MOUNT JEFFERSON STATE NATURAL AREA FIELDTRIP ACTIVITY GUIDE

Thomas D. Randolph

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This is to certify that the following professors have examined this project by Thomas D. Randolph in final form for submission as partial requirements for a Master of Science in Environmental Education from Montreat College.

Dorothea K. Shuman, Ph.D.
Professor of Outdoor and Environmental Education
Committee Chairperson

Dorothea K. Shuman, Ph.D.
August 22, 2013

Richard Bradley Daniel, Ph.D.
Professor of Environmental Studies, Outdoor and Environmental Education
Committee Member

Brad Daniel, Ph.D
August 22, 2013

Montreat College Final Approval and Acceptance:
Marshall Flowers, Ph.D.
Senior Vice President and Provost

Marshall E. Flowers Jr., Ph.D.
August 22, 2013

ABSTRACT

Students, who have participated on fieldtrips at Mt. Jefferson State Natural Area (SNA) in Ashe County, North Carolina (NC), have learned about science and local Appalachian environments through direct outdoor experiences. However, legislative mandates requiring strict adherence to state curriculum standards, urge teachers to justify taking students outdoors during school hours. Fieldtrip requests must include well-defined correlations between proposed outdoor activities and the state-mandated curriculum. During 2012- 2013 school year NC's public schools implemented a new state-mandated curriculum. This change created a need for the development of a new Mt. Jefferson SNA fieldtrip activity guide that addressed current academic standards, required for outdoor educational activities during school hours. This project was developed to correlate NC educational objectives to some of the educational themes listed in *Mt. Jefferson SNA Environmental Education Plan.* The activities in the guide were developed by using the principles and best practices that were identified in the scientific literature. The purpose of this project was to develop a curriculum guide that promotes responsible stewardship and enjoyable outdoor learning experiences that are correlated to the new state curriculum standards and the Mt. Jefferson SNA Environmental Education Plan

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CHAPTER 1.

INTRODUCTION

Mount Jefferson State Natural Area (SNA) located is within Ashe County, North Carolina (NC) and stands 4,683-feet above sea level. This rural SNA recognized as a Southern Appalachian National Natural Landmark, is known for its scenic vistas, metamorphic geology, and rich productive soils that promote highly diverse plant communities (Poindexter & Zack, 2008). Additionally, the SNA has a strong environmental education rapport with local public schools and offers a variety of curriculum-based environmental education activities that are conducted on-site and off-site at area schools (*Interpretive and Education Plan*, 2010).

This paper will describe the development of a new activity guide for Mount Jefferson SNA. The literature review (Chapter 2) will discuss the research and case studies that informed the overall development of the guide. In the methods section (Chapter 3), the activity topic selection process will be explained. This will include a review of relevant state documents that helped to identify curriculum standards and SNA objectives. The methods section will further describe the educational theory that was used to develop each topic into an original experiential activity. The methods section will include a discussion of the role that teacher and school administrator feedback had concerning the activity guide's academic relevance and curriculum correlation. The final section is an attached document that presents the SNA Fieldtrip Activity Guide.

Need for the Guide

This master's project identified a need for the new Mt. Jefferson Fieldtrip Activity Guide based on the following criteria: an outdated existing curriculum, new educational standards, and teacher requests for new program topics. Since 1999 Mt. Jefferson SNA's environmental education programs have been based on a SNA environmental education curriculum known as the *Environmental Education Learning Experience* (EELE). Written in 1999, the EELE's activities focus exclusively on geology, especially the park's metamorphic geology (*Metamorphic Mountain*, 1999). The EELE has been an outstanding curriculum-based activity guide for more than a decade. However, the SNA is expanding its environmental education programming opportunities in order to provide students and teachers with greater access to the SNA's natural and educational resources. Fieldtrip requests from local teachers for new environmental education activities related to landforms, earth materials, plants, and soil had not been address in the EELE. These teacher requests have identified educational gaps and missed opportunities for the SNA's environmental education programming potential. Teachers making these requests are also dealing with implementing new curriculum standards and developing new lesson plans.

In the 2012-2013 school year, new NC Curriculum Standards were implemented in all NC public schools (NC State Board Of Education, 2012). Correlation discontinuities between the SNA's existing EELE curriculum and the state curriculum objectives became apparent. Essentially, Mt. Jefferson SNA no longer had an environmental education activity guide that addressed the state's curriculum standards. The new standards created an environmental education correlation gap and solidified the need for a new Mt. Jefferson SNA Fieldtrip Activity Guide. The new activity guide is designed to address the current state mandated educational standards and serve as means for greater educational usage of the SNA's outdoor features. In addition the activities in the guide are based on current best practices found in the academic literature.

The new guide offers a variety of outdoor activities that were developed in accordance with the best practices in mind. Cronin-Jones (2000) for example demonstrated that students who were taught at outdoor locations had significantly higher test scores than those of students who were taught the same information indoors. Additionally, research suggests that students may remember fieldtrip hands-on activities for many months after the fieldtrip ends (Farmer, Knapp, and Benton, 2007). The literature also indicated that activity guides are unused by educators if the guides are not correlated to a state curriculum standards (McKeown, 2003). Therefore, the new fieldtrip activity guide developed for the SNA is correlated to NC State Standards in order to provide curriculum-based experiential learning opportunities that meet the state's current educational curriculum standards. The overall process of developing the activity guide began with the plan described below.

Activity Guide Development

The project's development process began with a literature review to identify key educational approaches appropriate for use at outdoor locations. Specifically, a literature review was conducted to examine educational methodologies that have been used at outdoor locations using experiential hands-on activities and best practice methods for fieldtrips. This literature review process included a survey of quantitative and qualitative research studies that evaluated various experiential education methods through the use of pre and post-field-trip student assessment testing (Cronin-Jones 2000; Farmer et al., 2007; Kuru, and Palmberg, 2000; Tretinjak & Riggs, 2008). Additionally, qualitative and phenomenological studies were reviewed in order to collect a wide range of educational perspectives. These qualitative and phenomenological investigations (Foran, 2005; Jacobson, & Padua, 1992; Lewin-Benham, 2006; Walley, 1992) describe the benefits of hands-on activities, outdoor observations, and lasting scientific knowledge reflected through informal student assessments.

The literature also provided specific teaching theories such as the Kolb's Experiential Learning Cycle (Kolb, 1984). Additionally several government publications were researched during the development of the activity guide. These documents included the 2012 North Carolina Essential Standards Clarifying Objectives (NC State Board Of Education, 2012) and the Mt. Jefferson SNA environmental education goals and objectives (*Interpretive and Education Plan*, 2010). The SNA operates under the General Management Plan (GMP, 1993) and an *interpretive and education plan*. Both SNA plans articulate the SNA and agency goals. By researching these government documents a relevant activity guide correlation was more likely assured thus ultimately leading to a more streamlined fieldtrip justification process available for teachers to articulate their reasons for student participation at outdoor SNA fieldtrips during school hours. Finally, to this end, a cadre of public school teachers, administrators and rangers reviewed the draft correlated fieldtrip activity guide. This was done to provide greater assurance that the activity guide was in fact appropriately correlated to current state standards and offered relevant hands-on activities that were practical for educators to facilitate.

Operational Definitions

Curriculum Based Education Standards - require each teacher within a jurisdiction where the education standard mandate was issued to teach the required content, objectives, or expectations. State-mandated curricula are updated or revised by each state's department of education (McKeown, 2003).

Environmental Literacy - is defined as a basic understanding of environmental processes and environmental knowledge accompanied by a concerned attitude toward the environment that leads toward responsible behavior (Moseley, 2000).

David Kolb's Experiential Education Learning Theory - is a sequential learning cycle that begins at any one of the following four stages. (1) Concrete experience that takes place in the moment (2) reflection, this allows for personal meaning, (3) abstract conceptualization, and then (4) hypothesis testing by active experimentation (Kolb, 1984). In David Kolb's words (1984) "learning is the process whereby knowledge is created through the transformation of experience" (p.38).

Pre-site & Post-site Student-based Activities - are planned and presented prior to and after a field trip. These activities may offer students an opportunity to become familiar with new vocabulary or concepts that will be presented during or after the fieldtrip (Klemm & Tuthill, 2003).

CHAPTER 2.

LITERATURE REVIEW

Before the SNA fieldtrip activity guide was developed a literature review was conducted. The review of literature revealed a variety of methods used for science related outdoor fieldtrips. Some of the studies (Cronin-Jones 2000; Palmberg and Kuru, 2000; Tretinjak and Riggs, 2008; Jacobson and Padua1992; Chase, Day, Lawhon, and Morley, 2008) used strict quantitative assessments that included pre-test and post-test assessments to compare measurements of student knowledge before and after field trip lessons. While other studies (Farmer et al., 2007; Foran, 2005; Knapp, 2000; Walley, 1992) opted for a more phenomenological, qualitative, or grounded theory approach in order to determine the quality and depth of understanding that students were grasping and retaining after participating in various fieldtrip activities. The literature helped to determine the types of curriculum-based fieldtrip activities that would contribute most to a student's scientific knowledge and understanding during an outdoor fieldtrip.

Four best practices were selected from within the literature to inform the development of the SNA Fieldtrip Activity Guide. These areas were chosen because they identified proven fieldtrip teaching methods that had been incorporated into successful outdoor fieldtrip programs. These following best practices were found repeatedly in the literature (a) student participation and benefits of hands-on activities; (b) overall educational benefits of learning at outdoor settings; (c) the benefits of activity to curriculum correlation, and (d) the use of pre-site, post-site fieldtrip activities to enhance fieldtrips. Each of these best practices was used in the development of the new SNA fieldtrip activity guide and will be summarized.

Hands-on Activities

Hands-on activities have been identified as proven best fieldtrip practices in several academic fieldtrip case studies. In each of these examples (Cronin-Jones 2000; Farmer et al., 2007; Palmberg and Kuru, 2000; Jacobson and Padua, 1992; Chase, Day, Lawhon, and Morley, 2008) higher student outcomes were associated with hands-on activities. A study entitled *Pupils in Parks*, Jacobson and Padua (1992) investigated the student activity development processes used in environmental education programs at several new national parks in developing countries.

In this study, researchers showcased a successful hands-on activity model, developed in two rural parks located in central Brazil and Malaysian Borneo (Jacobson & Padua, 1992). Their research indicated that through the implementation of hands-on activities such as leaf and bark rubbing, games that involved all five senses, soil and rotting log investigations, students began to become aware of the parks and its natural resources (Jacobson & Padua, 1992). During the environmental education program development stage, the needs of local teachers were identified and then addressed through hands-on interdisciplinary activities. Students who participated in the hands-on activities were pre-and post-tested. The results indicated significant increases in student knowledge (Jacobson & Padua, 1992).

These results in no way stand alone in the literature. Chase, Day, Lawhon, and Morley (2008) state in their paper on Leave No Trace ethics “Kids like to do things.

Learning about nature should be an active process" (p.31). This point is echoed in the results presented by Knapp (2000), who conducted a pilot study over an 18-month time span that used pre-and post-tests results from 71 third and fourth graders in a rural location in the United States. This study investigated student knowledge gained after a three-hour fieldtrip. Again this fieldtrip provided students with games, hands-on plant activities, guided hikes and discussions during the fieldtrip program. Similar to the types of hands-on activities that were employed during the Jacobson and Padua (1992) fieldtrips, the students in the Knapp (2000) study also learned about their local park through plant scavenger hunts, games, songs, and hikes. The Knapp (2000) study found that after one month, students remembered the activities that they did more than any other component of the fieldtrip. Eighteen months later a smaller sample of students were tested and their results demonstrated that the students still remembered the general types of hands-on activities that they did on the fieldtrip, but only a few students could recall the demonstrations that were performed by the teachers (Knapp, 2000). These results corroborate the implications suggested in the prior study. It is important to also note that 85% of the students wanted to return to "that" park to study more about the park and its plants. The students interviewed had a strong interest in learning more about nature (Knapp, 2000).

