education.

INTRODUCTION

The use of computers in education is a rapidly growing trend that has created a new paradigm for teaching America's youth (Tapscott, 1998; Mai and Neo, 2001). The United States spends over $5 billion dollars annually on educational technology in K-12 public schools (U.S. Department of Education, National Center for Education Statistics, 2002). Between 1990 and 2000, national educational technology expenditures increased by more than 300% (Monke, 2005). In Idaho, nearly $442 million of public and private funds have been allocated to school districts for the improvement and integration of technology into the state's public schools (Office of Performance Evaluations, 2005).

Educational computer use, also referred to as computer-assisted instruction or computer-aided instruction (CAI), has been primarily implemented and researched in mathematics, reading, and language arts (Reininger, 1996; Skinner, 1997; Graves et al., 2003). While the effectiveness of CAI in these subject areas is promising (Bangert-Drowns et al., 1985; Nordstrom, 1988; Cotton, 1991; Steinberg, 1991; Reininger, 1996; Soe et al., 2000), little is known about the potential effectiveness of CAI in science and natural resource education (Chang, 2001), although some applications have proven useful (Seiler et al., 2002). If CAI in youth environmental education proves beneficial, it may play an important role in addressing new pressures and mandates being placed on public schools to increase science content and educational technologies into their curricula.

Several factors Idaho favor the implementation of CAI in science curricula and the investigation of the natural resources and environments in which Idaho schools are located. Nearly half of Idaho (48%) is dominated by grasslands, shrublands, deserts, and woodlands that are collectively classified as rangeland (U.S. Geological Survey, 2003). Because rangelands are the dominant landscape of Idaho, they offer a model system for education citizens about their surrounding environment. Despite the dominance of rangelands in Idaho, a survey conducted by the Idaho Rangeland Resource Commission (IRRC) in 2001, reported that 50% of the adults questioned were only “somewhat knowledgeable” about the state’s rangelands and range issues, while 30% replied they were “not very knowledgeable.” Idaho’s youth are probably equally uninformed about the value of the state’s vast rangeland resources. Clearly, a disconnect exists between the state’s youth and their surrounding environment. In classrooms, children are more often presented with information about endangered animals and ecosystems in other parts of the world than with the natural ecosystems that surround them (Sobel, 1996).

An opportunity for including rangeland education in public schools is currently emerging because of the trend toward integrating educational technologies into classrooms, mandates to incorporate more science curricula into schools, and a responsibility to educate youth about the place in which they live. Computer-assisted rangeland education is a way to meet these increasing demands. However, additional research is needed to determine if rangeland education via computer-assisted instruction presents an effective means of teaching children about rangelands, especially since field-based learning experiences have traditionally dominated the range management discipline. The objective of this study was to compare the efficacy of a field- and computer-based module for rangeland education. We conducted this comparison by examining knowledge gain regarding rangelands and rangeland plants for students engaged in a field-based rangeland education activity at the McCall Outdoor Science School (MOSS), a computer-based version of the activity in public school classrooms, and a no-treatment control. The following research questions were addressed in this study:

Question 1: Does knowledge gain differ for students in control, field, and computer treatment groups and to what extent do gender and grade level influence knowledge gain in these treatment groups?

Question 2: To what extent do gender, grade level, prior levels of computer use, and student interfacing with the computer program influence knowledge gain for students engaged in a computer-based rangeland learning module?

Question 3: To what extent do gender, grade level, and prior experience in nature influence knowledge gain for students engaged in a field-based rangeland learning activity?

MATERIALS AND METHODS[1]

This research focused on an activity called, "Home on the Range," which aimed to help students learn about different kinds of rangelands, their spatial extent, their value and importance, and six common rangeland plants of Idaho. The six plants were: 1) big sagebrush (*Artemisia tridentata* Nutt.), 2) Idaho fescue (*Festuca idahoensis* Elmer), 3) western yarrow (*Achillea millefolium* L.), 4) grey rabbitbrush (*Chrysothamnus nauseousus* ([Pall.] Britt.), 5) shrubby buckwheat (*Eriogonum wrightii* Torr. ex Benth.), and 6) ponderosa pine (*Pinus ponderosa* P.& C. Lawson). The overall objective of the activity was to enhance conceptual knowledge about rangelands and rangeland plants. The computer- and field-based versions of the activity contained equivalent subject content and were used to compare the two learning modalities.

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[1] This research study was approved by the Human Assurances Committee at the University of Idaho (HAC# 05-037; Appendix A).

Field-Based Activity

The field-based learning activity was part of a week-long field school for 5th and 6th graders in Idaho called the McCall Outdoor Science School (MOSS). The field-based version of the “Home on the Range” activity employed a field notebook whereby students, working either individually or in groups no larger than three, read and discussed information about rangelands and then used a dichotomous key to identify the six rangeland plants. This activity took place in a sagebrush grassland meadow that neighbored the science school field campus. Directions for the activity were provided by a field instructor, but the activity was conducted by the students. To help the students with vocabulary, a glossary was included in the field notebook. All six plants were flagged in the sagebrush meadow before the activity. Once all of the students had identified the six plant types by common name, the field instructor reviewed the plants with the students as a group and the important characteristics of each plant were discussed. A training session was held with all field instructors before the study began to make sure each facilitated the activity and gave instructions in the same manner.

The McCall Outdoor Science School (MOSS) is the only publicly operated K-12 residential outdoor school in the state of Idaho (Palouse Clearwater Environmental Institute, 2004). The school operates from early September to mid-November at the University of Idaho Field Campus in McCall, Idaho. In the year of this study, 5th and 6th grade classes from throughout Idaho came to the field campus for a five-day session (Monday through Friday). Each five-day session included 10 to 55 students, generally from the same school. In the fall of 2005, 538 students participated in MOSS from 12 different classrooms throughout Idaho.

Computer-Based Module

The computer-based learning activity was administered in public school classrooms throughout Idaho. The computer-based version of the “Home on the Range” activity used text, graphics, photos, and maps to present the same information included in the field-based activity (Appendix B). Students were given the option of working alone or in groups no larger than three. All students completed the activity in their school computer lab. Teachers gave the students instructions and then the students completed the activity without their instructor. A meeting was held with each teacher before the activity to make sure they knew how the activity worked, felt comfortable using it, and facilitated the activity in the same manner as other teachers involved in the study.

The computer module was designed as a mystery whereby students acted as detectives to collect clues about rangelands and rangeland plants. First, students were presented with background information about rangelands and were given the option to click on different types of rangelands to see pictures and a map of rangelands in Idaho. They were also presented with information and pictures about the values and benefits of rangelands. The module then moved into a plant identification section. For each of the six plants, students were given access to a variety of pictures depicting different parts of the plant such as the stem and leaves. Using these pictures, the students answered three questions pertaining to important characteristics of that plant such as type of flower or leaf margin. Students had access to a glossary on each page of the program to help with vocabulary. The student could not proceed to the next view until they answered the current question correctly. After each click on an answer, an immediate feedback comment box appeared offering more information about the question and whether or not the answer was correct. Students were not penalized for wrong answers and were allowed to answer each question as many times as needed until they got it correct. After the students answered the three questions correctly for each plant, they navigated to a summary page which included a full-page graphic detailing the important characteristics of the plant. After examining all six plants, the student continued onto a review session where they were presented with photos and facts about each plant and were required to drag the correct name of the plant into an answer box. Again, the student could not move forward until they answered each question correctly. At the end of the review session, the student was allowed to exit the program.

The computer version of the "Home on the Range" activity was created using the software program Toolbook Instructor 2004 (Sum Total Systems Inc., 2005). The module was distributed on CD-ROM designed for use on Windows-based computer systems (Windows 98 or higher).

Student Treatment Groups

A pre-test-post-test non-equivalent control group design (Fitz-Gibbon and Morris, 1987) was used to assess student knowledge about rangelands and rangeland plants. Twelve public school classrooms participated in this study; 4 completed the field activity, 4 received the computer-based module, and 4 served as a control group and did not receive either of the treatments.

Students from the four classrooms attending MOSS in September and October 2005 completed a pre-test 1 week before their arrival at the field school. During their week at the school, students participated in the "Home on the Range" field activity as part of the rangeland ecology field module. The field activity took about 30-45 minutes to complete. Students were given a post-test immediately following the completion of the field activity.

Students from four classrooms receiving the computer-based version of the “Home on the Range” activity completed a pre-test 1 to 2 weeks before the module was administered. Students participated in the computer activity in September or October 2005 and took a post-test immediately following completion of the computer activity. The computer module took about 30-45 minutes to complete.

A control group was included in the design to provide a baseline measurement and to account for differences between pre- and post-test scores resulting from familiarity with the test. The control group was comprised of 5th and 6th grade public school classrooms that did not attend MOSS and did not receive any rangeland learning treatments. They received both the pre-test and the post-test, 1 week apart, during September and October 2005.

Because random assignment of the field treatment was not feasible, attempts were made to match each of the 4 field treatment classrooms as closely as possible with 4 computer treatment and control classrooms. We selected classrooms for the computer treatment and control from the same school districts as the 4 field treatment classrooms. If possible, another school from the same town as one of those attending MOSS was selected. If no comparison classrooms were available from the same town, a similar town was selected using the following key characteristics: percentage of town residents employed in resource-dependent professions (i.e., agriculture, forestry, fisheries, etc.); education levels of adults (i.e., percent high school, college graduates); and median household income (U.S. Census Bureau, 2000; Appendix C).

Study Sample

The total sample size was 512 students with 164 engaging in the field treatment, 202 experiencing the computer module, and 146 serving as the control. The total number of students in 5th or 6th grade was 166 and 346, respectively. The children ranged in age from 10 to 13 years old (field group: mean=11.0 years, SD=0.52; computer group: mean=10.9 years, SD=0.69; control group: mean=10.8 years, SD=0.73). Student participants included 278 male and 234 female students. The schools in this study were located in towns with populations ranging from about 400 to 31,000. Participation in this study was voluntary and only 32 students (6.3%) did not complete the post-test.

Measurement Instrument

The pre- and post-tests consisted of 20 items with a combination of multiple choice and true/false questions created to address the learning objectives of the “Home on the Range” activity (Appendix D). All questions were original and dealt specifically with types of rangelands and rangeland plant characteristics such as kind of plant (i.e., grass, forb, shrub, tree) and type of leaf margin (i.e., entire, lobed, divided, serrated). The questions were all drawn directly from content contained in the field and the computer versions of the “Home on the Range” activity. Content accuracy was verified by professors of Rangeland Ecology and Management at the University of Idaho. Reliability was not established because of the low number of questions pertaining to each area (i.e., rangelands and rangeland plants; Gardner et al., 1992). Additional questions (7 out of 20) relating to facts about Idaho and the scientific method were added to the pre- and post-test so that students would not readily recognize they were being tested on their knowledge of rangelands and rangeland plants.

Questions on both the pre- and post-tests were identical, but the order of the questions and answers were different. Four different versions of the pre- and post-test were created to ensure that memorization of answers and order of questions did not occur between test administrations. The format and administration of the pre- and post-test were similar to that of a standardized test whereby students received both written and verbal instructions and were then given a block of time to complete each test. Collaboration was not permitted during testing. Students were reminded throughout the testing that they would not be graded or be used to assess individual performance. In addition, each question on the pre- and post-test included an “I Don’t Know” response and students were encouraged not to guess (Gardner et al., 1992; Gosselin and Macklem-Hurst, 2002; Gotch, 2002; Heckler, 2004). These steps were taken to relieve student anxiety and to obtain responses that accurately reflected the students’ knowledge. Students were asked to write their gender, age, grade, date of birth, city of birth, and school name on the pre- and post-test so that matching of tests could be done afterwards (Wilson and Mires, 2001).