A similar type of long-term fieldtrip study primarily assessed student knowledge and attitudes that were remembered by participants one year after a fieldtrip had ended. This research was conducted using a phenomenological method (Farmer et al., 2007). Similar to the study done by Knapp (2000) this research sought to identify perceptions or concepts that students could remember one year after a 2001 field trip to the Great Smoky Mountains National Park.

The overall results of the Farmer et al., (2007) study indicated that students recalled many of the hands-on activities and concepts that were presented at the one-day fieldtrip one year earlier (Farmer et al., 2007). This important result combined with Knapp (2000) data demonstrates that hands-on activities leave an impression and a lasting memory on the students that were studied. Furthermore, the researchers of the Farmer et al., (2007) study noted the students' use of action words during the phenomenological interviews. Action words were used by the students to describe the hands-on activities that they did during their fieldtrip park experiences. Many of the students reported that they remembered activities such as doing tree rubbings, charting air pollution, and gathering pollution data. Farmer et al., (2007) stated that the students also described the straws, cups, and pins that they had used to demonstrate the ways that invasive species attack native trees.

An additional interview topic used in the Farmer et al., (2007) study assessed student content knowledge. The students again described the hands-on activities that they did. They talked about activities such as graphing the weather data and air quality data (Farmer et al., 2007). It is interesting to note that even after one year several students articulated the reason for the field trip was to learn about the damage invasive species have caused to the forest (Farmer et al., 2007). The fact that 14 of the 15 students were able to articulate some of the tangible ecological content presented in the form of hands-on activities indicates that they did retain memories based on these activities that might improve their overall environmental literacy and add to their overall ecological knowledge. The authors state that the students tended to remember kinesthetic or hands-on activities (Farmer et al., 2007). Both of these long-term studies suggest that there are measurable benefits and fieldtrip memories associated with hands-on activities.

A quantitative study measured student knowledge that had resulted from basic ecological science lessons taught at outdoor locations using hands-on activities. These data were then compared to test scores of students who were taught the same material at indoor locations using traditional teaching methods (Cronin-Jones, 2000). In this research, strict quantitative methods compared how well students retained basic ecological science knowledge after either participating in outdoor fieldtrips, or indoor classrooms. Based on tests scores from 285 students, the study attempted to determine if learning in an outdoor setting would improve student assessment test scores (Cronin-Jones, 2000). The author suggested that there was a significant educational benefit which, resulted from using different types of activities, such as hikes and hands-on games, which are practical for an outdoor classroom environment (Cronin-Jones, 2000). The results of this study reveal that outdoor hikes and hands-on activities have demonstrated a statistically significant educational value when they are compared to classroom presentations of the same environmentally related topics. These data further justify the practice of outdoor fieldtrip activities during school hours as a proven beneficial learning experience and reinforces the importance of developing experiential lesson plans and hands-on activities. Therefore the research suggests that curriculum-based outdoor activities that feature hands-on programs should be purposefully planned and correlated to lessons in the classroom if they are to be relevant to the course of study.

The Cronin-Jones (2000) research identifies the need and benefits that result from developing hands-on outdoor education programs for the SNA fieldtrip activity guide.

The studies described above have examined the relationship between hands-on activities and student knowledge. However the SNA fieldtrip activity guide's purpose is more than academic in nature. Promoting environmental stewardship is also a SNA agency goal. The following study describes the importance of hands-on activities and how students perceive their responsibility toward nature. In a study titled *Outdoor Activities as a Basis for Environmental Responsibility*, Palmberg and Kuru (2000) examine the role that hands-on outdoor activities and experiences have in developing a student's relationship with nature and personal responsibility toward nature. This case study addresses one of the SNA agency goals to promote good stewardship (SNA Interpretive & Environmental Education Plan, 2010).

Thirty-six, 11 and 12-year old students participated in Palmberg and Kuru (2000) study. Some of these students in this study learned about nature during activities on school fieldtrips or through hiking, playing outdoor games, or camping; while other students included in the study stated that they had not experienced these types of outdoor activities. Through interviews, participant observations, and drawings it was determined that the students who had the prior outdoor experiences expressed a greater concern for the protection of nature and empathy toward the environment than the students who did not experience outdoor games and hands-on activities (Palmberg & Kuru, 2000). Unlike the prior research that had an overall focus on knowledge and curriculum benefits, this data implied that hands-on activities may lead to stronger individual stewardship qualities in activity participants.

The literature described above strongly suggests that hands-on-activities and outdoor fieldtrips provide useful learning opportunities that improve student understanding of some scientific concepts (Cronin-Jones, 2000; Farmer et al., 2007; Jacobson and Padua 1992; Knapp, 2000; Palmberg and Kuru, 2000). These outdoor fieldtrips studies use a variety of student assessment methods and show results that demonstrate the considerable educational benefits that may result from hands-on learning activities on fieldtrips. Fieldtrips and outdoor educational experiences have also been shown to increase student understanding at measurable levels beyond those observed in students who have participated in classroom lessons alone (Cronin-Jones, 2000). Farmer et al., (2007) also identified that there were scientific concepts which are remembered by students for several months after a curriculum based outdoor fieldtrip has been concluded. Each of these studies identifies the importance and proven benefits that result from developing hands-on activities. The SNA Fieldtrip Activity Guide was developed with a focus on creating hands-on learning opportunities at outdoor settings in Mt. Jefferson SNA. The following section will address the educational benefits that come from implementing fieldtrip best practices at specific outdoor locations.

Fieldtrip Best Practices through Outdoor Locations

Each of the SNA activity guide on-site programs are designed to be conducted at specific SNA outdoor locations. Past research (Cronin-Jones, 2000; Foran, 2005; Tretinjak & Riggs, 2008; Walley, 1992) has found that location can have a measurable effect on a student's ability to understand new information. The use of outdoor learning environments as opposed to traditional indoor classrooms have been identified as significant factors in lesson comprehension for students. The location where a lesson is presented may have a measurable impact on student comprehension of some ecological topics (Cronin-Jones, 2000). Research related to the importance of outdoor locations provided valuable insights during the development of the SNA fieldtrip activity guide because educators are asking whether students should be taught at indoor or outdoor locations (Tretinjak & Riggs, 2008).

Currently faced with school issues such as cost, school liability concerns, and schedule conflicts with other classes many teachers turn away from outdoor park fieldtrip experiences (Tretinjak & Riggs, 2008). Instead, some schools have begun to offer their students virtual fieldtrip in the classroom to replace the outdoor education experience. Virtual fieldtrips are presented in traditional classrooms and utilize internet and other multimedia teaching tools (Tretinjak & Riggs, 2008). Conversely, the SNA fieldtrip activity guide is based on an outdoor experiential approach. The outdoor on-site activities that are included in the SNA fieldtrip guide are based on the best practices that are supported by the following case studies.

Two investigations (Tretinjak & Riggs, 2008; Cronin-Jones, 2000) examined the qualitative and quantitative benefits of teaching earth science at outdoor locations. In a 2008, mixed methods study entitled *The Enhancement of Geology Content Knowledge through Field-Based Instruction for Pre-Service Elementary Teachers,* Tretinjak & Riggs (2008) articulated the student assessment results from 36 students over two school semesters. The researchers compared the level of geologic understanding and earth science knowledge that two groups of students gained from two different learning environments (Tretinjak & Riggs, 2008). Similarly, the Cronin-Jones (2000) study also compared two groups of students. In this study, 285 students were taught in either an indoor or an outdoor location. The Cronin-Jones (2000) study started with a hypothesis that teaching children ecology at an outdoor site was much more pedagogically successful than teaching in an indoor setting. In order to test their hypothesis, a series of pre-test assessments were administered to all of the students in the study.

The population of 285 students was randomly divided into two experimental groups and one control group. Group one was instructed with a series of ecological lessons in a traditional classroom setting. Group two participated in a series of lessons at an outdoor classroom setting (Cronin-Jones, 2000). The control group did not receive any ecological lessons. The students were tested after the lessons were presented. The post-test scores, showed that the control group had a mean test score of 10.07 out of 25 questions while the traditional indoor classroom's mean score was 12.26. The students who were taught at the outdoor locations had a mean score of 15.73. These findings supported the author's hypothesis that students would learn more ecology at an outdoor setting was consistent with the students' assessment results (Cronin-Jones, 2000).

Similarly, the Tretinjak and Riggs (2008) study administered student assessment to the students who participated in classroom lectures and then compared those scores to the students who participated in outdoor field lessons (Tretinjak & Riggs, 2008). The authors suggest that the teaching process based on curriculum objectives and transferability of knowledge may be improved by utilizing fieldtrip opportunities as part of the learning process (Tretinjak & Riggs, 2008). The researchers found that "there was a significant difference between the outdoor field lesson pre-test and post-test scores, and it can be concluded that the students experienced gains in content as a result of the fieldtrip and the curriculum" (Tretinjak & Riggs, 2008, p.19). The researchers concluded that some earth science concepts are difficult for many students to immediately grasp. Without some type of concrete real-world foundation, some lessons in the classroom become unproductive and inadequate for producing maximum learning opportunities (Tretinjak & Riggs, 2008). Traditionally, courses of study that involve three-dimensional spatial concepts like geology or the identification of landforms, require students to visualize objects and ideas with only the use of classroom abstractions (Tretinjak & Riggs, 2008).

Fieldtrips to outdoor locations offer students a variety of tangible examples of earth processes, landform examples, and other spatial features that may potentially increase a student's understanding of lesson content. Potentially, those students who go to outdoor locations may gain a stronger grasp of the overall earth science concepts being taught in the classroom (Tretinjak & Riggs, 2008). Based on the findings and discussion by Tretinjak & Riggs (2008) and Cronin-Jones (2000) the outdoor location itself provides the educator with a valuable teaching tool and suggests that including outdoor practices are important for fieldtrip lesson plan development.

Additional studies support the evidence found in the previous research. One such case study included a phenomenological study, *The Experience of Pedagogic Intensity in Outdoor Education.* In this investigation Foran (2005) included interviews with several teachers in Nova Scotia after they had each conducted an outdoor fieldtrip. Each teacher interviewed expressed a consistent "intensity of student interest" that resulted in students actively learning and engaging in the educator's outdoor activities. Student interest was witnessed by the teachers during the various outdoor fieldtrips and the opinion of each of the teachers concluded that the outdoor locations helped the students to learn (Foran, 2005). Unlike the Cronin-Jones (2000) study that used quantitative methods to measure student outcomes the Foran (2005) phenomenological research introduced the reader to previous literature that had articulated the importance of using *place* as a tool for education. The author states that outdoor education best practices that "help students connect with their unique context in the world" (p.149) were advocated by John Dewey (Foran, 2005).

Each of the Foran (2005) teacher interviews provided an overwhelming endorsement of outdoor fieldtrip activities. For example in one of the teacher interviews an educator explained "this intensity in the outdoors is possible because the four walls, the staleness and the classroom structure is removed" (Foran, 2005, p.153).

In a similar type of interview a history teacher explains that he had never thought of outdoor activities as relevant to his pedagogical responsibilities. The teacher recalls a student's face during an outdoor fieldtrip. "This was a look of engaged learning, not the dull stare of traditional learning that is typical indoors" (Foran, 2005, p.155). Additionally, the unexpected teachable moment is also identified as another benefit that sometimes occurs during outdoor fieldtrips. One teacher stated "the outdoors has a wonderful way of offering a multitude of possible moments" (Foran, 2005, p.157). These phenomenological interviews examined several teachers' perspectives concerning outdoor fieldtrips. Each teacher articulated a variety of positive effects that resulted in student learning and participation during the outdoor fieldtrips.

To further emphasize the positive effects of outdoor fieldtrip locations a phenomenological study, *Discovering Dandelions,* was reviewed by Walley (1992). This study offers an example of how a series of outdoor fieldtrips were presented at a park during times of seasonal changes and articulates the benefits of using outdoor park locations as a means to teach students about seasonal change and other curriculum based topics (Walley, 1992). This phenomenological study took place after several school fieldtrips were conducted in the outdoors at the same park over a year. In this study all of the students participated in an adopt-a-tree activity at the park and visited their tree on each succeeding fieldtrips. The park provided staff that accompanied the teacher and students. The park staff also provided resource information to the teacher and the students quickly learned a variety of park plant species as they met various curriculum standards.

Much like in the Foran (2005) study, the students went outside and experienced a variety of locations and natural phenomenon. Both studies demonstrate how outdoor fieldtrip programs provide more than teaching opportunities, they also promote environmental interest, student enthusiasm, and natural resource awareness. Additionally, the academic and park goals were met through the use of outdoor park resources (Walley, 1992). Each of the fieldtrips was planned by the teacher and park staff cooperatively. Teachers prepared the students for the outdoors by encouraging each student to read various nature books as part of the pre-site activities provided by the park (Walley, 1992). Because the fieldtrips in these studies were implemented outdoors the students were able to experience a wide variety of memorable experiences. Each of the teachers in both studies stated that their students exhibited a genuine enthusiasm for learning because of the outdoor experience (Foran, 2005).

The case studies above provide examples of some of the best practices that were successfully incorporated into fieldtrip programs. The use of hands-on activities and outdoor locations are shown to be proven methods for transferring curriculum content to students during fieldtrips. The above best practices, hands-on activities, and outdoor locations have been incorporated into the SNA fieldtrip activity guide. Additionally, the literature suggests that activities must also be sufficiently correlated to a state's current curriculum standards if the activity guide will be used during school hours in public schools. The following section addresses an additional fieldtrip best practice, curriculum correlation.

Fieldtrip and Curriculum Correlation

Past research has found that a relevant fieldtrip activity guide must be correlated to the state's current curriculum standards if it is to be used by public school teachers for fieldtrips (McKeown, 2003). Proper correlation enables teachers to justify park fieldtrips and in-class park related activities during school hours. The need for such justification is discussed by McKeown (2003). The author discusses the importance of correlating all student science activities that are intended for public school to the current curriculum standards. McKeown, who served as Secretariat for the UNESCO Chair on Reorienting Teacher Education to Address Sustainability, explains that curriculum standards are mandated topics that require teachers to teach specific subjects and to meet specific objectives (McKeown, 2003).

McKeown (2003) suggests that if a program's activity guide or curriculum is developed by government agencies or non-governmental organizations that are not aware of curriculum standards then those activity guides will not even be considered to be used by teachers. This view is also shared by authors Cassell and Nelson (2010) who state that "Educators and K-12 classroom teachers find themselves mired in an increasingly narrow field of focus, compulsively fixated on prescribed and generalized definitions of achievement and homogenized content mastery-obsessed curricula" (p. 184). Teachers do not have time for "extra topics" that are not in the prescribed curriculum. McKeown (2003) also points out that mandated standardized requirements may cause many teachers to choose not take their students into nontraditional learning environments such as parks, museums, and outdoor fieldtrips. State curriculum standards are rigorous and often exceed the classroom time available for the teacher to accomplish their state-mandated pedagogical responsibilities. Because of these time limitations and requirements, many teachers are often reluctant to use or even inquire about outside curricula or field trip programs that are not required by the state standards (McKeown, 2003). Researchers Cassell and Nelson (2010) explain that a hurried superficial approach to science and the other core subjects may do a disservice to students and their academic potential. However, by offering a variety of ongoing reflective and dynamic fieldtrip education opportunities, environmental educators could be a part of the entire educational transformative process (Cassell & Nelson, 2010).

When fieldtrips are correlated to engage outdoor natural resources, students gain a wide range of learning opportunities that can build on the subjects they are learning in the classroom. Jacobson and Padua (1992) clarify the importance of using a park's outdoor setting in conjunction with a school curriculum for teaching natural resource education. A park's natural resource, through academic correlation, becomes an additional education resource for public education (Jacobson & Padua, 1992). The environmental educator, who seeks to introduce environmental literacy through fieldtrips, must address curriculum standards and collaborate with teachers and their classroom goals (Coughlin, 2010). Furthermore, if a new park activity guide is to be used by public schools teachers, it must be recognized by those teachers and administrators as relevant and useful in meeting their pedagogical responsibilities.

Jacobson and Padua (1992) explain how two parks in developing countries began to create a new environmental education program using "curriculum and teacher input" (p.291). As part of the development process, local teachers were invited to the park so they could explain the academic needs and curriculum objectives that the new park program might address. During this planning stage at Kinabalu Park the environmental education staff mandated that the fieldtrip program would be "coordinated with the State's educational system" (Jacobson & Padua, 1992, p.291)

Following the example of the above best practices, the SNA activity guide was designed to help teachers meet their classroom goals in accordance with the established 2012 North Carolina Essential Standards (North Carolina State Board of Education, 2012). The literature suggests that an academic collaboration between the teacher and the field trip educator should also lead students to a better understanding of the subject matter. This type of collaboration, allows for greater meaning and more in-depth teaching opportunities to be incorporated into the field trip as well (Coughlin, 2010).

Classroom Pre-Site and Post-Site Activities

Cassell and Nelson (2010) articulate the educational transformative process that includes the use of the traditional indoor classroom setting. This provides support for the use of pre- and post-site activities in the classroom. Classroom activities that are presented before and after a fieldtrip are an additional fieldtrip best practice (Klemm & Tuthill, 2003). Pre-site and post-site field trip activities offer students an orientation to the park prior to their fieldtrip experience. These activities address topics or skills that students will be learning about on the field trip. The pre-site programs should also introduce the student to unfamiliar technical terms or concepts that will be reintroduced on the fieldtrip (Klemm & Tuthill, 2003). Pre-site classroom activities are presented to students either by the teacher or by a ranger in the classroom several days prior to the departure for the field trip and post-site activities are presented several days after the onsite fieldtrip has finished. Post-site activities are frequently used for student assessments of field trip knowledge. These activities are also an opportunity to reinforce the fieldtrip concepts and vocabulary (Klemm & Tuthill, 2003).

Jacobson and Padua (1992) explain that as a part of their new park fieldtrip program that was successfully developed in Malaysia, the students were asked to complete various post-site activities at home or at school. "In Malaysia we implemented post-program activities for students at their schools thereby increasing their exposure to the concepts introduced during their visit to Kinabulu Park" (Jacobson & Padua, 1992 p.292). The park also used pre-site lessons to prepare both the students and teachers for their on-site park fieldtrip.

The use of pre-site and post-site field trip materials offer students and teachers an opportunity to experience the park virtually prior to their experience visit. These materials may also include relevant cultural history information as well as maps or other background data (Jacobson & Padua, 1992). Furthermore, pre-site activity may require students to research questions that will be due to their teachers upon departure for the trip. These assignments may also allow students an opportunity to use materials like maps, Munsel color charts, or soil texture identification charts prior to arriving at the field trip activity site. Students will also have an opportunity to locate the field trip destination on a map or virtually explore the location on a suggested Internet website that can be viewed in the classroom (Buchanan, Schwab, and Thompson, 2006).

Post-site materials may include formal or informal assessments and activities. These outcome assessments offer teacher and non-formal educators an opportunity to measure student outcomes. Student may be given an opportunity to take field notes in order to answer post-site questions (Buchanan et al., 2006). These post-site questions may be directly related to the park resources or the school's end of grade testing. Post-site activities may also include the use or art or poetry. Walley (1992) explains how poetry, journaling, and post-site assignments were used in conjunction with park fieldtrips. She also states that there are benefits from using what she calls "interesting" words to describe things that were encountered during each seasonal fieldtrip (Walley, 1992). Pre and post in-class opportunities are included in the SNA fieldtrip activity guide.

Literature Review Summary

The literature review identified a variety of best practices and fieldtrip methods that were implemented on public school fieldtrips and case studies. These studies (Cronin-Jones 2000; Farmer et al., 2007; Palmberg and Kuru, 2000; Tretinjak and Riggs, 2008; Jacobson and Padua1992; Chase, Day, Lawhon, and Morley, 2008; Farmer et al., 2007; Foran 2005; Walley, 1992) used a variety of assessment methods to determine the quality and depth of understanding that students were retaining after participating in fieldtrips best practices. Additionally, the literature reveled four examples of fieldtrip best practices that are used throughout the entire SNA fieldtrip activity guide. These best practices are (a) conducting hands-on activities, (b) presenting the programs outdoors, (c) properly correlating each activity to the state curriculum standards and (d) presenting pre- and post-site activities before and after the fieldtrip. These four best practices offer an overall frame-work for the development of the deliverable. Each new program in the SNA fieldtrip activity guide incorporates the principles and methods described in the best practices above. The following method section examines the procedures that were used to select the appropriate fieldtrip topics, apply the educational theory, and incorporate feedback form local teachers in order to complete the Mt. Jefferson SNA Fieldtrip Activity Guide.

CHAPTER 3.

METHODS

The methods section will discuss the process that led to the development of the project deliverable, the SNA Fieldtrip Activity Guide. The literature review identified fieldtrip best practices and supported the need for the project. State Park documentation and state education standards were reviewed to inform the fieldtrip topic selection process. Additionally an overriding educational theory was added to support and inform curriculum development (see Figure 1). In addition the teacher feedback was used to ensure project relevance and proper curriculum correlation.

Figure 1.

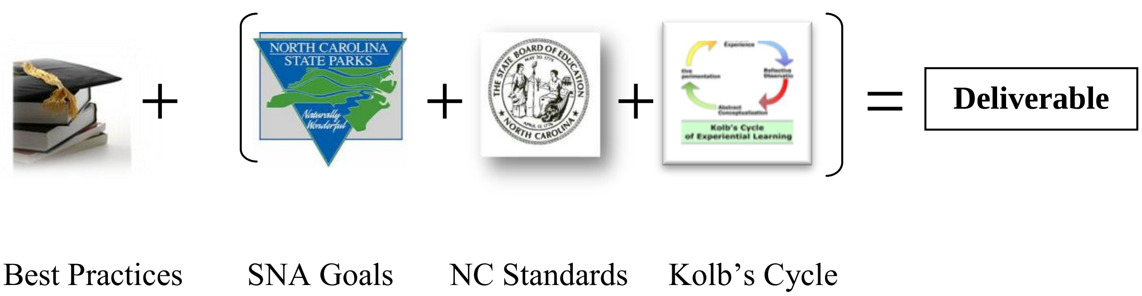

Figure 1. Methods section synthesizes the literature based best practices with NC State Curriculum, SNA goals and the education theory to produce the original deliverable.
Kolb Cycle image retrieved from http://serc.carleton.edu/introgeo/enviroprojects/what.html

Two documents were primarily used for the development of the topics that would be covered in the curriculum. The first of these documents is the Mt. Jefferson SNA General Management Plan (GMP). The GMP is the SNA's primary document used to articulate the park's official resource education, and outreach goals. The second group of documents originated from the North Carolina State Board of Education (2012), the *2012 North Carolina Curriculum Standards*. The State Board of Education Document provides the current educational curriculum standards that are required to be met by teachers in all NC public schools.