The post-test given to the field treatment group contained an additional four questions that broadly assessed the students’ experience in nature (Appendix E). These questions included such topics as the number of times the student camped, hiked, watched wildlife, and looked at plants in the past 12 months. The post-test given to the computer treatment group contained an additional four questions that broadly assessed the students’ level of computer use (i.e., how many hours a week did they spend using a computer at home and at school in the past week) and how they interfaced with the computer activity (i.e., did they use the glossary, did they look at the pictures, did they read the feedback comments; Appendix E). These data helped to determine whether low amounts of student interaction with the computer module, or minimal experience with nature and computers, effected student knowledge gain in the field and computer treatment groups.

Key Variables

The primary criterion variable of interest was knowledge about rangelands and rangeland plants exhibited by students involved in field- or computer-based rangeland learning activities. This construct was measured through 13 items on the pre- and post-test. A greater number of correct responses indicated greater conceptual knowledge of rangelands and rangeland plants.

Gender and grade represented two student-level variables of interest for interpreting the results of this study. The computer use variable was created by averaging student computer use at home and at school on a scale of 0 to 4 (0 = never, 1 = 15 minutes or less, 2 = 15-60 minutes, 3 = 1 to 2 hours, 4 = 2 hours or more). The glossary, pictures, and comment box variables were created by averaging student responses on a scale of 0 to 4 (0 = never, 1 = a few times, 2 = about half the time, 3 = most of the time, 4 = always) for how many times they utilized each of these features during the computer activity. The nature activity variable was created by averaging student responses on a scale of 0 to 3 (0 = never, 1 = 1-2 times, 2 = 3-9 times, 3 = 10 times or more) for the number of times they hiked, camped, looked at plants, and watched wildlife in the past 12 months.

Statistical Analyses

Knowledge gain was measured as a percentage of how much the student had to improve after accounting for their pre-test score; students with high pre-test scores had less opportunity for improvement compared to students with low pre-test scores. Because 13 was the highest obtainable score on the pre- and post-test, knowledge gain, or the percentage of potential improvement (%PI), was calculated using a formula presented by Wilson and Mires (2001): (post-test score – pre-test score)/(13 – pre-test score) x 100. Stated differently, %PI is the actual increase in knowledge divided by the possible increase in knowledge. From here on, knowledge gain and %PI will be used interchangeably. Students' "I Don't Know" responses were analyzed to determine if the frequency changed from pre- to post-test between treatment groups.

To account for the natural clustering of students within classrooms, multilevel regression modeling was used to answer the first research question (Bryk and Raudenbush, 1992). For this analysis, two, two-level models were developed representing students as level-1 units and classrooms as level-2 units. The first model, called the 'empty' or 'null' model, was estimated with no explanatory variables (i.e., treatment group, grade, gender) and was used to calculate an intraclass correlation coefficient. This coefficient represented the ratio of between-class variance to the total variance in the dependent variable. The 'null' model simultaneously measured the total variation in %PI that was due to students (level-1) and classrooms (level-2) and is explained by the following equation: $\sigma^2_{\%PI} = \sigma^2_{STUDENT} + \sigma^2_{CLASSROOM}$. The second or 'final' model included the explanatory level-1 and level-2 variables that were associated with %PI. Level-1 variables were gender and level-2 variables were treatment group and grade level. Explanatory variables (i.e. treatment group, grade, and gender) were classified as fixed effects in the model and classroom was classified as a random grouping variable. Bonferroni adjustments were made to test for significant differences among explanatory variables in the multiple comparison analysis. For both models, the Wald Z test statistic was used to verify the significance of within- and between-class variation. The data were analyzed using SPSS for Windows Version 13.0 (SPSS, Inc., 2004) at a significance (alpha) level of $P<0.05$.

To answer the second and third research questions, intraclass correlation coefficients were first calculated by developing two separate ‘null’ models with only computer and field group cases selected. These analyses provided insight into the amount of total variation in %PI that was due to differences between and within classrooms for the two treatment groups. In both analyses, the amount of variation due to classrooms was not statistically significant, thus providing justification in using general linear model techniques for the remainder of the analyses. Analysis of covariance was subsequently used to answer the second and third research questions. For research question 2, only cases within the computer treatment group were selected. The dependent variable was %PI. Grade and gender were fixed factors, and the computer use, glossary, pictures, and comment box variables were entered as covariates. In the analysis for research question 3, only cases in the field treatment group were selected and the same analysis procedure was used with the nature activity variable acting as the only covariate.

RESULTS

The study groups (computer, field, control) did not differ in their pre-test scores ($P=0.101$). Overall, students had an average pre-test score of 2.66, out of 13 possible points (Table 1). Treatment groups differed in “I Don’t Know” responses on both the pre- and post-test ($P<0.001$). On average, students answered a question with “I Don’t Know” on the pre-test 6.3 times and on the post-test, 3.0 times. The control group did not differ in terms of “I Don’t Know” responses from pre- to post-test ($P=0.157$), but field and computer treatment groups did ($P<0.001$). Students’ “I Don’t Know” responses in the field group decreased by 41% from pre- to post-test, while “I Don’t Know” responses in the computer group decreased by 30%.

Research Question 1:

Results from the first ‘null’ model estimated the overall mean %PI across classrooms as 25.3 percentage points (Table 2). Variance component estimates revealed that 56% of the total (“raw”) variance in %PI was accounted for within classrooms (level-1) and 44% was accounted for between classrooms (level-2). The ratio of between-class variance to the total variance in %PI gave the intraclass correlation coefficient of R=0.44. Based on the observed significance value of the Wald Z test, knowledge gain, as a percentage of potential improvement, varied significantly between classrooms (P=0.025) and within classrooms (P<0.001).

Explanatory variables at both levels were included in the final model to determine the amount of variation in %PI that was attributable to level-1 and level-2 components. Variance component estimates for students (level-1) were only slightly impacted by explanatory variables, however, classroom (level-2) estimates were greatly impacted and were reduced from 413.2 to 8.2 (Table 2). Overall, 98% of the total between-class variance and 0.63% of the total within-class variance were attributable to the explanatory variables (treatment group, grade, and gender). Stated differently, R^2 for the model was 43% of the total variance, 98% of the classroom variance, and 0.63% of the student variance. After the effects of treatment group, grade, and gender had been accounted for, knowledge gain, as a percentage of potential improvement, varied significantly within classrooms (P<0.001), but not between classrooms (P=0.392).

An examination of fixed effects revealed that treatment group (P<0.001) and grade level (P=0.002) significantly influenced knowledge gain (Figure 1). Males and females between the three treatment groups did not differ in terms of %PI (P=0.248). Students engaged in the field learning activity exhibited increased knowledge gain compared to students in the control group ($\overline{X}_{diff}$ =45.3; P<0.001). Knowledge gain was also much higher for students engaged in the computer-based learning activity compared to students in the control group ($\overline{X}_{diff}$ =39.3; P<0.001). However, differences in knowledge gain were not observed for students in the field and computer treatment groups ($\overline{X}_{diff}$ =6.0; P=0.315). Examination of grade level effects revealed that 5th graders exhibited greater increased %PI compared to 6th graders ($\overline{X}_{diff}$ =11.6; P=0.002).

Research Question 2:

This research question focused on students within the computer treatment group. It addressed the extent to which grade, gender, prior levels of computer use, and student interfacing with the computer program effected knowledge gain. To discern whether or not a multilevel analysis was warranted, a ‘null’ model was developed to calculate an intraclass correlation coefficient. The intraclass correlation coefficient was .10 and represented the ratio of between-class variance to total variance in %PI. Variance component estimates for students (level-1) and classrooms (level-2) revealed that only 10% of the total (“raw”) variance in %PI was explained by differences between classrooms and 90% was explained by student differences within classrooms. Therefore, knowledge gain, as a percentage of potential improvement, did not vary between classrooms (P=0.300) and the use of general linear model techniques were warranted.

Grade level (Figure 1; $F_{(1, 176)}$=9.69; P=0.002) influenced knowledge gain with 5th grade students out-performing 6th grade students by almost 12 percentage points. Prior computer use also influenced knowledge gain for students engaged in the computer-based learning activity ($F_{(1, 176)}$=6.25; P=0.013). A negative regression coefficient value of -5.4 percentage points revealed an inverse relationship between prior computer use and student improvement. Gender ($F_{(1, 176)}$=0.721; P=0.397) and program interfacing, including glossary use ($F_{(1, 176)}$=0.689; P=0.408), picture use ($F_{(1, 176)}$=0.754; P=0.386), and comment box use ($F_{(1, 176)}$=0.038; P=0.846) did not influence knowledge gain.

Research Question 3:

This research question focused on students in the field treatment group. It addressed the extent to which grade level, gender, and previous experience in nature effected knowledge gain. To discern whether or not a multilevel analysis was warranted, a ‘null’ model was developed to calculate an intraclass correlation coefficient. The intraclass correlation coefficient was 0.07 and represented the ratio of between-class variance to total variance in %PI. Variance component estimates for students (level-1) and classrooms (level-2) revealed that only 7% of the total (“raw”) variance in %PI was explained by differences between classrooms and 93% was explained by student differences within classrooms. Therefore, knowledge gain, as a percentage of potential improvement, did not vary between classrooms (P=0.400) and the use of general linear model techniques was warranted.

Grade level influenced knowledge gain for students engaged in the field-based learning activity with 5th grade students out-performing 6th grade students by almost 15 percentage points ($F_{(1, 152)}$=9.61; P=0.002). Gender ($F_{(1, 152)}$=3.64; P=0.075) and prior experience in nature ($F_{(1, 152)}$=0.152; P=0.697) did not influence overall student knowledge gain.

DISCUSSION

The main objective of this study was to compare the efficacy of a field- and computer-based module for rangeland education. Perhaps the most significant finding from this research study was the overwhelming affect of both field- and computer-based versions of the "Home on the Range" activity on increasing student knowledge about rangelands and rangeland plants. This finding is important for future rangeland education activities because it illustrates that a computer-based learning experience can provide an effective alternative to the more traditional field-based learning activities that have dominated the range management discipline. This finding is especially beneficial in a state like Idaho where rangelands are the dominant landscape (Hart, 1994) and where teachers are facing increased responsibilities to incorporate more educational technology use and science content into their curricula, despite increased budget cuts which, in turn, make it more difficult for them to take students into the field to learn about their surrounding environment.

There is evidence that the computer- and field-based learning approaches were more effective for 5th grade students than they were for 6th grade students. This can potentially be explained by several reasons. With regards to the computer treatment group, 5th graders might have viewed the computer activity as more novel and interesting than did 6th graders. This hypothesis is supported by Kmitta and Davis (2004), and others, who found that computer-assisted instruction was more successful at lower grade levels because younger children view the computer as being more novel. Our data revealed an inverse relationship between computer use and knowledge gain providing additional evidence to support this theory. Perhaps, the same idea applied to 5th grade students in the field treatment group who might have viewed the field learning experience as being more “exciting” and “novel” compared to 6th graders.

Gender did not affect knowledge gain in both computer and field treatment groups. Regarding computer-based learning, Gunn et al. (2002), and others, report that gender differences in computer learning environments have diminished over time. Although few studies provide insight into the ways that field-based experiences impact youth (Gough, 2001; Loughland et al., 2003), research findings by Barnett et al. (2004) reveal that field-based education was effective for all youth involved in their study, regardless of gender.

For the computer-based module, it was surprising that the number of times a student used the glossary, looked at the pictures, and read the immediate feedback comment boxes during the computer activity did not appear to affect student knowledge gain. This finding suggests that students simply vary in how they learn concepts and while the use of the glossary, pictures, and comment boxes might have been important for some, these features were not essential to a students’ ability to learn during the activity. In essence, students seemed to use these features to the extent needed. This finding could be valuable in the development of computer-based natural resource education modules.