SNA General Management Plan and Topic Selection

The Mt. Jefferson SNA GMP is the North Carolina State Park's official plan specifically designed for Mt. Jefferson SNA and the area that it serves. The GMP's purpose is to comprehensively describe the park's resources and analyze park visitor use and trends within its service area (GMP, 1993). The GMP includes a description of park resources, the future plans for the park, and an outline of the park's informational, educational, and interpretive themes. In addition to the Mt. Jefferson GMP, there is a supplemental document, the *Annual Interpretation and Education Plan* (AIEP) (2010). This document identifies relevant program themes that are important to the SNA mission and environmental education goals; sub-sections of this document includes *interpretation, exhibits, outreach*, and *environmental education* (AEIP, 2010).

Within the environmental education sub-section of the AEP is a list of needed environmental education lesson plans and topics that had not been formally developed into the SNA's correlated environmental education programs. These environmental education lessons were not included in the SNA's older 1999 curriculum EELE guide. The identification of these lessons along with additional SNA supporting documentation corroborated that there were several fieldtrip topics needed for the new curriculum. This supporting documentation included teacher program requests recorded in the SNA's Interpretive and Environmental Education monthly programing report. The following program topics were most requested by teachers between 2005 and 2012 (See Table 1).

Table 1

Undeveloped Topics Most Requested by Teachers

Topic	**Years**							
	2005	2006	2007	2008	2009	2010	2011	2012
Landforms	3	5	9	5	5	11	8	10
Soils Science	4	15	10	8	7	3	10	36
Plants	4	8	10	7	8	8	10	16
Earth Materials	5	7	5	4	3	4	5	9

The GMP states that "Mt. Jefferson is well suited for environmental education, with its excellent representation of geology and habitat types found throughout the mountain provinces" (GMP, 1993). Therefore, some of the fieldtrip topics were identified and selected as candidate topics for the new SNA fieldtrip activity guide. Landforms, soil science, plants, earth materials were the most frequent topics identified. Each of the above natural resource topics have been identified as frequently requested environmental education programs that had not been formally developed into the park's existing programming or the park's EELE (SNA Documents & Personal Communication 2008-2012).

The SNA candidate topics, i.e. landforms, soil science, plants, and earth materials were identified because they promote greater student awareness of the park's natural resources and beauty. Similar fieldtrip topics to those listed above were used in the (Jacobson and Padua, 1992) park education program model sited in the literature review. The program topics used in Jacobson and Padua (1992) promoted greater park awareness. The potential topics also promote the North Carolina State Park's overall agency mission. "The park system exists for the enjoyment, education, and inspiration of all our citizens and visitors" (GMP, 1993). Participation in park fieldtrips at Mt. Jefferson SNA has been documented through thousands of fieldtrip poems, as an inspiration for students and teachers, therefore further participation would likely continue to reinforce those NC Parks agency mission goals. The data provided in Table 1, articulates the number and kind of program requests that the SNA has received. The SNA has determined that there is a need to expand its environmental education program and formally developed the types of program listed in Table 1 (AEIP, 2010). Finally, local educators have consistently expressed an interest in new fieldtrip topics such as those listed in Table 1 for SNA fieldtrips during school hours (Mt. Jefferson SNA documents, 2012).

Based on the SNA input, the four topics landforms, soil science, plants, earth materials moved to the top of a short list of potential SNA fieldtrip activity guide topics. The SNA's documents provided only one part of the criterion used in the final topic selection. The previous literature review (Cassell & Nelson, 2010; Jacobson & Padua, 1992; McKeown, 2003) determined that a fieldtrip activity guide must be correlated to the state current curriculum standards if it is to be used in public schools during school hours (McKeown, 2003). Therefore each of the candidate SNA potential topics also needed to address the current North Carolina Curriculum Standards if they were to be incorporated into the SNA fieldtrip activity guide. This process required the second source of government documents, the 2012 North Carolina Curriculum Standards.

North Carolina 2012 Essential Standards and Topic Selection

North Carolina public schools are in the process of curriculum reform. Many of the state's curriculum standards have been changed, and these changes impact several course content Clarifying Objectives for a variety of grade levels in the 2012-2013 school year. This 2012 reform process and changes in course content may offer educators an opportunity to bring their students outdoors for park fieldtrip experiences that are now academically justifiable. "North Carolina's Accountability and Curriculum Reform Effort (ACRE), is the state's comprehensive initiative to redefine the Standard Course of Study for K-12 students, the student assessment program and the school accountability model" (North Carolina State Board of Education, 2012).

The State of North Carolina has been moving toward the full implementation of the new curriculum standards for several years. During the 2012-2013 school year, many of the final changes will be implemented in all of North Carolina's public schools (North Carolina State Board of Education, 2012). "In undertaking this ambitious work, North Carolina education leaders are the first in the nation to address learning standards, student assessments, and school accountability simultaneously" (North Carolina State Board of Education, 2012).

The changes to the curriculum standards did have an influence on the science education topics that were being considered for the activity guide. The following example demonstrates how the 2012 North Carolina Curriculum has affected park fieldtrip topics at Mt. Jefferson SNA. Landforms, for example has been a part of the fifth grade science competency objectives for many years. The North Carolina State Board Of Education (2004) fifth grade science standards included the following:

> 2.02 Investigate and discuss the role of the water cycle and how movement of water over and through the landscape helps shape land forms.
>
> 2.03 Discuss and consider the wearing away and movement of rock and soil in erosion and its importance in forming: Canyons, Valleys, Meanders, and Tributaries.
>
> 2.06 Identify and use models, maps, and aerial photographs as ways of representing landforms (North Carolina State Board of Education, 2004).

The above example identifies several outdated science objectives are no longer included in the fifth grade science curriculum. Therefore, local fifth grade teachers are not responsible for teaching about landforms. Furthermore, landform focused fieldtrips are not justified academically for the fifth grade fieldtrips in North Carolina Public Schools. However, as of the 2012-13 school year, landforms topics are included in the third and fourth grade science 2012 Essential Standards (North Carolina State Board of Education, 2012). This change in curriculum, offers third and fourth grade teachers an opportunity to academically justify outdoor fieldtrips to locations like Mt. Jefferson SNA that now has curriculum-based grade appropriate landform activities in place and ready to use. The North Carolina State Board Of Education (2012) Third grade Essential Standard Clarifying Objectives now state:

Compare the structures of the Earth's surface using models or three-dimensional diagrams. 3-E2.1 Compare the earth's oceans, seas, rivers, lakes, ponds, streams, and glaciers.

3-E2.2 Compare Earth's land features (including volcanoes, mountains, valleys, canyons, caverns, and islands) by using models, pictures, diagrams, and maps (North Carolina State Board of Education, 2012)

These changes in curriculum standards allow for a variety of new environmental education programs to be developed that will encourage student understanding through age appropriate hands-on activities. The following lesson plan topics - landforms, soil, science, plants and earth materials are clearly identified within the North Carolina's 2012 Educational Clarifying Objectives. These topics offer teachers and students new educational opportunities to engage in outdoor learning experiences that are academically justifiable and curriculum-based. Each of the selected lesson plan topics address one or more of the North Carolina's 2012 Educational Clarifying Objectives, as well as several of the Mt. Jefferson SNA's General Management Plan or I & EE documented goals.

Limiting the fieldtrip guide to these four topics was done to ensure a focused correlation between park and school objectives was maintained. The four selected lesson plan topics had a profound influence on each of the hands-on activities and tangible deliverables that were created for this project. Each lesson plan topic had to meet an established need that was identified by the literature or by the other supporting government documents. Each topic within the guide is compatible to the established Clarifying Objective found in the 2012 North Carolina State Essential Standards. This was done to keep the activity guide practical, and to ensure ease for use for educators, rangers, and school administrators could justify its use during school hours (McKeown, 2003).

The literature review described earlier in this paper supported the use of hands-on activities and outdoor settings as a productive part of teaching various science topics. Therefore it was prudent to select topics that would be experienced in the outdoors and easily developed into hands-on activities in order to encourage a memorable fieldtrip. The chart below summarizes each of the four SNA fieldtrip activity guide lesson plan topics (1) Landforms, (2) Soil science (3) Plants, and (4) Earth Materials. Each of the four topics meets the established criterion as shown in Table 2.

Table 2

Lesson Plan Topic Selection Criterion

Lesson Plan Topic	**Addresses NC Clarifying Objective**	**Addresses SNA Education Goal**	**Appropriate for Outdoor Hands-on Activities**	**NC Grades Levels Addressing Topic**
Landforms	X	X	X	3rd, 4th
Soils	X	X	X	3rd, 1st
Plants	X	X	X	1st,3rd
Earth Materials	X	X	X	1st

Once the fieldtrip topics were selected, an educational model was chosen for the overriding philosophy of the curriculum praxis. The selected educational model for the SNA fieldtrip activity guide would essentially animate each of the lesson plan topics by using best practices found in the earlier literature review. These best practices include the use of hands-on activities, outdoor locations, and the structure of curriculum correlation. David Kolb's (1999) versatile and adaptable Four Stage Learning Cycle was researched and selected as the educational model that would best address the praxis of science related fieldtrip activities conducted at dynamic outdoor locations.

Kolb's Theory and Activity Development

The education theory that was used to inspire and direct the development of the SNA fieldtrip guide activities and lessons was David Kolb's Learning Cycle. David Kolb, is the author of the *Four Stage Learning Cycle* as described in McAninch (2000). Kolb's experiential learning background is rooted deeply in his interest in John Dewey's principles of education and Piaget's model of learning and cognitive development (Kolb 1984). Kolb had a particular interest in Dewey's model of experiential learning, Dewey emphasized that it is through experiences that students gain understanding. Kolb (1984) describes Dewey's "emphasis on learning as a dialectic process integrating experience and concepts, observations, and actions" (p.22). Dewey (1899) states, "Education, therefore, is a process of living and not a preparation for future living" (p.7). Based on these and other educational insights, Kolb began experimenting, testing, and developing various new learning theories.

Kolb (1984) stated that "learning is the process whereby knowledge is created through the transformation of experience" (p36). Kolb took the next step beyond Dewey's model and developed his Four Stage Learning Cycle portrayed in Figure 2. This four-stage process is a step-by-step model that educators can use to develop an experiential lesson plan, such as the fieldtrips lesson plans developed for SNA fieldtrip activity guide project. The Learning Cycle has four major stages: learning through direct experience; observational reflection; abstract conceptualization, such as drawing a deep conclusion; and then active experimentation. Each of these stages offers students opportunities to explore new ideas or make scientific observations based on their own real life experience and application (Healey & Jenkins 2000). Kolb's theory of experiential learning suggests that each part of this cycle works together to offer students an opportunity to not only experience, but also to analyze, understand, and then apply what they learn. Kolb (1984) states, "Ideas are not fixed and immutable elements of thought but are formed and re-formed through experience" (p.27). The Learning Cycle stages may also benefit students by providing students with unique reflection and thinking opportunities that correlate very closely to the Revised Bloom Taxonomy (RBT) objectives stated in the (North Carolina Curriculum Standards, 2012).