The observation that knowledge gain in the field module was not affected by the amount of time a student spent in nature before engaging in the field activity, suggests that students, regardless of their level of comfort or experience with nature, will benefit from the field-based instruction. This point suggests that the instruction provided at the MOSS and other outdoor learning modules will likely be successful and beneficial, regardless of differences in students’ backgrounds and experiences.

Certain limitations and drawbacks of this study should be mentioned. As with most educational research, a random sample of participants was not practical or feasible. In addition, our study examined only a single learning activity about rangelands which limits the generalizations that can be made to other activities and content areas. What we can draw from this study, however, is an indication of potential uses and results for computer-assisted rangeland instruction and a strong basis to promote the use of more innovative and novel techniques for teaching youth about rangelands.

Finally, it is inherently difficult to compare two different modes of learning (Clark, 1985) such as field- and computer-based learning because it is difficult to establish that the material contained in both modalities are comparable and that only the method differs (Wilson and Mires, 2001). For example, CAI is often carefully designed with sequenced instruction and navigation that follow clear educational objectives, whereas traditional instruction is often not as carefully planned and guided (Jenks and Springer, 2005). In this study, we made every effort to address similar content in the computer- and field-based modules. It is also clear that the impact of computer technology and field-based learning on student knowledge gain is a complex relationship and a variety of different variables can impinge on the success or failure of each learning modality (Kmitta and Davis, 2004).

Future research should further investigate the extent to which students retain their knowledge of rangelands and rangeland plants after engaging in both field- and computer-based range education. Additionally, exploration into the ways that students use different components of a computer-based module would provide more evidence as to which features enhance learning the most. Finally, it would be interesting to examine if attitudes of youth towards rangelands changed as a result of field- or computer-based range education.

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Table 1. Observed descriptive statistics for pre-score, post-score, and percent of potential improvement (%PI) by group, grade level, and gender for students engaged in a field- or computer-based rangeland learning module plus a no-treatment control.

			Pre-Score†			Post-Score†			%PI‡	
			--------------------------------			%			------------------------------	
Treatment	**Grade**	**Gender**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**Mean**	**SD**
Control	5th	Male	31	15.4	14.6	29	17.8	14.6	1.3	18.8
		Female	29	16.4	14.6	28	19.8	14.1	2.3	17.1
	6th	Male	50	19.1	14.6	46	16.2	12.7	-6.0	17.7
		Female	36	23.7	16.8	34	21.0	10.8	-6.9	26.7
Field	5th	Male	19	9.3	10.1	18	50.0	24.8	45.6	24.8
		Female	13	10.1	9.1	13	62.7	12.1	58.3	13.4
	6th	Male	70	21.8	15.7	69	48.9	17.7	33.3	23.6
		Female	62	22.8	17.7	58	54.9	19.8	40.3	25.0
Computer	5th	Male	39	20.7	16.6	35	56.5	15.2	43.3	21.4
		Female	35	14.9	10.5	32	51.7	15.4	42.5	19.7
	6th	Male	68	26.5	12.5	64	51.0	16.5	30.2	28.4
		Female	60	22.6	12.3	54	47.2	16.8	30.1	23.2

† Pre-test and post-test score = % of 13 questions answered correctly.
‡ %PI = (post-score – pre-score)*100/(13 – pre-score).

Table 2. Multilevel regression estimates for %PI across two models, the null and final model. The null model does not include any explanatory variables.

	Model 1: Null		Model 2: Final	
	Estimate	Standard Error	Estimate	Standard Error
Fixed Effect				
Intercept	25.3*	6.0	32.3*	2.8
Treatment Group				
Control	-	-	-39.3*	3.4
Field	-	-	6.0	3.3
Computer	-	-	0	0
Grade				
5^{th}	-	-	11.6*	2.9
6^{th}	-	-	0	0
Gender				
Male	-	-	-2.4	2.1
Female	-	-	0	0
Random Component				
Student level				
$\hat{\sigma}^2_{STUDENT}$	525.5*	34.4	522.2*	34.1
Classroom level				
$\hat{\sigma}^2_{CLASSROOM}$	413.2*	183.7	8.2	9.6

Note: Multilevel estimates for Models 1 and 2 are based on restricted maximum likelihood (REML). The intraclass correlation coefficient for Model 1 is 0.44. N=480 students nested within 12 classrooms.
* $P<0.05$.

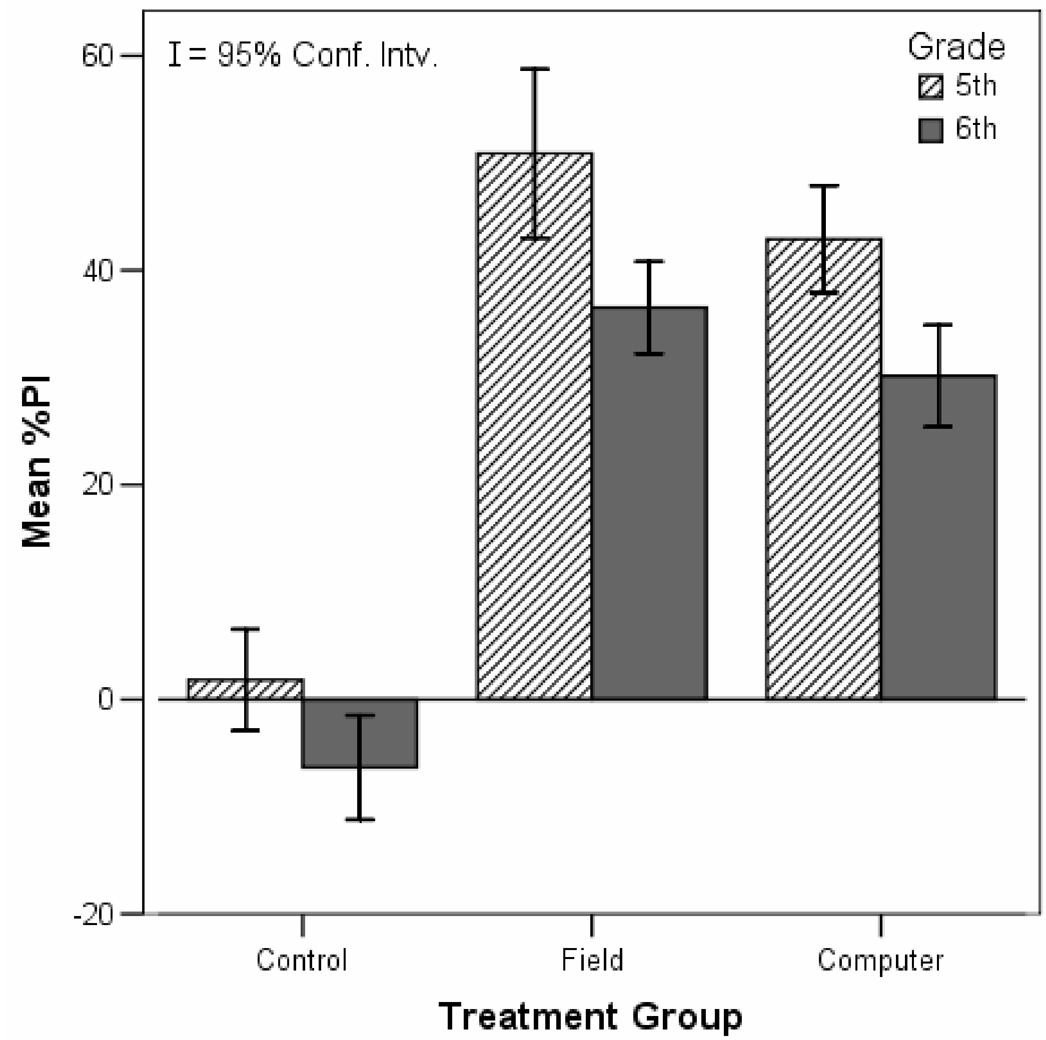

Figure 1. Mean knowledge gain, denoted as percentage of potential improvement (%PI), for 5th and 6th grade students engaged in a field- or computer-based rangeland learning module compared to a no-treatment control.

CHAPTER 4: VIRTUAL TOUR OF IDAHO'S RANGELANDS

The use of the internet has revolutionized the way people search for information. Internet use has grown 107% since 2000 (Miniwatts International, LLC, 2005) and continuous advances in internet technology have only helped to sustain this upward trend. It is estimated that close to 68% of the nation is connected to and uses the internet (Pew Internet and American Life Project, 2005).

An interactive website titled, "Virtual Tour of Idaho's Rangelands," was created to help inform internet users about rangelands. The website employs extensive use of digital multimedia to facilitate a unique online learning experience about Idaho's rangeland resources. This web-based project was created as a combined effort between the Department of Rangeland Ecology and Management at the University of Idaho, the Bureau of Land Management (BLM), and the Idaho Rangeland Resource Commission (IRRC). These organizations list the dissemination of information about rangelands and increased public awareness of rangelands as paramount in their organizational goals. The objective of the project was to capture the vastness and diversity of Idaho's five rangeland regions and to inform internet users about the value and importance of the state's most abundant natural resource.

NEED FOR THE WEBSITE

The idea for this project originated at an IRRC planning meeting in March 2004. Members of the Commission saw a need for some type of online informational tour of Idaho's rangelands. The internet was viewed as a growing source of information and venue for spreading knowledge about rangelands. Until this point, not much existed in the form of online and interactive information about the extent, values, and benefits of rangelands in the state. With the advancements made in internet technology over the years and with increased internet access by users nationwide, creating a website to exhibit and host the information seemed like the best avenue to pursue in order to meet our goals.

The primary need for a website of this nature rested solely on the belief that it was necessary and important to inform Idaho's citizens about the environment on which they live and depend. Idaho's predominant land type is rangeland making it the most abundant natural resource in the state (Hart, 1994). Nearly half (48%) of the state is grasslands, shrublands, woodlands, and deserts that are classified as rangeland (U.S. Geological Survey, 2003). The uses and values derived from rangelands are paramount to Idaho's economy, ecological health, natural beauty, and cultural heritage (Harp and Hyde, 1999). Despite this fact, a survey conducted by the IRRC in 2001 revealed some startling information about just how little the state's residents really know about the rangelands that surround them; 50% of the respondents admitted they were only "somewhat knowledgeable" about the state's rangelands and range issues (the same question in the 1997 survey yielded a 44% response) while 30% admitted they were "not very knowledgeable" about rangelands.

Nearly 69% of Idaho's rangeland is public land that is managed by government agencies such as the U.S. Forest Service (USFS) and the BLM (Sharp and Sanders, 1978). The management of these lands is heavily influenced by public opinion. This leads one to the next logical question: how can Idaho citizens make informed decisions about the management of rangelands in their state when they know very little about them?

One way is to create a tool that is widely accessible and facilitates learning about rangelands at multiple scales (i.e., local, national, global). Consequently, Idaho citizens will become more aware and informed about the decisions being made on their public lands

(Sharp and Sanders, 1978) and will develop a sense of place and connection with the environment surrounding them.

SCOPE AND ORGANIZATION OF THE WEBSITE

The "Virtual Tour of Idaho's Rangelands" website was developed as a DHTML (Dynamic HyperText Markup Language) book using the software program, Toolbook Instructor 2004 (www.sumtotalsystems.com), and was created to reach a limitless audience. The website was intended as both an informational and interactive tour of rangelands at the local, national, and global scales. The virtual tour focuses on five rangeland regions found in Idaho including the Pacific Bunchgrass, Coniferous Forest and Mountain Meadow, Juniper Woodland, Sagebrush Grassland, and Salt-Desert Shrubland.