Each of the four stages of the Kolb cycle allows for student participation and in-depth reflection of thinking opportunities. First, in the concrete experience stage, students engage the world around them. This may be accomplished by walking a trail, making a model with clay, or any other hands-on activity that offers a concrete experience. In the next stage, students reflect on the concrete experience. Journaling, poetry, and group discussions are all possible examples of the reflection stage. The reflection stage also offers educators an opportunity to conduct an informal student assessment. Next, in the abstract conceptualization stage, students can develop what might be described as Metacognitive Knowledge, as will be described in the RBT. Students may then potentially realize a new concept, develop a hypothesis, or begin to ask how can this idea be applied to a given situation? Finally, there is a stage for active experimentation. At this stage, the student may ask; “how can I test this idea or how can I use this information?”

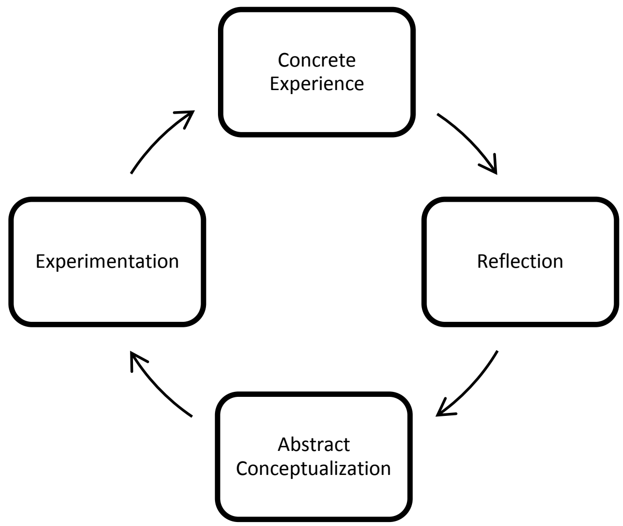

Figure 2. The Kolb Cycle (Healey & Jenkins 2000).

Kolb’s Learning Cycle is versatile because the educator does not need to begin engagement with the students in any particular stage of the Kolb’s Cycle. The cycle can be entered at any point. However, all stages should be followed in sequence after entering into the experiential learning process to remain true to Kolb’s model. The Learning Cycle demonstrates that it is not sufficient to have an experience in order to learn. It is necessary to reflect on the experience and to make generalizations and formulate concepts that can then be applied to new situations (Kolb, 1984). The Kolb Learning Cycle was chosen to guide the development of this new hands-on activity fieldtrip guide that focuses on learning through outdoor fieldtrip experiences and reflection. The Kolb model promotes student understanding through experience, reflection, conceptualization, and experimentation. The Kolb model is compatible for outdoor fieldtrip activities and also addresses many of the RBT goals listed in the 2012 North Carolina Essential Standards.

Curriculum Correlation and Revised Bloom Taxonomy

The Revised Bloom Taxonomy (RBT) uses action words to describe student thinking and understanding as well as the importance of developing the students' ability to accomplish tasks. Students in North Carolina schools are expected to demonstrate their knowledge and understanding through practical application of learned concepts. North Carolina has chosen RBT to help students move toward the kind of complex thinking expected from 21st Century graduates (North Carolina State Board of Education, 2012).

In order to correlate the SNA activity guide topics appropriately with the new Essential Standards, RBT cognitive learning ideals were incorporated into the development and design of the Mt. Jefferson fieldtrip activity guide. By participating in experiential hands-on activities and experiments students may have better understanding of the meaning of concepts presented in each program. The RBT approach uses action words such as create, evaluate, and analyze, to clarify comprehension of learning objectives (North Carolina State Board of Education, 2012). The students that participate in the SNA activities will demonstrate their understanding through this kind of active learning. The activities in the fieldtrip guide have been designed using Kolb's Experiential Learning Cycle in order to lead students toward of the highest cognitive learning levels that are identified in the RBT.

Throughout the development of the fieldtrip activity guide, special attention was focused on the RBT and the North Carolina Essential Standards. This added focus helped to keep each activity correlated to the pedagogical objectives that teachers and school administrators must accomplish. It was beneficial to have a working knowledge of the RBT in order to apply those principles during project development. An additional source of information about RBT comes from David Krathwohl (2002), who was a co-author with Benjamin Bloom on various academic projects. Krathwohl (2002) points out that there are several components that have been modified within the Revised Blooms Taxonomy. One component is the knowledge dimension. The knowledge dimension had originally consisted of three categories, but it now includes a fourth dimension known as *Metacognitive Knowledge* (Krathwohl, 2002).

This addition now takes into account the student's own self-awareness of gained knowledge. The Metacognitive Knowledge component involves the student's awareness, use, and application of new knowledge (Krathwohl, 2002). The Metacognitive Knowledge component provides a fieldtrip opportunity to develop measurable outcome criterion such as hands-on activities. For example, students who participate in the on-site fieldtrip activities will experience new learning environments as they gain science-based knowledge. The science-based hands-on activities will likely enable the students to apply their Metacognitive Knowledge to each of various fieldtrip activities or experiments. The students will know that they understand, to some degree, the topic they are learning because they will actually be "doing what they are learning." The Metacognitive dimension has added an additional definitive element that helped to refine the fieldtrip guide's overall activity goals. Based on Kolb's Experiential Learning Cycle each participant will experience a concept, reflect, and then apply that knowledge to a hands-on situation or experiment thus meeting the Learning Cycle and RBT objectives.

Teacher Feedback

To ensure that the finished activity guide was functional, practical and correlated appropriately for use in public schools, a cadre of teachers from Ashe County's public schools and school administrators were asked to review the SNA fieldtrip activity guide and provide written and verbal feedback concerning the fieldtrip guide and its potential relevance to their pedagogical responsibilities. This cadre of self-selected teachers, rangers, school administrators, will likely be among the first and most frequent users of this new activity guide. This makes their feedback extremely valuable and useful.

During this feedback phase of the activity guide's development, several program requests were made by teachers who wanted the new activity guide programs to be presented for their students during the 2012-13 school year. These unexpected park program requests gave teachers the opportunity to see how some of these new activities in the development phase may work in the park and in the classroom. The following comments below are from teachers, school administrators and State Park Rangers who have examined the SNA fieldtrip activity guide.

Mt. View Elementary School teacher replied:

> These two plans look fantastic. I would recommend setting aside more than an hour for the lesson. This would give the students longer to discuss each landform. If it wasn't too expensive, then you might provide them with a little more Play-doe, just because they usually will use more than you recommend. This is not a major issue, but it might be beneficial and allow them to develop more accurate landform representations. I know a few students were concerned when they

> couldn't get the river to reach all the way to the ocean and meander at the same time. This would take the focus of off that, and put it back on the important thing of understanding the terms. The soil unit also looks great. I know my students really enjoyed acting out the parts of the plant and seeing the different types of soil. I think the idea of bringing in the soils from home would be great, because it would allow students to see the differences in soil within our own county. I could see this working well as a sample science fair project, where the class actually completed it together, but the whole process would be modeled for students. I love the activities at the park as well. They are very hands-on and provide an opportunity for students to take the knowledge they learned into the real world. Thanks again for all your hard work in preparing these lessons. It is very obvious that a lot of thought has been put into the planning of the activities, providing the maximum amount of learning possible. (Personal Communication, February 14, 2013).

Mt. View Elementary School teacher responded by saying:

> I just looked over the fourth grade unit again, and I really like it. I think the activities are grade appropriate and very engaging. Good luck with this project. Mountain View fourth grade would like to schedule a field trip to the park. (Personal Communication, March 15, 2013).

Teacher at Westwood Elementary school said:

> The acid test is more advanced than what we do in the classroom. We use vinegar and look for "bubbling". I like that he uses the litmus paper and pH scale. I love

> the crayon experiment and how it demonstrates the process of breaking down (physical weathering). Students will LOVE the chemical weathering Play-doh experiment! Great idea and hands-on fun for 4th graders. (Personal Communication March 10, 2013).

Teacher at Westwood said:

> I love these activities!! I think they are excellent for classroom use because they are very clear about the differences between chemical and physical weathering. The lessons meet the needs of many learners because there are visual, auditory & hands-on activities. Students are learning valuable information in many formats. Ranger Randolph's lessons meet each of the essential standards addressed (Personal Communication March 10, 2013).

The Ashe County Schools, director of testing accountability and curriculum, Phil Howell wrote;

> You've done an excellent job of aligning the standards with activities that incorporate many avenues from technology to higher levels of learning and student achievement. The activities are so explicit that even I would have a hard time messing up. Have you entertained the idea of listing Desired Student Outcomes? Such as, "Following the activity the student will be able to .... Phil Howell Ashe County Schools. P. Howell (Personal Communication March 6, 2013).

State Park Ranger said,

> I read over landforms for the 3rd grade. There is a lot of info here and all the activities seemed great. At the beginning, why would you hand out materials and show a video at the same time? This seems like the kids would get so distracted and not really listen to the video? Is the video really important? This is the only real critique I had. The rest is great! Great job on this! (Personal Communication March 4, 2013).

State Park Ranger stated,

I looked at the Contour Mountain Hike. It combined elements of math in addition to the map reading, topography, landform theme. I thought it was good and something that the kids could enjoy while also learning something important (Personal Communication March 4, 2013).

The variety of useful feedback provided by the public school educators and state rangers has helped to improve the fieldtrip activity guide's quality. Moreover, because the feedback was of a favorable nature concerning practical relevance and appropriate correlation, the guide has now entered into its completion phase of development.

Conclusion

Each step in the development process of this project deliverable was driven by the need for a Mt. Jefferson SNA Fieldtrip Activity Guide that is correlated to the current NC State Curriculum Essential Standards and the SNA's environmental education goals. The literature review strongly suggested that a new activity guide that would be used in public schools needed to be properly correlated to that state's mandated curriculum standards. The literature furthermore provided examples of proven fieldtrip best practices that utilized correlated, outdoor, hands-on teaching methods. These types of experiential methods were developed into original hands-on fieldtrip activities that make up the deliverable. David Kolb's Experiential Learning Cycle provided the education theory and cognitive learning structure for each activity's development. Each new activity within the deliverable reflects best practices found in the academic literature, and addresses the curriculum taught in local schools. The SNA Fieldtrip Activity Guide offers step-by-step instructions for each activity. All of the sections offer pre-site activities intended for the classroom prior to the park visit. Next, the guide addresses the on-site activities that are designed for SNA fieldtrips. Finally, the post-site activities are intended for the classroom after the SNA fieldtrip. These activities were designed for students to assimilate a variety of concepts through experiential and hands-on learning. Teachers can easily adapt any activity to be implemented as a stand-alone educational experience. Additional grade appropriate topics should be added to this guide and further fieldtrip research should be conducted to ensure that current state standards are identified and are correlated to park activities. Fieldtrip research may help ensure that park fieldtrips will continue to be conducted "outdoors" during school hours.

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Mt. Jefferson State Natural Area Fieldtrip Activity Guide

Correlated to NC Essential Standards

2013

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Mt. Jefferson State Natural Area

Fieldtrip Activity Guide

Developed By

Thomas D Randolph

Masters of Science in Environmental Education

Montreat College

Montreat, NC 28757

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"Education is not

preparation for life;

education is life itself."

John Dewey

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Fieldtrip Activity Sections

Introduction

This guide book offers teachers and park rangers a variety of experiential hands-on, activities, models, and experiments that are correlated to the 2012 North Carolina Essential Standards. As you explore the pages of this guide remember that you are the facilitator and you have the freedom to adapt and change these programs to meet the needs of your students. Your enthusiasm and courage to try these new activates will hopefully encourage the joy of leaning in the hands and minds of your students.