Our internet site design was original and included original and adapted media. In addition, all of the photographs used in the website were my own and were all taken in Idaho between May 2004 and December 2005. Video of the five different range regions in Idaho was provided by Idaho Public Television (contact person was Jeff Tucker). The majority of the textual information about Idaho's five rangeland regions was obtained from the "Backpack Guide to Idaho Range Plants" (Hankins, 2002) and the "What is Range" website managed by the University of Idaho - Department of Rangeland Ecology and Management. Dr. Karen Launchbaugh was involved throughout the entire design and building phase with regards to content and layout.

The first page of the website is a title page which includes the name of the website, logos of the three organizations that sponsored the project (BLM, IRRC, and University of Idaho RLEM Department), and a navigation menu (Figure 1). The navigation menu lists the names of five hyperlinked pages that the user can jump to in any order. These pages are titled, "What is Rangeland?", "Values of the Range", "Who Manages Idaho Rangelands?", "Idaho Range Regions", and "Take A Virtual Tour!" At the top of the navigation menu is an "Exit" button that allows the user to quit the program at any time and return to the "What is Range" webpage located within the Rangelands West website (www.cnr.uidaho.edu/what-is-range/). A "Home" button also allows the user to navigate to the first page of the virtual tour website. In the upper right hand corner of each webpage are navigation arrows that direct the user either forwards or backwards.

Figure 1. Title page of the "Virtual Tour of Idaho's Rangelands" website.

When the user clicks on the first menu option, "What is Rangeland?," they are presented with three pages of information; the first page presents information regarding the definition of rangeland and the types of rangelands found in North America, the second page presents a map showing the different types of rangelands found in the world, and the third page presents a map and information regarding the types and amounts of rangelands found in Idaho (Figure 2).

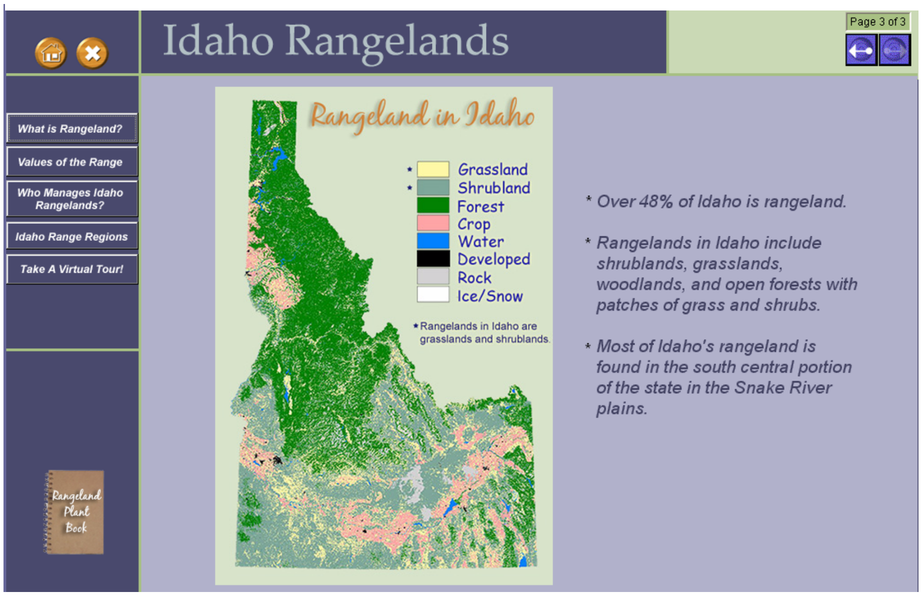

Figure 2. Third page of the "What is Rangeland?" section of the "Virtual Tour of Idaho's Rangelands" website.

The next menu option, "Values of the Range," introduces the user to the benefits and values that rangelands provide. Such benefits include grazing lands for livestock and wildlife, habitat for native plant species, sequestration of carbon to prevent global warming, and a source of high quality water and clean air (Figure 3). The user can click on each value to see a representative picture of that particular value. When the user clicks again, the picture disappears.

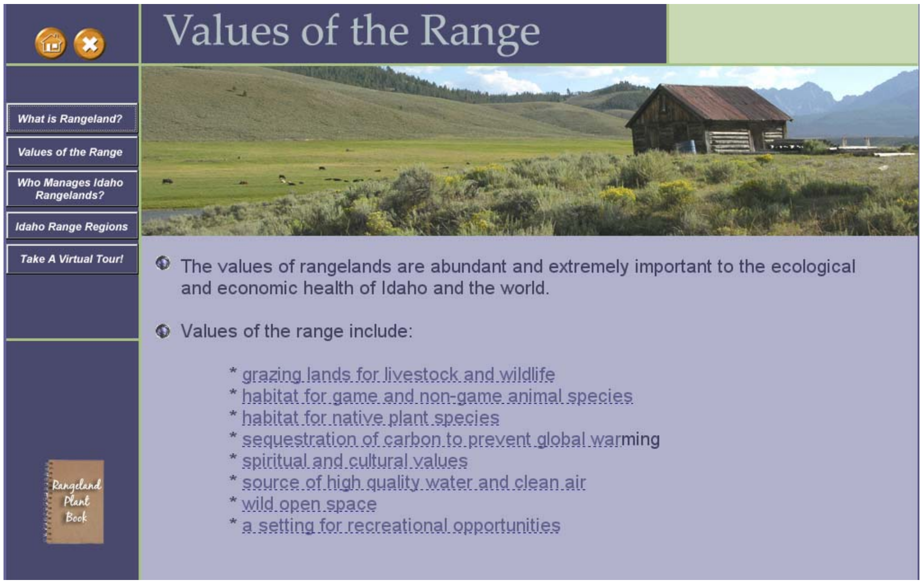

Figure 3. First page of the "Values of the Range?" section of the "Virtual Tour of Idaho's Rangelands" website.

"Who Manages Idaho Rangelands" is the next menu option which gives the user information about the organizations responsible for the management of Idaho's vast rangeland resources. This section is comprised of three pages; the first page discusses the different agencies and private entities involved in the management of Idaho's rangelands, the second page provides a pie chart which diagrams the percentage of total land area in Idaho that is managed by different agencies and private organizations, and the third page discusses the responsibilities of professional range managers and the role that the University of Idaho plays in providing tailored degree programs to meet the growing natural resource management needs of the state.

When clicking on the next menu option, "Idaho Range Regions," users are directed to an interactive map of Idaho's five rangeland regions (Figure 4).

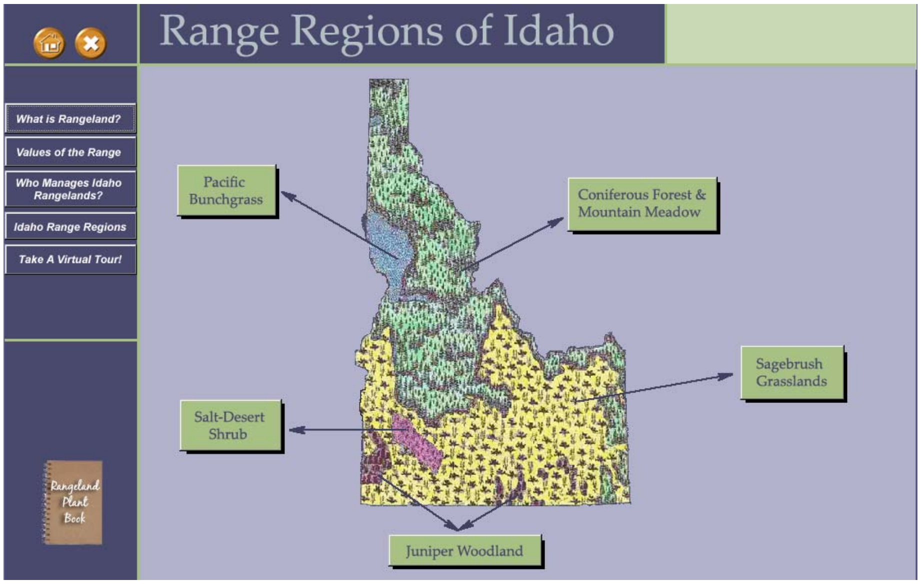

Figure 4. First page of the "Values of the Range?" section of the "Virtual Tour of Idaho's Rangelands" website.

The user can then click on each region to find out more information about that particular rangeland type. Information typically included in these pages concerns the history, geographical location, use, annual precipitation, and common plants and animals found in each of the regions (Figure 5).

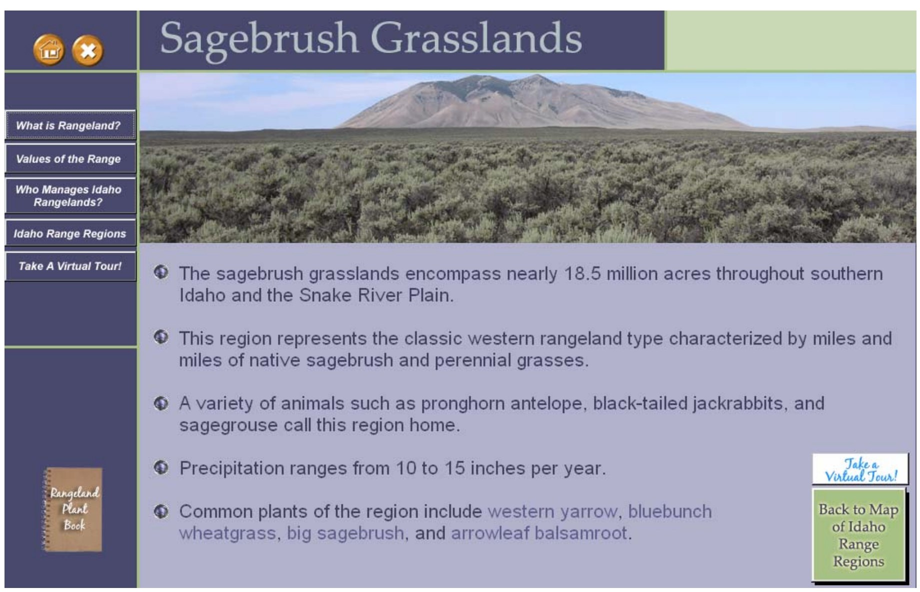

Figure 5. Information page for the Sagebrush Grasslands region of the "Idaho Range Regions" section of the "Virtual Tour of Idaho's Rangelands" website.

The last menu option, “Take a Virtual Tour!” allows the user to take an online tour of the region by way of video footage and digital photos. Clicking on this option brings the user to a page that lists each of the five regions (Figure 6). When the user clicks on any of the five regions, they are directed to a page that highlights the geographical area of Idaho where that particular region is found, presented with a media player where the user can view a 30-second video clip of the region by air, and are given the option to view a landscape and plant photo gallery of that particular region. Users are also given the choice to navigate back to the page that lists the five rangeland regions so they can take a virtual tour of the other regions as well.

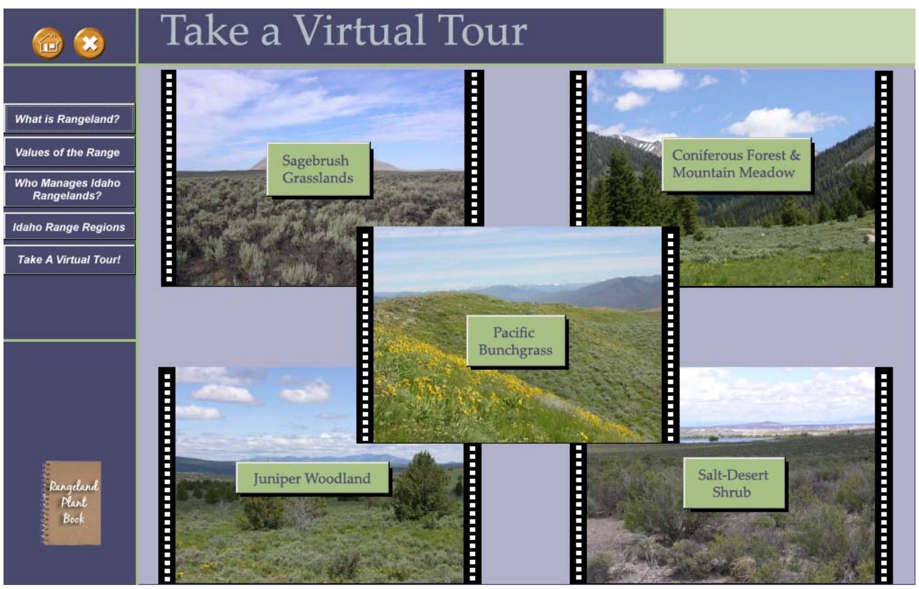

Figure 6. “Take a Virtual Tour” section of the “Virtual Tour of Idaho’s Rangelands” website.

Finally, users are provided a chance to explore some important plants found in Idaho’s rangelands by clicking on the “Rangeland Plant Book” icon located in the bottom left corner of each webpage. When this icon is clicked, a list of common plant names appears that is separated and alphabetized into three different columns; the first column lists some of the grasses and sedges found on rangelands, the second column lists some of the wildflowers, and the third column lists some of the woody plants found on rangelands (Figure 7). When the user clicks on each of the plant names, they are directed to a page that shows a picture of the plant and the common and scientific name of the plant. From this page, they can navigate back to the plant book or can use the different menu options on the far left to navigate to other pages in the website.

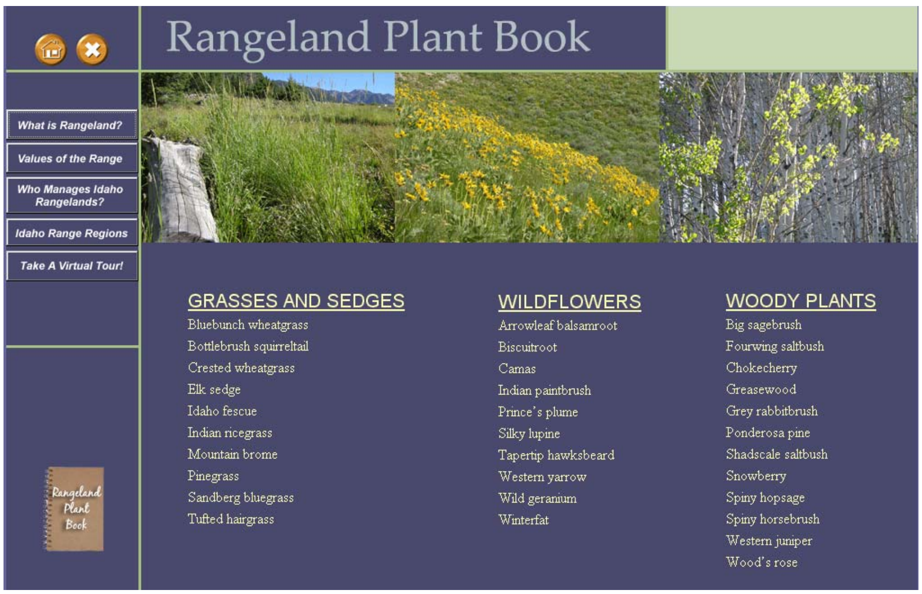

Figure 7. "Rangeland Plant Book" section of the "Virtual Tour of Idaho's Rangelands" website.

CURRENT AND FUTURE USES OF THE WEBSITE

The Virtual Tour of Idaho's Rangelands website was developed with some specific uses in mind. Perhaps the most important intended use was a source for valuable, accurate, and useful information regarding rangelands at the national and global scales, but most importantly at the local and state scales.

In addition, the extensive use of videos and photos of rangelands on the website could help attract different kinds of users as well as increase the interactivity of the website as a whole. If users are provided a variety of avenues to explore rangelands that are exciting and interactive, they hopefully will enjoy the learning process even more and will take something positive away from their online learning experience.

Another intended use of the website was to use technology to facilitate learning by all types of people. Traditionally, the range management discipline has been deeply rooted in field-based learning experiences. However, the use of the internet has grown rapidly in the last years and has become the first option for many people searching for information on a given topic. By putting information about rangelands on the internet, a broader and larger audience will undoubtedly be reached. Three organizations that will host the “Virtual Tour of Idaho’s Rangelands” site are: 1) Idaho Rangeland Resource Commission, 2) Department of Rangeland Ecology and Management at the University of Idaho, and 3) Rangelands West.

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CHAPTER 5: OVERALL CONCLUSIONS AND FINAL RECOMMENDATIONS

The success of both the field- and computer-based versions of the "Home on the Range" activity was certainly uplifting and encouraging from a range management perspective. It is a well-known fact that many rangeland concepts are difficult to grasp and understand for an adult, let alone for a 5th or 6th grader. When asked, most people have a fuzzy sense of what rangelands are, but many don't truly understand all of the benefits and values derived from various rangeland resources. I believe much of the success for both applications was due to the novelty and uniqueness of the subject matter. Despite the difficulty and complex nature of rangeland concepts, presenting the subject matter in an exciting and fun way could reach various audiences, both young and old, and ultimately increase knowledge about basic ideas such as values, benefits, and uses of rangelands.

With respect to children, the use of technology is like riding a bike; most don't know a world without computers or video games. Several children from the computer treatment group commented on the interactive nature of the computer activity and said they liked the fact that they were able to have fun learning and using the computer at the same time. Some students, however, suggested making the activity more like a video game with sound and animated characters. Students who participated in the field experience commented on the hands-on nature of the activity and how they liked learning new and exciting information outdoors. A week didn't go by, however, where at least one student didn't ask if they were going to get to use the computer, watch TV, or play a video game. I don't believe that field-based learning should ever be replaced by computer-based learning. In fact, most of the current research suggests that computer-assisted learning in combination with more traditional teaching approaches works the best. Results from this study provide evidence to support the fact that teachers can rely on computer-based approaches in teaching students about their surrounding environment, especially if facilitating learning in the outdoors is difficult due to budget and time limitations. Maintaining a high level of interactivity and novelty in the learning activities will be crucial to their success, however, especially if content material is difficult to understand.

Whatever the reason, it is apparent that both modalities of range education seemed to work and that a foundation has been set for further exploration into the use of computer technologies for rangeland education. While this research study sought to examine the potential applications of computer-based education as it compared to more traditional field-based learning experiences, it did so without considering some fundamental design issues that might have added more power or conclusive evidence for the benefit of computer-assisted instruction in range education. For example, design limitations lead to the grade and classroom variables being confounded because only 1 grade level was selected from each classroom for inclusion in the study. Also, the inability to randomly select students, classrooms, and treatment groups for this research study hinders certain generalizations that can be made to other populations or content areas.

Another fact worth considering was the immeasurable amount of time it took to design and create the computer learning module. While the end product was of high quality and value, the amount of time needed to build the software program far outweighed the amount of time it actually took to participate in the program. It is estimated that 100 hours of software development work equates to 1 hour of instructional time for the end user. However, once a solid template has been designed that works well for the subject matter and intended audience, the creation of new modules becomes much easier to handle. In addition, the product then becomes much more versatile and far-reaching because programs can be placed on CD-ROMs or downloaded via the World Wide Web.

With the limitations of this study recognized, I feel that a great effort was made in using a multilevel modeling approach to answer the global research question. This method of data analysis is truly powerful as it enables the researcher to simultaneously partition the variance at different levels (i.e., students and classrooms) of the data to obtain a more accurate picture of the patterns and relationships emerging from the numbers. While the most basic application of multilevel modeling was used, it nonetheless provided a powerful sense of the true effectiveness of field- and computer-based rangeland education. The analysis also was helpful in teasing out differences between the confounding grade and classroom variables.

The future of the range management discipline is an exciting one that holds an incredible potential for incorporating new, innovative techniques to inform children and adults about rangelands. While further research is still needed in the field of rangeland education, compelling evidence now exists to support the effective use of computer-assisted instruction in teaching various rangeland concepts.

An important avenue meriting future research is the effect that computer-assisted range education, in combination with field-based learning, has on student knowledge gain. A combination of modalities could enhance learning by targeting different learning styles and by including more interactive and innovative techniques to capture student excitement and participation.

I believe that testing the same population of students again to see how much rangeland knowledge they retained would be both beneficial and interesting. This would provide even more insight into the comparison of field- and computer-based rangeland education by examining the effects of each on a more long-term basis. Perhaps the computer treatment worked only as well as it did in the short-term because of the novelty of the technology and the learning module. Maybe students who went to MOSS and engaged in the field learning activity exhibited short-term knowledge gain because they were away from the traditional school setting and were learning in the outdoors. While the evidence is strong to suggest that both the computer- and field-versions of the "Home on the Range" activity improved student knowledge by a significant amount, there is no evidence to suggest that students will retain this knowledge over a period of weeks, months, or even years.

It would also be beneficial to assess students' attitudes towards rangelands to determine whether they changed before and after both field- and computer-based learning experiences. I suspect that most children in the 5^{th} or 6^{th} grade haven't formed attitudes towards rangelands yet, especially if they don't exactly know what they are, but it would be valuable to assess their attitudes after a learning treatment and document how they might change over time.

Investigating the effects of different designs of computer-based modules is also very important because different designs could produce different results. We were somewhat limited in how we could design the computer-based version of the "Home on the Range" activity because we had to closely parallel it to the field-based version of the activity and we were certainly limited in how much time we could go into each school to use their computer labs. In addition, it would be interesting to see how these different designs might affect students' critical thinking skills and their ability to synthesize information, rather than just memorization of facts to increase their conceptual knowledge in a particular area. Along these lines, it might be important to examine the use of alternative dependent variables, other than %PI, to see if they might better capture knowledge gain, critical thinking skills, and information synthesis.

Finally, future research is needed to discern additional student-level characteristics that effectively contribute to enhanced learning through field- and computer-based education. Our results indicated that a huge amount of within-class variation existed, but we didn't have any additional student-level data to explain this phenomenon or account for the individual student differences. The relationship between student achievement and differing learning modalities is a complex one that is intricately tied to various social, demographic, and political underpinnings beyond the scope of this project. However, future research could focus on these areas to gain a better understanding of individual characteristics and backgrounds that might affect the varying successes of learning activities.

APPENDIX A: HUMAN ASSURANCES COMMITTEE ACCEPTANCE LETTER

Federalwide Assurance: FWA00005639
Federal Assigned IRB #: 00000843
UI Assigned Number: 05-037

University of Idaho
WWAMI Medical Education Program
P.O. Box 444207
Moscow, Idaho 83844-4207
208-885-6696
www.webs.uidaho.edu/wwami

MEMORANDUM

TO: Jennifer Peterson, CNR - 1135

FROM: Michael B. Laskowski, Chair
Human Assurances Committee

DATE: April 28, 2005

SUBJECT: Approval of "The effectiveness of computer-assisted rangeland education for Idaho 5th and 6th graders."