Each of the following activity sections are divided into pre-site, on-site, and post-site units. These units are further divided into subsections labeled; (a) Concrete Experience, (b) Reflection, (c) Abstract Conceptualization, and (d) Active Experimentation subsection. This sequence is based on the David Kolb's Experiential Education Learning Theory. This educational theory will be discussed later. A variety of original films and short YouTube video links are also included with this guide. These short films add visual and aesthetic context to your pre- and post-site activities. These films can be viewed using the internet and a Smart board. The film links will be issued by CD or email for teachers who request these activities. Materials and supplies for each activity are easily obtainable craft items. Because of the flexible nature of these activates, teachers are free to improvise activity materials in order to meet their teaching goals. Some supplies will be available from the park upon request. Activity supplies should be returned to park upon arrival for field trip or may be scheduled for picked up from school after their use.

The actual on-site fieldtrip activity sites are located within Mt. Jefferson State Natural Area in Ashe County North Carolina. The Natural Area facilities are equipped with seasonal restrooms, water fountains, a covered picnic shelter, fireplace, picnic tables, and cooking grills. This location offers a variety of trails and breathtaking views that will be used by your students as living science classrooms and laboratories. Students who participate in Mt. Jefferson fieldtrips gain unforgettable opportunities to learn about science and their local Appalachian environment through direct experience.

The mountain summit is 4683 feet above sea level. If this is your class's first visit to the park, the park ranger will discuss the appropriate outerwear that your students should bring to the park. Safety concerns and weather issues will be addressed when you make your fieldtrip reservation. A park ranger will be able to answer your questions in much greater detail at that time.

The Educational Theory

The educational theory that inspired and directed the development of this activity guide is based on the principles of David Kolb's Experiential Education Learning Theory. David Kolb, a graduate of Harvard University followed his interest in John Dewey's principles of education. Kolb held a particular interest in Dewey's theory of *Continuity of Experience*. This principle of continuity posits that "every experience both takes-up-something from those which have gone before and modifies in some way the quality of those which come after" (McAninch**,** 2000).

Kolb began experimenting, testing, and developing various new learning theories. Finally, in 1984, Kolb took the next step beyond Dewey's continuity of experience and developed his *Four Stage Learning Cycle*. In each of the four parts of the cycle, students develop individual understanding of the subject being experienced (Healey & Jenkins 2000). Each of the four stages of the Kolb cycle allows for student participation and in-depth reflection and thinking opportunities. Kolb stated that students perceive new information through experiencing the concrete, tangible, felt qualities of the world, relying on one's senses and immersing oneself in the concrete (Kolb,1999).

Within the concrete experience stage of each activity, students engage the world around them. This may be accomplished by walking a trail, making a model with clay, or any other hands-on activity that offers a concrete experience. In the next stage, students reflect on their concrete experience. Journaling, poetry, and group discussions are all possible examples of the reflection stage. The reflection stage also offers educators an opportunity to conduct informal student assessments. Next, is the abstract conceptualization. In this stage students may develop what might be described as Metacognative Knowledge, as mentioned in the Revised Bloom Taxonomy. Students may potentially realize that they have learned a new concept, developed a hypothesis, or may begin to ask how can this idea be applied to a given situation? Finally, there is a stage for active experimentation. At this stage, the student may ask how can I test this idea or how can I use this information?

David Kolb's Experiential Education Learning Theory is versatile; the educator need not begin at any particular stage of the Kolb's Cycle. Students do not have to start at the concrete stage or any other stage of the cycle. The cycle can be entered at any point.

However, all stages must be followed in sequence after entering into the experiential learning process. The Learning Cycle demonstrates that it is not sufficient to have an experience in order to learn. It is necessary to reflect on the experience and to make generalizations and formulate concepts which can then be applied to new situations (Kolb, 1999).

Conceptual Framework

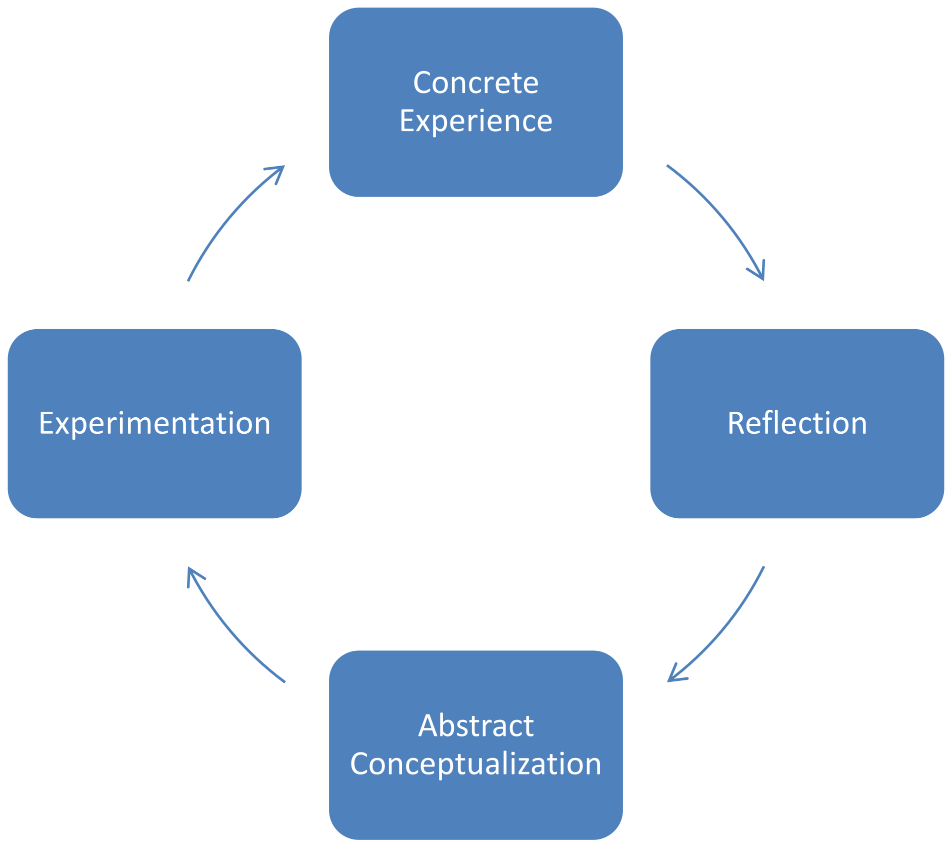
Each program is designed to initiate a profound student awareness of scientific methods, earth science, and the local Appalachian environment. Using David Kolb's Experiential Education Learning Theory as the model for knowledge acquisition; these activities create experiential links between the state curriculum objectives and Mt. Jefferson State Natural Area's educational mission. Through an interdisciplinary approach, these activities have been designed to build intellectual connections between course objectives and tangible real-world experiences. By offering these authentic real-world learning opportunities, educators may incorporate the following hands-on programs and fieldtrips into their lesson plans in order to address and achieve a variety of pedagogical responsibilities.

The activities, experiments, and model building opportunities described within this guide are designed to provide students with a variety of authentic learning opportunities that encourage student originality and adaptation. Developed with the 2012 Essential Standards of North Carolina Public Schools in mind, these activities address specific clarifying objectives. Those objectives are located at the beginning of each activity section and include a brief introduction to the activities and students outcomes.

The guide offers step by step instructions for each activity. All of the sections offer pre-site activities intended for classroom use by the teacher or the visiting ranger prior to the park visit. Next the guide addresses the on-site activities that are designed for the park fieldtrip. Finally, there are the post-site activities that are intended for classroom review. These activities were designed for students to assimilate a variety of concepts through experiential and kinesthetic learning. Therefore each activity can be easily adapted by teachers to be implemented as a stand-alone educational experience.

Although these activities may be useful as stand-alone lessons, they are targeted to address specific science objectives for 1st and 4th grade and the science and social studies objectives for 3rd grade. By linking the science and social studies disciplines together, students will have an opportunity to make connections and develop deeper understandings of the lesson content.

Addressing topics such as landforms, soils, plants, and minerals, this activity guide helps you to bring these topics to life. By rotating among a variety of learning styles and guided by David Kolb's Experiential Education Learning Theory, each activity in this guide will challenge your students to ask questions about science and nature. The activity's build on the student's existing knowledge as it challenges student's uncertainty. Through the use of the senses, complex ideas are transformed into tangible concepts that are understood with certainty. This guide uses simple experimentation, experience, reflection, and abstract conceptualization; to encourage students to learn how to learn, as they construct deeper meanings from a variety of enjoyable learning experience.



David Kolb's Experiential Education Learning Theory

(Kolb, 1984)

Fieldtrip Activity Section

Arriving at one goal is the starting point to another.

John Dewey

First Grade: Physical Properties of Earths Materials

All of these first grade activities were developed to introduce students to Mt. Jefferson's natural resources and to encourage environmental literacy. Using an interdisciplinary approach these activities consistently address the 2012 North Carolina Essential Standards while they encourage each child to explore and experience the natural world.

The target class size and duration of each activity are flexible. The time that will be required for each activity will depend on the educator's requirements and objectives.

This section offers several films and model building activities that may be used multiple times prior to and after the park field trip. These lessons are labeled as pre and post-site activities. The park fieldtrip section includes on-site activities that are designed to build on concepts addressed in the classroom prior to the park visit. However, each lesson may be used as a stand-alone activity in order to meet various pedagogical goals.

Outcomes

First grade students who participate in these activities will be able to:

(1) Describe the stages of plant growth, the physical properties of earth materials, and several useful benefits that earth materials provide.
(2) Each student participant will be able to demonstrate how soil particle sizes affect water holding capacity in various soil samples. Students will also be able to discuss the importance of soil and water for plants life.
(3) Through hand-on experiences, student will be able to discuss the basic needs of plants and animals while they experience the water cycle, photosynthesis and food chains through music and games.
(4) Students will also be able to explain how regional soils differ from one another while making soil maps and models that demonstrate those color and textural differences.

(5) Students will be able to describe the useful benefits that rocks and minerals provide people on the earth.
(6) Students will be able to demonstrate their understanding through model building and active experimentation. Students will also demonstrate their understanding of earth materials by actively experimenting with rocks, crystal growth, and soil water capacity.

North Carolina Essential Standard and Clarifying Objectives

1.L.1 Understand characteristics of various environments and behaviors of humans that enable plants and animals to survive.

1.L.1.1 Recognize that plants and animals need air, water, light (plants only), space, food and shelter and that these may be found in their environment.

1.L.1.2 Give examples of how the needs of different plants and animals can be met by their environments in North Carolina or different places throughout the world.

1. 2 Understand the physical properties of Earth materials that make them useful in different ways.

1.E.2.1 Summarize the physical properties of Earth materials, including rocks, minerals, soils, and water that make them useful in different ways.

1.E.2.2 Compare the properties of soil samples from different places relating their capacity to retain water, nourish and support the growth of certain plants.

1.L.2 Summarize the needs of living organisms for energy and growth.

1.L.2.1 Summarize the basic needs of a variety of different plants (including air, water, nutrients, and light) for energy and growth.

1.L.2.2 Summarize the basic needs of a variety of different animals (including air, water, and food) for energy and growth

Pre-Site Activities

Preparation: The facilitator of these activities should review the individual program instructions and have all necessary materials available for each activity. Materials may be available in the box that you receive from Mt. Jefferson State Natural Area. Materials include 10 bags of small rocks, 30 hand lenses, 10 small magnets, plastic water jars, salt, soil, and a mineral hardness kit. A variety of You Tube short films and power point pages found on enclosed CD or sent by email, and may be used during these activities. An email will be sent to the facilitator with links to the online films. They should be shown on the classroom smart board as part of the following activities.

Procedure: Explain to your class that they are going to be learning about Earth Materials. Next break the words “earth” and “materials” down into easy to understand definitions. Earth is our planet and it is made up of rocks, minerals, water, gasses, life, and a variety of other wonderful things.