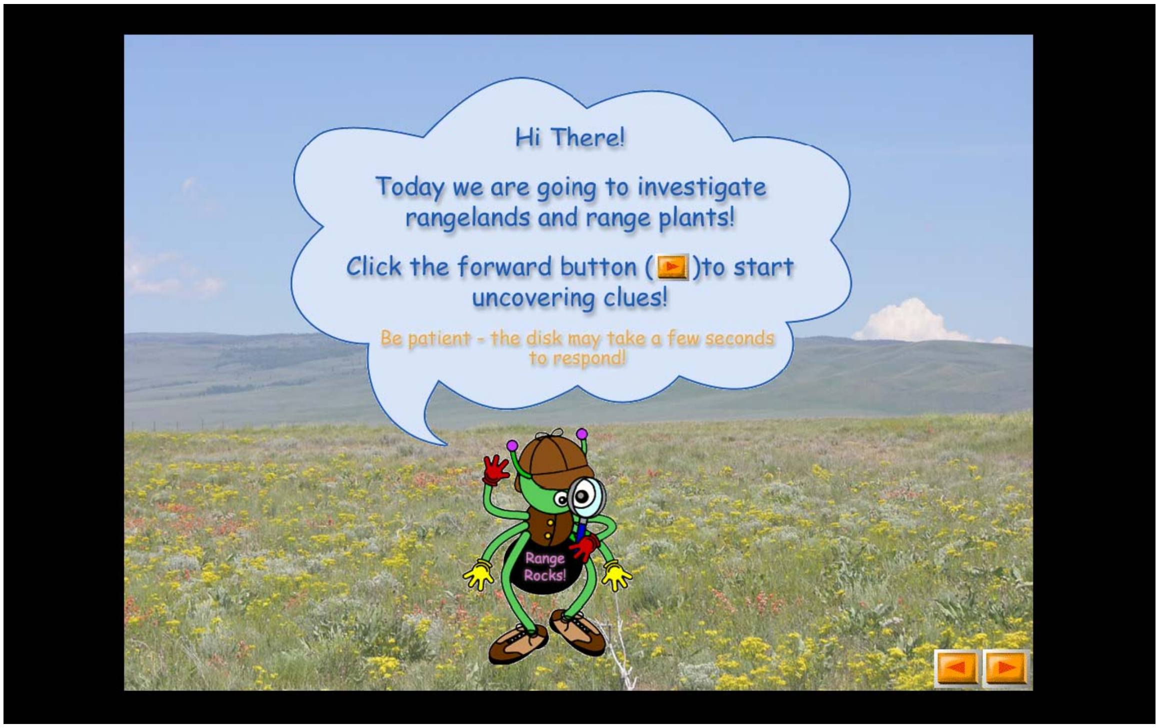
On behalf of the Human Assurances Committee at the University of Idaho, I am pleased to inform you that the above-named proposal is approved as offering no significant risk to human subjects. This approval is valid for **one year** from the date of this memo. Should there be a significant change in your proposal, it will be necessary for you to resubmit it for review. Thank you for submitting your proposal to the Human Assurances Committee.

Michael Laskowski

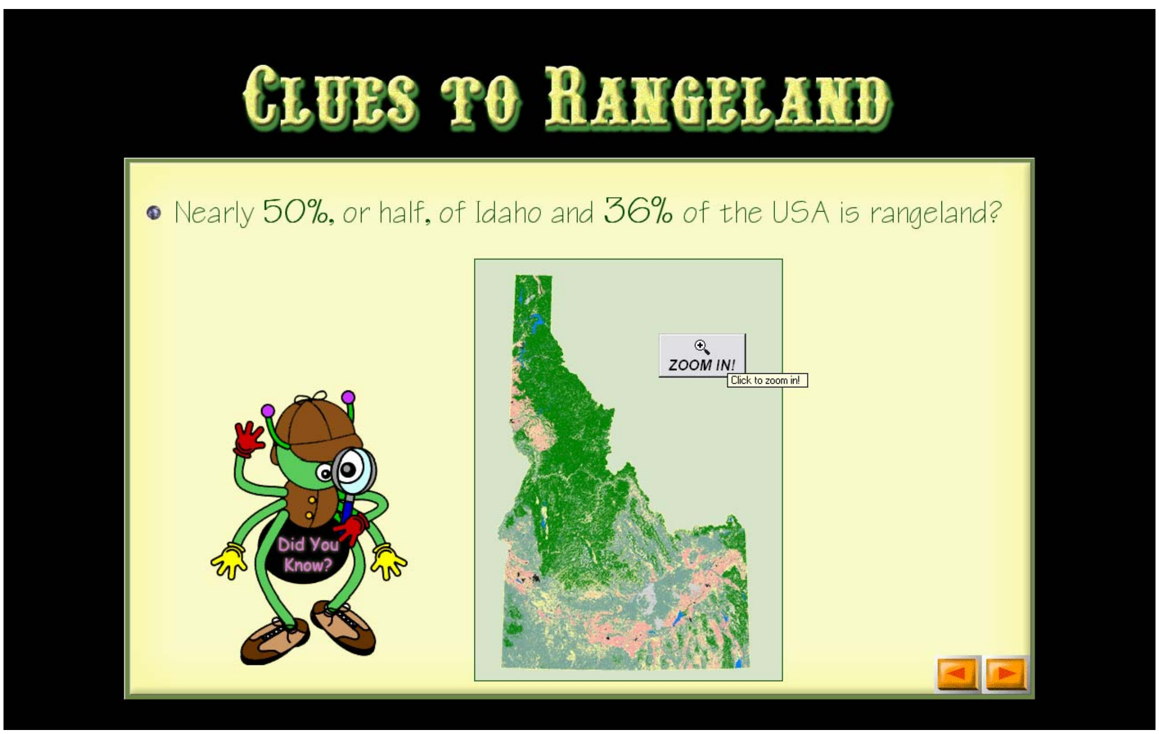
Michael Laskowski

MBL/ca

APPENDIX B: "HOME ON THE RANGE" COMPUTER ACTIVITY

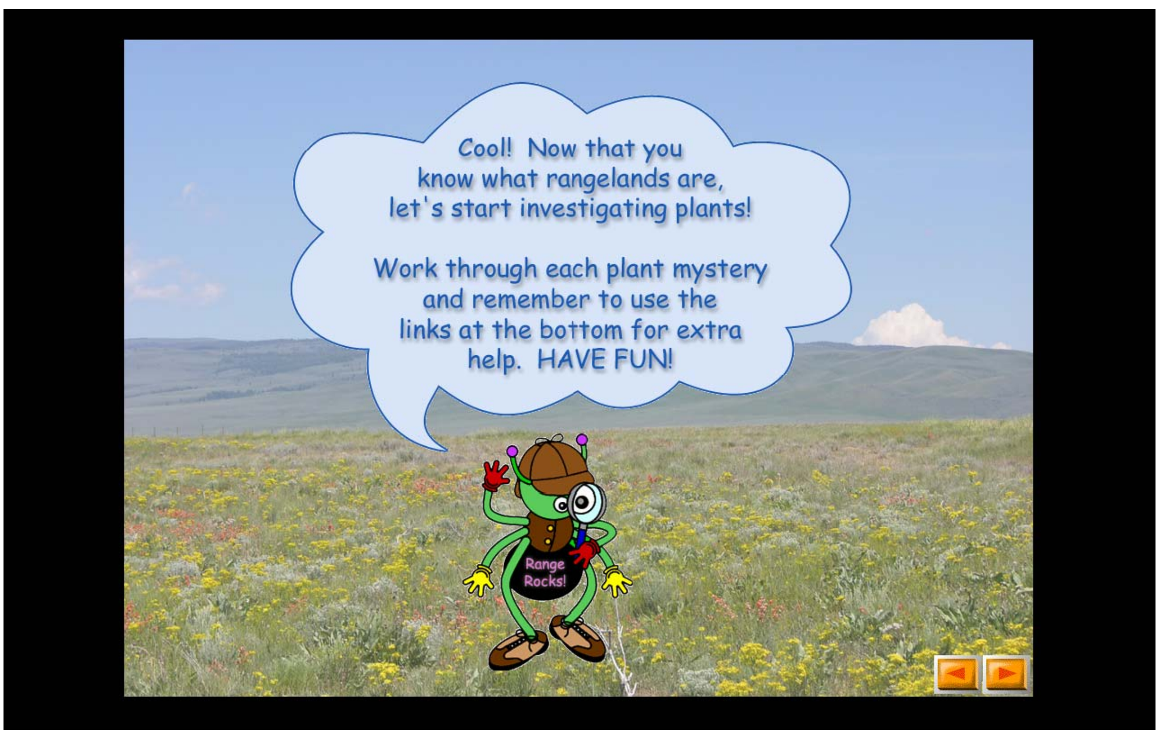


Clues to Rangeland
Rangelands are a type of land where grasses, forbs and shrubs grow. Some types of rangeland are:
prairies
plains
savannas
deserts
shrublands
grasslands
A prairie is an area that is dominated by grasses and wildflowers.



Clues to Rangeland
Nearly 50%, or half, of Idaho and 36% of the USA is rangeland?
ZOOM IN!
Click to zoom in!
Did You Know?

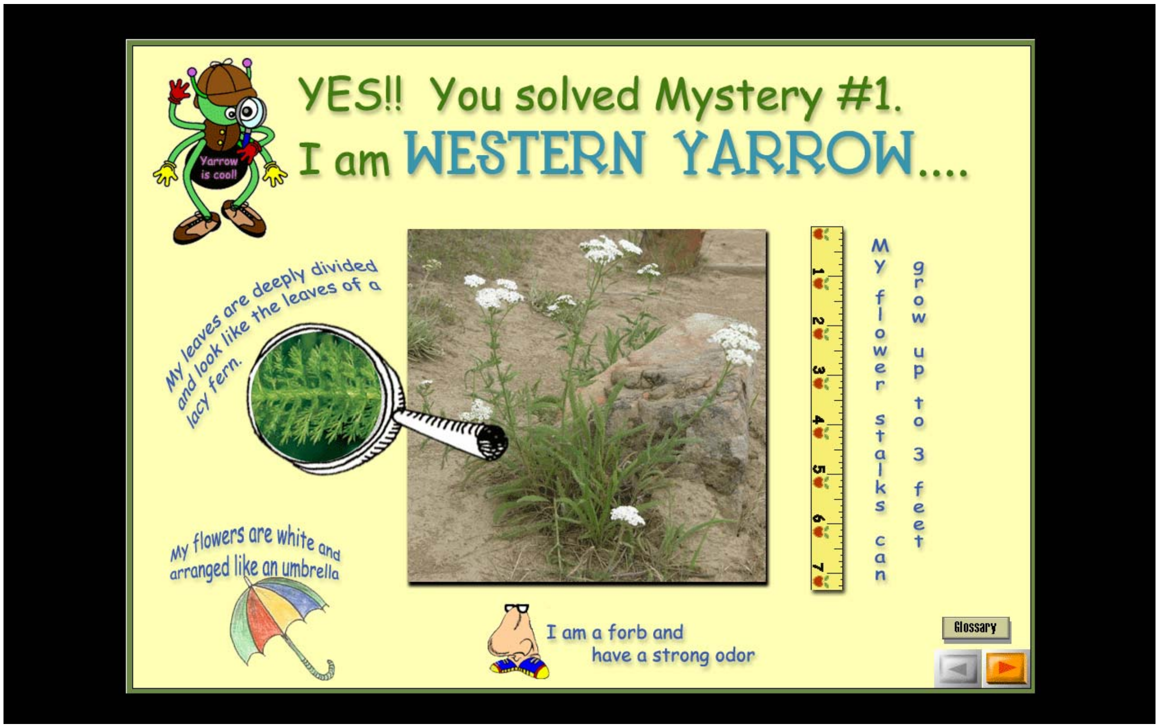

CLUES TO RANGELAND
Rangelands are unique because they provide:
habitat for wildlife
forage for livestock
water
mineral resources
open space
wildland recreation
wood products
natural beauty
Rangelands provide habitat (cover and food) for all sorts of wildlife like pronghorn, elk, deer, rabbits, grouse and more!


Cool! Now that you know what rangelands are, let's start investigating plants!
Work through each plant mystery and remember to use the links at the bottom for extra help. HAVE FUN!
Range Rocks!


MYSTERY PLANT #1
~ Look through all of the pictures before answering the question.
~ Use the glossary link for extra clues!
Glossary
1. What kind of plant am I ?
(Click the right answer below to move on!)
Grass
Forb
Shrub
Tree
ZOOM IN!
Whole Plant 1
Whole Plant 2
Flower
Flower Closeup
Leaf
Leaf Closeup


MYSTERY PLANT #1
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
2. Would you describe my leaves as needle-like?
Yes
No
ZOOM IN!
Whole Plant 1
Whole Plant 2
Flower
Flower Closeup
Leaf
Leaf Closeup


MYSTERY PLANT #1
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
3. Are my leaves entire or deeply divided?
Entire
Divided
* Remember the glossary has more clues! *
ZOOM IN!
Whole Plant 1
Whole Plant 2
Flower
Flower Closeup
Leaf
Leaf Closeup


YES!! You solved Mystery #1.
I am WESTERN YARROW....
Yarrow is cool!
My leaves are deeply divided and look like the leaves of a lacy fern.
My flowers are white and arranged like an umbrella
My flower stalks can grow up to 3 feet
I am a forb and have a strong odor
Glossary

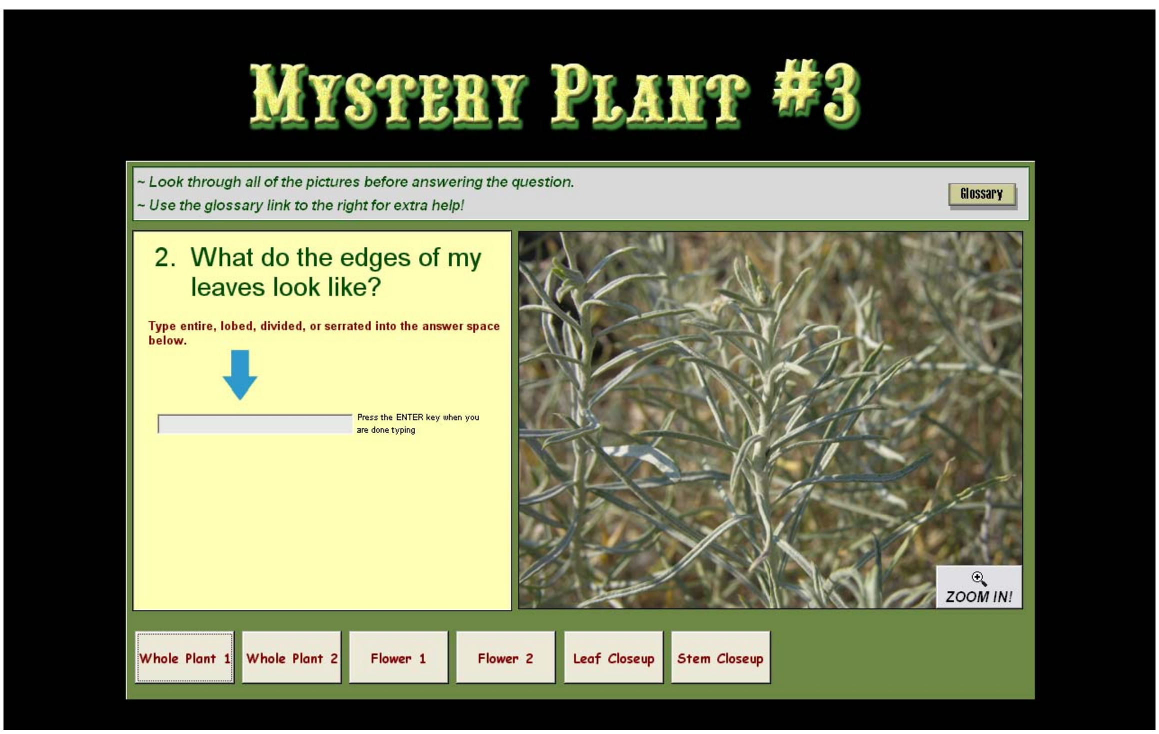

Mystery Plant #2
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
1. What kind of plant am I?
Grass
Forb
DRAG the correct answer box into the BULL'S-EYE
Shrub
Tree
ZOOM IN!
Landscape 1
Landscape 2
Whole Plant 1
Whole Plant 2
Leaf Closeup
Stem Closeup


Mystery Plant #2
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
2. Do I have woody growth?
Yes
No
DRAG the correct answer box into the BULL'S-EYE
ZOOM IN!
Landscape 1
Landscape 2
Whole Plant 1
Whole Plant 2
Leaf Closeup
Stem Closeup

MYSTERY PLANT #2
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
3. What do my leaves look like?
Entire
Lobed
DRAG the correct answer box into the BULL'S-EYE
Divided
Serrated
ZOOM IN!
Landscape 1
Landscape 2
Whole Plant 1
Whole Plant 2
Leaf Closeup
Stem Closeup

YES!! You solved Mystery #2 !!!!
I am Big SageBRUSH....
Sage is SWEET!
My older stems are covered with grey-brown bark that shreds into long strips.
My leaves are long and narrow, triangle shaped, and have three lobes, or rounded points, at the end of each leaf.
I am one of the most important plants in southern Idaho rangeland!
My flowers are not very noticeable and bloom in the fall
Glossary


MYSTERY PLANT #3
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
1. What kind of plant am I?
Type grass, forb, shrub, or tree into the answer space below.
Press the ENTER key when you are done typing
ZOOM IN!
Whole Plant 1
Whole Plant 2
Flower 1
Flower 2
Leaf Closeup
Stem Closeup


MYSTERY PLANT #3
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
2. What do the edges of my leaves look like?
Type entire, lobed, divided, or serrated into the answer space below.
Press the ENTER key when you are done typing
ZOOM IN!
Whole Plant 1
Whole Plant 2
Flower 1
Flower 2
Leaf Closeup
Stem Closeup


MYSTERY PLANT #3
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
3. Am I an annual or a perennial plant?
Type annual or perennial into the answer space below.
Press the ENTER key when you are done typing
* Remember the glossary has more clues! *
ZOOM IN!
Whole Plant 1
Whole Plant 2
Flower 1
Flower 2
Leaf Closeup
Stem Closeup


YES!! You solved Mystery #3 !!!!
I am GREY RABBITBRUSH....
RABBIT brush??
My leaves are long, narrow, and entire.
My flowers are bright yellow and bloom in late summer.
My seeds are fluffy and blow away in late fall.
My branches are yellowish-green and very fuzzy!
I have a very strong odor which many people find unpleasant.
Glossary


Mystery Plant #4
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
1. I have woody growth.
(Click the right answer below to move on!)
True
False
ZOOM IN!
Whole Plant 1
Whole Plant 2
Whole Plant 3
Plant Base
Leaf Closeup
Flower Closeup


Mystery Plant #4
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
2. My leaves are entire and tightly curled.
True
False
ZOOM IN!
Whole Plant 1
Whole Plant 2
Whole Plant 3
Plant Base
Leaf Closeup
Flower Closeup

MYSTERY PLANT #4
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
3. I am a bunchgrass.
True
False
* Remember the glossary has more clues! *
ZOOM IN!
Whole Plant 1
Whole Plant 2
Whole Plant 3
Plant Base
Leaf Closeup
Flower Closeup

YES!! You solved Mystery #4 !!!!
I am IDAHO FESCUE....
Fescue is FINE!
My leaf blades are tightly rolled and grow mostly from the soil surface, not from the stem
There are small nodes on my stem which look like little knots.
My flowers and seeds form a panicle!
I am an important bunchgrass found throughout Idaho rangelands!
Glossary


MYSTERY PLANT #5
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
1. What kind of plant am I?
(Click on the right answer box below!)
Grass
Forb
Shrub
Tree
None of the Above
ZOOM IN!
Whole Plant
Stem
Leaf
Leaf Closeup
Flower
Flower Closeup


MYSTERY PLANT #5
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
2. What do the edges of my leaves look like?
(Click on the right answer box below!)
Entire
Divided
Lobed
Serrated
ZOOM IN!
Whole Plant
Stem
Leaf
Leaf Closeup
Flower
Flower Closeup


MYSTERY PLANT #5
~ Look through all of the pictures before answering the question.
~ Use the glossary link to the right for extra help!
Glossary
3. What type of flower structure do I have?
(Click on the right answer box below!)
Spike
Raceme
Panicle
Umbel
* Remember the glossary has more clues! *
ZOOM IN!
Whole Plant
Stem
Leaf
Leaf Closeup
Flower
Flower Closeup

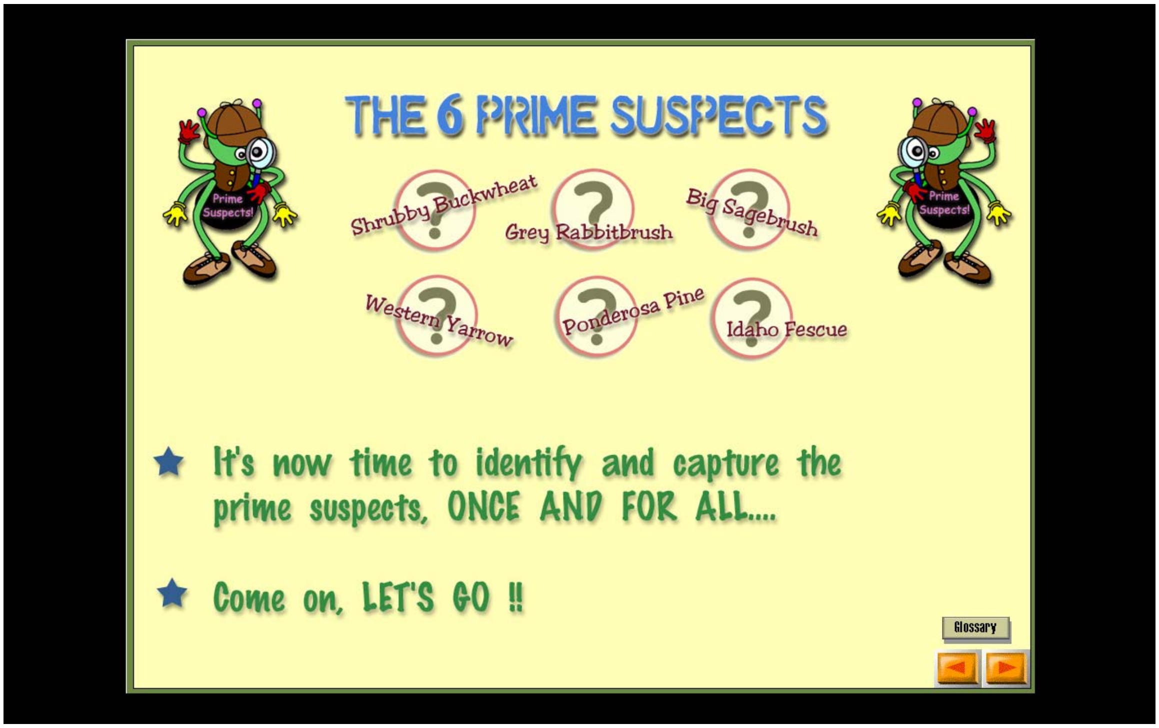

YES!! You solved Mystery #5 !!!!
I am SHRUBBY BUCKWHEAT....
Do I look shrubby?
I have silky, leathery, small, gray-green leaves.
In the fall, I produce brown, dry seedheads.
I am a half-shrub which means I have woody stems near the ground and non-woody stems above the ground surface.
1
My flowers grow to about a foot tall and bloom in the middle of summer!
Glossary