Materials are things that are used to make other things. People and animals use materials to make things like houses, nests, walls, beaver dams, cars, and rockets. After you define the terms “earth” and “materials” then introduce your students to the following soil song.

Introduce your students to Soil (dirt)

1. Begin by asking your student if they think soil is important? Sing Banana Slung Band’s song “*Dirt Made My Lunch*” http://www.youtube.com/watch?v=SCeyXW64cns

2. After the song place the soil color and soil texture image on the smart board. (CD)

Concrete Experience

3. Introduce the soil to your class using the three soil textures; *sand, silt,* and *clay*. Find the three small bags of soils sand, silt, and clay. Pour a small sample of each soil texture into each of the labeled cups. Explain that soil particles have three different sizes and those sizes hold the water and nutrients that feed the plants in different ways.

4. Pass around the cups of soil. Each cup will be labeled Sand, Silt, or Clay. Ask the students to feel the difference between the three soil textures (Sand, Silt, Clay). The students should use a magnifying glass to look at the soil color and particle size. Ask the students to try and match the soil sample to the soil color on the smart board. Ask if they notice any differences between the three soils. The students should also feel the difference between each soil texture in regards to rough vs. smooth.

Reflection

5. Next ask the students to think about what soil might be made of? Explain to the students that as rocks become smaller and mix with rotting plants and other materials, they slowly develop into soil. Use smart board to play YouTube "*The Silly Soil Song"*
http://www.youtube.com/watch?v=fAbsHR7b33w

This may help your students reflect on the benefits of the soil building process. Explain that soil is needed for most plants to grow. Explain that soil particles sizes hold water and nutrients in different ways.

Abstract Conceptualization

6. Ask your student if they can name any food that we eat that does not come from soil. Try to get the students pondering the question. Is there any food that does not need soil? “What about ice cream?”… Yes or No? Remind the students that milk come from cows that ate the grass that grew in the soil. And the sugar that makes the ice cream sweet is from a plant that grows in the soil too. Give the students a chance to think of some type of soil independent food. Are there any?

(Other Examples) Pizza has cheese from milk that came from a cow that ate grass that grew in soil. Crust from flour that came from wheat that grew in soil.

Candy has sugar from sugar cane the plant that grows in soil. Apples come from apple tree whose roots are in soil.

Is there a student consensus that soil is an important earth material that we should take care of?

Active Experimentation

7. Explain that scientists have learned that the soil particle size is important because a soil’s size determines how much water can be stored in the soil for plants. Soil particle size also plays a role in how well nutrients stay in soil.

8. Ask the students to hypothesize, what soil size holds more water and more nutrients (sand, silt or clay)?

9. Locate the three clear plastic cups that have small holes in the bottom. The first cup will be half filled with sand, the second one 1/2 filled with silt, and the third one 1/2 full of clay. Next place three empty watertight cups beneath the cups with holes in them. Pour

a half a cup of water slowly into each of the three cups of soil. Ask the students to use a ruler to measure the amount of water that came out the bottom of each of the three cups.

10. Once you determine the results, explain that the sand's big particles make it hold less water and less nutrients. The water passes quickly through the sand. What about the silt and clay? Point out that most soils are usually a mix of all three soil sizes.

Properties of Rocks Activity

Concrete Experience

1. Pass around the bags of rocks and ask the students to notice how different one rock is from the other. Some rocks feel rough and others are smooth. Some rocks are heavy and some are light. The students should take the rocks out of the bags.

2. Ask the students to use their magnifying glasses to look at the rocks. What colors do they see in the rocks? The students should pass the rocks around. All of the bags will have magnets in them and a local rock mineral from White Top Mountain called Magnetite. There will also be a few pieces of volcanic Pumice. The Pumice will float while the other rocks will sink.

The instructor should occasionally remind the students to use the magnifying glasses to look closely at the rocks. Occasionally ask the students to stop and describe the rock that they are holding. Allow a few students to take turns sharing their observations with the class.

3. Ask for a few volunteers to demonstrate the magnetite's magnetic properties with a magnet. Also, ask the students to test rock floating/sinking qualities. Compare the

pumice and another rock using a plastic jar of water. Give the students to an opportunity discover that some rocks float. Students return rock samples.

Reflection

4. What characteristics and differences did they notice about the rocks? Have a class discussion by raising hands (hints below). Rocks are hard and solid. Rocks have different shapes and hold their shape. Rocks can be carved and shaped by nature and by people. Some rocks are heavy and they stay in place unless acted on. Rocks are colorful.

Abstract Conceptualization

5. Now ask the students to think about how rocks can be used by humans or animals. Begin a list of all possible uses for rocks on you classroom smart board. Show the attached YouTube link of a rock crusher at a quarry.

http://www.youtube.com/watch?v=9a_UHOutcjI

People use rocks and gravel to make roads. People use rocks to make buildings. People use rocks to build walls. Fish and crayfish use rocks as shelters in rivers and streams. Land animals use rocks for shelters and dens.

Active Experimentation

6. Give each student a small cup of pebbles that may be used inside the classroom or even better, go outside and ask your students to find a few small rocks. Students may be paired up into teams. After the students locate a few small rocks ask the students to create a model of how rocks can be useful to people. They can create walls, buildings,

roads, chimneys, dams, jewelry, tools, bridges or anything that demonstrates the usefulness of the physical properties of rocks. Take a few photos of the things that the students make with the rocks.

<u>Properties of Minerals</u>

Concrete Experience

1. Place the mineral page up on the smart board. Explain to your students that rocks are made up of minerals. There are thousands of different kinds of minerals on earth and they are natural, unique, nonliving materials. Some minerals like diamonds are very valuable and others like quartz are common. Show the class a small tube of toothpaste. Ask your students if they think minerals are in toothpaste? Explain that the minerals in tooth paste t have come from the earth and they keep our teeth clean. See the Toothpaste information sheet http://www.mii.org/toothpaste.html

2. Hold up each of the minerals in the kit and tell a little about each one. Color, shape or cleavage, hardness, and value may be discussed. It may be helpful to start with the minerals that are commonly found in North Carolina. These include: Clay (Cl), Copper (Cu), Gold (Au), Granite (Gn), Marble (Mr), Mica (Mi), Phosphates (P),Talc (Tc), and Tungsten (W).

3. Pass the minerals around the class. Each student should be given time to touch these minerals and examine them with a magnifying glass. The Magnetite and magnet should also be passed around at this time. Ask the students to look for lines and shapes in the minerals, explain that minerals of the same kind share the same number of sides when they are broken, this property is called cleavage.

4. Demonstrate the streak plate and pass several streak plates around for students to try. Allow the students to try to see mineral colors using the streak plates. The streak plate is a piece of porcelain that the students may scratch with a mineral. This should produce a color on the plate. Students should notice the colors of each sample.

5. Explain that each mineral sample has a specific hardness that ranges from one thru ten. Number one for example is soft Talc while ten is a diamond, the hardest mineral.

Reflection

6. Ask your students to think about how different these minerals are from each other. Explain that there are many other kinds of minerals on earth. Ask them to imagine how many other kinds of minerals exist. Show the Mineral photos on CD. Remind the students that some crystal minerals do grow, but they are non-living things that have unique formulas.

Abstract Conceptualization

7. Read excerpts from *The Magic School Bus Rocky Road Trip* by Judith Bauer Stamper and allow for a classroom discussion about the different kinds of minerals that were mentioned in this fun book.

Active Experimentation

8. Grow your own Halite Crystals. Halite is a crystal mineral that forms when saltwater evaporates. Explain to your students that many minerals form in the earth as crystals, and Halite is one of those minerals. Halite is made from salts. We humans and all animals cannot live without salt.

9. Begin with the four provided containers: two small white tubs and two plastic petri dishes. Because the crystals grow as the water disappears ask your students to nominate and vote on the locations in the class to place the dishes.

10. Once the locations are determined, ask your students to hypothesize which container will have the bigger Halite crystals. Do you think the containers in the warm places will evaporate quicker? Will rapid evaporation form bigger crystals, or will the cooler, slower

forming crystals be the bigger ones? Remember: It is important that, once the containers are in place they should not be moved. This experiment may take up to two weeks. Show your students this You Tube video that demonstrates crystal growth http://www.youtube.com/watch?v=12o4kn-8LzA

11. After the video and your locations are selected, dissolve a 1/2 thimble size amount of sea salt in a cup with two thimbles of warm water. Next pour the mixture into the petri dishes use more salt and water for the tubs. Have the containers in place as you pour in your solution.. Check for results using a magnifying glass or hand lens. Once the crystals form, begin to look for the number of sides each crystal has.

Properties of Water

Concrete Experience

1. Place any appropriate water image up on the Smart Board and begin to introduce the word "water." Explain to your students that the earth and our bodies are made up of mostly water and water is required for any and all life on earth to live.

2. Explain that the same water has been on earth for as long as earth has existed. Water stays on our planet and it also moves from place to place. For this activity the students will become drops of water and see the journey water might take as these drops start to move through an *Incredible Journey*. This activity is listed in The Project Wet Activity Guide. (See the Project Wet link) http://files.dnr.state.mn.us/education_safety/education/project_wet/sample_activity.pdf

3. The stations will be paper plates with pictures of a water location. Water location names will also be labeled on each plate. These stations will include locations like

glaciers, soil, lake, animal, ground water, ocean, clouds, lakes, rivers, plants, fungus, animal, and streams. At each station there will be a cube dice. The divided class should have two or three students at each station at the beginning.

4. The students should be standing in line ready to go on their journey. Remind the class to notice what station they are at. You may go around the stations and ask the first person at each station to say where they are (cloud, ocean, plant, animal etc...).

5. When the activity begins each first person rolls the dice. Then that students goes to that station or stays if the die says stay. Students leave the dice at the station when they move.

Reflection

6. After a few rounds ask a student where they went, you may do this as many times as you like. The process allows the students to see that a drop of water moves through the water cycle. Explain to the student that a fungus is like a mushroom it is not a plant nor is it an animal. Still a fungus needs water too. Sing the Water Cycle Boogie before and/or after this activity. The Water Cycle Boogie link

http://www.youtube.com/watch?v=StCRr6iqHxs

Abstract Conceptualization

7. Explain to the class that water is needed to activate plant seeds and allow them to grow. The water allows the cells to begin to break the seed shell and begin to grow. Show the time-laps video of a seed growing.

http://www.youtube.com/watch?v=eDA8rmUP5ZM

8. Point out that even a fungus needs water. Show the fungus *You Tube*

http://www.youtube.com/watch?v=Evp6oQst0v8

Active Experimentation

9. Prior to beginning this unit the facilitator should ask the students to help set up an experiment by following the directions below.

10. The students should place ¼ of a small packet of activated yeast into an empty dry one liter plastic bottle. The students should also pour four small packets of sugar into the dry bottle. There should be no liquid in the bottle at all. After the sugar and yeast are in the bottle, place a balloon over the lid of the bottle. There should be no reaction because the fungus has no water. The students should note this.

11. Ask two students to take the balloon off the bottle and pour in one cup of warm water into the bottle with the yeast and sugar then put the balloon back on the bottle securely. The water will activate the yeast fungus and the sugar will feed the now active fungus. The fungus will give off a gas carbon dioxide, that's the same air that we breathe out.

12. When the water activates the fungus then the class should watch for the result because the fungus is breathing and making more and more carbon dioxide.

What do you think the balloon will do? ??