MYSTERY PLANT #6
~ Look through all of the pictures before answering the question.
~ Use the glossary link for extra clues!
Glossary
1. What kind of plant am I ?
(Click the right answer below to move on!)
Grass
Forb
Shrub
Tree
ZOOM IN!
Whole Plant 1
Whole Plant 2
Leaves
Leaf Closeup
Stem
Stem Closeup


MYSTERY PLANT #6
~ Look through all of the pictures before answering the question.
~ Use the glossary link for extra clues!
Glossary
2. Would you describe my leaves as needle-like?
Yes
No
ZOOM IN!
Whole Plant 1
Whole Plant 2
Leaves
Leaf Closeup
Stem
Stem Closeup


MYSTERY PLANT #6
~ Look through all of the pictures before answering the question.
~ Use the glossary link for extra clues!
Glossary
3. Are my leaves entire or deeply divided?
Entire
Divided
* Remember the glossary has more clues! *
ZOOM IN!
Whole Plant 1
Whole Plant 2
Leaves
Leaf Closeup
Stem
Stem Closeup


YES!! You solved Mystery #6 !!!!
I am PONDEROSA PINE....
PONDO Pine!
I have long, slender needles usually in bundles of three.
I have orange-brown bark that looks like puzzle pieces when fully grown.
When I am big, my bark smells like vanilla!
I am a tree which means I have a woody stem and can grow up to 200 feet!
Glossary


THE 6 PRIME SUSPECTS
Prime Suspects!
Shrubby Buckwheat
Grey Rabbitbrush
Big Sagebrush
Western Yarrow
Ponderosa Pine
Idaho Fescue
It's now time to identify and capture the prime suspects, ONCE AND FOR ALL....
Come on, LET'S GO !!
Glossary


PRIME SUSPECT #1
VISUAL CLUES
Click on each picture to see a larger view!
Glossary
- I am a shrub
- My leaves are lobed
- My bark peels when it gets old
- I am one of the most important plants in southern Idaho rangelands.
WHAT IS MY NAME?
Big Sagebrush
Drag the suspect's name into the box above!
Western Yarrow
Shrubby Buckwheat
Grey Rabbitbrush
Idaho Fescue
Ponderosa Pine


PRIME SUSPECT #2
VISUAL CLUES
- My flowers and seeds form a panicle
- I am an important bunchgrass in Idaho rangelands
- My leaf blades are narrow, tightly rolled, and grow in a thick bunch from the soil surface
- There are small nodes on my stem which look like knots
WHAT IS MY NAME?
Drag the suspect's name into the box above!
Click on each picture to see a larger view!
Glossary
Western Yarrow
Shrubby Buckwheat
Grey Rabbitbrush
Idaho Fescue
Big Sagebrush
Ponderosa Pine


PRIME SUSPECT #3
VISUAL CLUES
- My leaves are deeply divided and look like the leaves of a lacy fern
- I am a forb and have a strong odor
- My flower stalks can grow up to 3 feet tall
- My flowers are white and arranged like an umbrella
WHAT IS MY NAME?
Drag the suspect's name into the box above!
Click on each picture to see a larger view!
Glossary
Western Yarrow
Shrubby Buckwheat
Grey Rabbitbrush
Idaho Fescue
Big Sagebrush
Ponderosa Pine


Prime Suspect #4
VISUAL CLUES
- I have long slender needles usually in bundles of three
- I am a tree which means I have a woody stem and can grow up to 200 feet
- My bark looks like puzzle pieces and smells like vanilla
What is my name?
Drag the suspect's name into the box above!
Click on each picture to see a larger view!
Glossary
Western Yarrow
Shrubby Buckwheat
Grey Rabbitbrush
Idaho Fescue
Big Sagebrush
Ponderosa Pine


Prime Suspect #5
VISUAL CLUES
- My leaves are long, narrow and entire
- My flowers are bright yellow and bloom in late summer
- My branches are yellowish-green and very fuzzy
- My seeds are fluffy and blow away in late fall
What is my name?
Drag the suspect's name into the box above!
Click on each picture to see a larger view!
Glossary
Western Yarrow
Shrubby Buckwheat
Grey Rabbitbrush
Idaho Fescue
Big Sagebrush
Ponderosa Pine


Prime Suspect #6
VISUAL CLUES
Click on each picture to see a larger view!
Glossary
- I have silky, leathery, small, grey-green leaves
- My flowers grow to about 1 foot tall and bloom in summer
- In the fall, I produce brown, dry seedheads
- I am a half-shrub which means I produce both woody and annual growth
What is my name?
Drag the suspect's name into the box above!
Western Yarrow
Shrubby Buckwheat
Grey Rabbitbrush
Idaho Fescue
Big Sagebrush
Ponderosa Pine


YEAH BABY!
CONGRATULATIONS !
You have solved all of the plant mysteries!
YEAH BABY!
I hope you have enjoyed investigating rangelands and range plants.
Please click the EXIT button at the bottom of your screen!
Or click here to find out more about this project!
EXIT


This project was made possible by:
Rangeland Ecology and Management at the University of Idaho
Berklund Graduate Research Fellowship at the University of Idaho
Idaho Rangeland Resource Commission
Created by Jennifer Peterson... Click for Author and Credits Information
Berklund Research Assistantship
University of Idaho Rangeland Ecology & Management
Click to Exit

APPENDIX C: SCHOOL NAMES AND NUMBER OF STUDENTS INCLUDED IN STUDY

	Number of	Gender		Grade	
FIELD TREATMENT SCHOOLS	**Students**	**M**	**F**	**5th**	**6th**
Prairie Middle	28	16	12		28
McDonald Elementary	63	32	31		63
Lena Whitmore Elementary	41	22	19		41
Clearwater Valley Elementary	32	19	13	32	
Total	**164**	**89**	**75**	**32**	**132**
COMPUTER TREATMENT SCHOOLS					
Prairie Middle	41	20	21	41	
Camelot Elementary	73	39	34		73
Grangeville Elementary	55	29	26		55
Russell Elementary	33	19	14	33	
Total	**202**	**107**	**95**	**74**	**128**
CONTROL SCHOOLS					
Webster Elementary	23	13	10	23	
Riggins Elementary	21	12	9	13	8
Orofino Elementary	78	45	33		78
Lena Whitmore Elementary	24	12	12	24	
Total	**146**	**82**	**64**	**60**	**86**

APPENDIX D: PRE-TEST

Please answer each question as best as you can. YOU ARE **NOT** BEING GRADED ON THIS SO RELAX AND HAVE FUN!

Today's Date: ____________ ______, 2005
(Month) (Day)

School Name: ______________________________

Grade: ____
(Fifth or Sixth)

Gender: ______________ **Age:** ____________
(Male or Female)

Date of Birth: ____________ ______, __________
(Month) (Day) (Year)

City of Birth: ________________________________

1. About how much of the land in the United States is rangeland?
    a. 15%
    b. 36%
    c. 55%
    d. 75%
    e. I Don’t Know

2. What is a hypothesis?
    a. A scientific question about a subject
    b. A tested answer to a question
    c. A scientific experiment
    d. An educated guess
    e. I Don’t Know

3. Which of the following are considered types of rangeland?
    a. Deserts
    b. Forests
    c. Prairies
    d. Both A and C
    e. I Don’t Know

4. Rangelands provide _______________.
    a. Habitat for wildlife
    b. Forage for livestock
    c. Wildland recreation
    d. All of the above
    e. I Don’t Know

5. The Mountain Bluebird is the state bird of Idaho.
    a. True
    b. False
    c. I Don’t Know

6. A forb is a plant that has woody branches and can grow up to 60 feet tall.
    a. True
    b. False
    c. I Don’t Know

7. About how much land in Idaho is rangeland?
    a. 21%
    b. 34%
    c. 48%
    d. 57%
    e. I Don’t Know

8. Idaho fescue is a bunchgrass.
    a. True
    b. False
    c. I Don't Know

9. Idaho is known as the _____ state.
    a. Gem
    b. Constitution
    c. Friendly
    d. Potato
    e. I Don't Know

10. __________ has fern-like leaves and white flowers.
    a. Grey rabbitbrush
    b. Big sagebrush
    c. Western yarrow
    d. Shrubby buckwheat
    e. I Don't Know

11. Shrubby buckwheat is considered a "half-shrub".
    a. True
    b. False
    c. I Don't Know

12. Which of the following is a hypothesis?
    a. Why are plants found on rangeland?
    b. Plants grow on rangelands because there is soil and water.
    c. There are more trees in a forest than there are in a grassland.
    d. Both A and C.
    e. I Don't Know

13. This type of plant has a hollow stem.
    a. Grass
    b. Forb
    c. Shrub
    d. Tree
    e. I Don't Know

14. What is the largest bird on Earth?
    a. Parrot
    b. Ostrich
    c. Eagle
    d. Parakeet
    e. I Don't Know

15. ____________ has long, narrow leaves and is a shrub.
    a. Idaho fescue
    b. Big sagebrush
    c. Grey rabbitbrush
    d. Western yarrow
    e. I Don’t Know

16. Which of these is a dominant woody plant found in southern Idaho rangeland?
    a. Idaho fescue
    b. Big sagebrush
    c. Shrubby buckwheat
    d. Western yarrow
    e. I Don’t Know

17. What is the hardest mineral in the world?
    a. Granite
    b. Gold
    c. Iron
    d. Diamond
    e. I Don’t Know

18. The leaves of this plant are triangular and have 3 lobes.
    a. Idaho fescue
    b. Big sagebrush
    c. Grey rabbitbrush
    d. Western yarrow
    e. I Don’t Know

19. The largest city in Idaho is _________.
    a. Pocatello
    b. Lewiston
    c. Boise
    d. Moscow
    e. I Don’t Know

20. A ________ is a woody plant that does not have a single trunk.
    a. Grass
    b. Forb
    c. Shrub
    d. Savannah
    e. I Don’t Know

APPENDIX E: POST-TEST ADDITION FOR FIELD TREATMENT GROUP

Please circle the response that best answers each question.

	In the past year, how often have you:			
Gone hiking in a natural place like a forest or grassland outside of town?	0 times (never)	1 to 2 times	3 to 9 times	10 times or more
Gone camping outside of town?	0 times (never)	1 to 2 times	3 to 9 times	10 times or more
Looked at plants in nature and tried to identify them?	0 times (never)	1 to 2 times	3 to 9 times	10 times or more
Gone hunting or watched wildlife in a natural place like a forest or grassland?	0 times (never)	1 to 2 times	3 to 9 times	10 times or more

APPENDIX F: POST-TEST ADDITION FOR COMPUTER TREATMENT GROUP

Please answer these questions to help us improve this computer activity:

1. On a <u>typical day</u>, how much time do you spend using a computer:

In School?	**At Home?**
○ None	○ None
○ 15 minutes or less	○ 15 minutes or less
○ 15 to 60 minutes	○ 15 to 60 minutes
○ An hour or two	○ An hour or two
○ Over two hours	○ Over two hours

2. Did you use the glossary during the computer activity?

○ Always ○ Most of the time ○ About half of the time ○ A few times ○ Never

3. Did you read the comment boxes that popped up after each question?

○ Always ○ Most of the time ○ About half of the time ○ A few times ○ Never

4. Did you click on the pictures and look at them to answer the questions?

○ Always ○ Most of the time ○ About half of the time ○ A few times ○ Never

5. What did you like or not like about the computer activity?