Explain that as NASA scientist looks for signs of life on other planets they start by looking for signs of water. Show the Mars Rover video on You Tube. This video is about the search for water, but first explain that there have been several robots sent to Mars by NASA to look for signs of water on Mars. This fast paced video tells the story of just one of these water seeking robots. http://www.youtube.com/watch?v=gwinFP8_qIM

First Grade: Soils

On-site activity

Depending on number of students, there may be a need to divide groups. In this case students will rotate with teacher to the listed stations i.e. Shelter, Trail, and Summit Area.

Concrete Experience

Group 1: Picnic Shelter

1. Give each student a hand lens. Explain that we are going to compare different kinds of soil from a variety of different locations around the country.

Give each student a simple map sheet of the United States. (provided at park)

2. Ask the students to put the student's names on the map. The map will have numbers marked on it in 5 different locations. #1. Rainforest, # 2. Desert, #3. Prairie, # 4. Rocky coast and #5. Appalachian Mountain. Explain that soils are different in different places because of the climate, weather, slope, rock types, water and other factors.

3. Next give each student a set of 5 small pictures and glue sticks. These are photos of the different regions that were just mentioned. Each photo is numbered 1-5. Ask the students to look at the Photo #1. Explain a little about that location in the North West. Continue through each of the photos.

4. Next ask the students to glue the numbered photo to their map over the number on the map, so photo #1 is glued to the number 1 on the map, and photo # 2 is glued to 2 on map and so on. Pass around the numbered cups of soil. Each cup holds a sample of soil from each of the numbered regions. Ask the students to pass the cups around and look at the different colors.

5. After the cups have been passed around one time, take the #1 cup and sprinkle a sample for each student to look at. Ask the students to glue the #1 soil sample onto the region of the map that has #1 photo. Do the same with each cup of soil #1through #5. Try not to cover the photo with the soil.

Reflection

6. Once the five soil samples are glued onto the map ask the students to look at the types of plants that are in the photo. Ask them if the types of plants might be the result of the soil? Or could the soil be the result of the climate and rock types?

Abstract Conceptualization

7. Lead a discussion about soils and plants relationships. Explain that some types of plants do not grow well in all kinds of soils. Soils have unique qualities and characteristics that result from regional differences in climate, weather, topography, and geology. There are a wide variety of plant species on earth and these species often help researchers identify the local soil type, climate, and topography just by observing the plants.

Active Experimentation

8. Once again give each student a map. This map is a map of North Carolina. Hold up a larger version of the map and explain that we are going to look at three-regions of North Carolina: The mountains (here), the coast (beach) and the piedmont (Raleigh). Show the students that there are three numbered regions on their maps. Next pass around the three samples of soil. There will be no numbers on the samples.

9. Ask the students to hypothesize about what soil goes where on the map. You can give clues. What soil is at the coast on the beach? What does your Appalachian mountain soil look like? The students should walk over to the picnic area and look at the soil with hand lenses.

10. Once the students have glued their soil to their map regions then pass out three plant photos (Palm tree, Cotton, Catawba Rhododendron) to glue on to their maps. The students will again have to think about what photo goes where, (help them if needed). Ask the students to share their observations about soil types.

Group #2

1st Grade Soil Program On-site Hike

Facilitator note: During the hike record all student songs on park digital voice recorder. These will be put on CD later for post site in-class activity.

Concrete Experience

1. Begin the hike up the trail. Once the group is far enough from the shelter, stop to explain that this special place is their park. Ask the students if they think the park rangers feed all of the animals here in the park every day? Does someone feed every bird, bug, snake, fox, and skunk? Then where are they getting their food from? Continue up the trail… Point out a red maple tree and ask them is this a food for animals? Do deer eat these trees?

2. Let's make a tree. Ask for a volunteer to be the sun, that person says, "I'm so bright." Next we need two volunteers to be plant leaves. One volunteer says "Clora" and the other says "Phil." Clora & Phil are the green stuff in the leaves. Explain that they also can turn light into food. The facilitator says "Wow- If I could turn light into food I could just live at the beach and surf all day." To demonstrate the amazing power of chlorophyll, the facilitator opens his/her mouth toward the sun…. "Nothing" says the facilitator, "I'm still hungry." Point to Clora and Phil they say their names again.

3. Next we need what? Ask for at least three volunteers to be soil. One is sand, silt, and clay; together they say "Dirt-dirt-dirt."

Ask if dirt is important. This is a review from the pre-site activity. "Did dirt make our pizza?" Ask the student to name any food that they think does not come from dirt (pizza for example). The cheese comes from milk and the milk from the cow that ate the grass that grew in the dirt. Give the students a several tries to come up with a food that does not somehow come from soil.

Then sing the pre-site song "Dirt made my lunch." Ask the student to sing and tell them that we are going to record the song.

4. Continue on with the hike until your next stop and then ask everyone to take their places. Sun, Clora, Phil, Dirt, Dirt, Dirt.

5. Next ask about water. Do plants need water? Ask for three volunteers. They say Trickle, Trickle, Trickle. The facilitator asks where does the water come from?

6. Sing and record the water cycle boogie (song from pre-site): evaporation, condensation, precipitation. Up and down around and around.

7. Now start with the sun and have each player play their part. The facilitator says “We have made a plant.”

8. Point out a few Mountain plants or trees in the area. It’s good to have the students thinking about plant identification. Look at leaf shape, stems, and tree bark.

Reflection

9**.** Continue with the hike and ask the students to think about what might eat a plant. Next stop and introduce the idea that bugs eat plants. Sing and record the insect song *Head Thorax, Abdomen*. This song is sung to the tune song, *Head, Shoulder, Knees, and Toes.* CD with song and lyrics available to borrow from Mt. Jefferson SNA.

10. What other animals might eat plants? What about us? Do we eat plants? Do any of us have a wood stove to keep warm in the winter? Well, the wood we burn is kind-of like a battery that has stored the sun's energy and when we bunt the wood we release the energy.

Abstract Conceptualization

11**.** Out of the park facilitator pack, remove a skull of a beaver and show the teeth. Explain that this is a plant eater. Allow the students to feel the beaver pelt. Explain that the energy from the sun is passed to the plant and then goes to the plant eaters like the beaver. Next show the Coyote skull and teeth, explain that then energy goes next from the plant eater to the meat eater. Other skulls can be used to show this energy transfer idea. Set each plant, skull or fur down in a line demonstrating each part of the energy exchange. Also explain that the animals need safe food, clean water, clean air and safe space too. In order to bring this back to the soil remind the students that the leaves and animals eventually decompose and become a part of the soil, and all these things work together in nature, much like recycling.

Active experimentation

12. Lead the students to the clearing near the park summit.

Assign all students into teams of two. Line up each team on the edge of the tree line where the exposed soil test area is. Ask the students to go to a soil station where there will be two hand lenses, two Petri dishes, and two data sheets for each team.

Each data sheet should have pictures or sketches of common items that the students should look for. There should be a place for a stamp to mark the page when they find an item. These sheets can be made up for each field trip by the lead teacher or ranger to address the particular season or fieldtrip location.

13. Explain that they are looking for the ingredients of Mt. Jefferson's soil. When a student team finds a leaf particle, bug, worm, rock, or change in color in the soil the students raises their hand and the facilitator stamps their individual papers in the appropriate box. The student teams are also asked to make an individual leaf rubbing of a full size leaf while they are at their soil station.

Ask the students to use hand lenses and Popsicle sticks and dig through the soil to see what is in it. The facilitator should walk along the line and be ready to help or celebrate the student's discoveries. Watch for potential teachable moments.

14. If time allows ask the students to stand in a circle and bring a sample of Mt. Jefferson soil up to the circle in their dish. Explain that we are going to find out if all types of soil hold the same amount of water.

15. Ask the students to sit down. Go around to half of the circle and ask half of the students to pour their small soil sample into the sieve #1. Tell the other students to wait. Ask three students to each measure out one cup of water from the water container at the soil area, and put one drop of food dye in it and wait.

16. Next go around the circle with sieve #2 and ask 1/2 of those students to put soil into the sieve then ask the remaining students to pour their soil on the ground and replace it with the same amount of sand from the bag of sand at the test area. Those students pour that sand into Sieve #2. Lastly the facilitator takes sieve #3 and pours sand into sieve #3 to the same level as the other two sieves. At this point sieve #1 will be Mt. Jefferson soil, sieve #2 will be half sand and half Mt. Jefferson soil and sieve # 3 will be all sand.

Ask the students if they think that the three soils in the sieves will hold the same amount of water? This is their hypothesis opportunity!

17. Do the experiments at one side of the circle so all can see. While three students hold the three sieves an additional three students hold one cup each under the sieves to collect and measure the results.

Now the three students with the cups of water slowly pour the water in the sieve while the rest of the students make thunder-storm sounds. Look at the results and lead a discussion about how different soils types are able to hold different amounts of soil. Return to picnic shelter.

First Grade Soils & Earth Materials: Post Site Activity

Concrete Experience

1. Play the CD from the park fieldtrip. The CD should be the voices and songs of your students singing on the field trip. Ask the students to stand up and sing along with the recording and do the dance. Dirt Made My Lunch, Water Cycle Boogie, The insect song: "Head, Thorax, Abdomen." Next hand out each student's data stamp sheets, leaf rubbing, and soil maps. These are the sheets that they made in on their park fieldtrip.

2. Pass out an additional sheet of construction paper and ask the students to make a cover for all of their other activity sheets from their Mt. Jefferson field trip, (soil maps, soil investigation stamp sheet). The students should draw on the inside cover of the sheet a picture of each of the songs that we sang. On the front cover the students should draw a picture of Mt. Jefferson and put their name on their cover sheets.

Reflection

3. Between each of the children's songs, pause the CD and lead a discussion about how each song relates to earth materials, and how important earth's natural resources are. Discuss how important our earth materials are for people and the animals who share our world. Nature sounds recorded at Mt. Jefferson are on the CD after the student songs and these sounds may be listened to while the students make their drawings.

Abstract Conceptualization

4. Remind the students about the field trip plant skit and the things that are necessary for growing plants. They need light, water, air, and soil. Also discuss the ways that nature recycles itself, plant leaves and animal decomposition all play a part in the process to make soil. Show YouTube video http://www.youtube.com/watch?v=3nRVZPJdXOo This film is a "time-laps" of a seedling growing in soil.

Active Experimentation

5. Ask the students to bring to class one small plastic container that was going to be thrown away; the students will need to ask their parent for help finding just the right container. It should be clean and safe to use plastic.

6. Next take the students out the school trail area and fill their container half way with soil. Allow your students to plant bean seeds in their cups. They should plant several seeds that will need to be watered and have sunlight.

7. Measure how many days it take for a seed to sprout and add this data to their soil books. Students should take their seed cup home with their soil book when the unit is finished.

3rd Grade: Landforms and Social Studies Geography

All of these third grade activities were developed to introduce students to Mt. Jefferson's natural resources and to encourage environmental literacy. Using an interdisciplinary approach these activities consistently address the 2012 North Carolina Essential Standards while they encourage each child to explore and experience the natural world.

The target class size and duration of each activity are flexible. The time that will be required for each activity will depend on the educator's requirements and objectives. This section offers several films and model building activities that may be used multiple times prior to and after the park fieldtrip. These lessons are labeled as pre and post-site activities. The park fieldtrip section includes on-site activities that are designed to build on concepts addressed in the classroom prior to the park visit. However, each lesson may be used as a stand-alone activity in order to meet various pedagogical goals.

Outcomes

Third grade students who participate in all of these activities will be able to:

(1) Compare a variety of earth features by creating three-dimensional play-doe models.
(2) Students will also design several Play-doh examples of fresh and salt water sources while paying careful attention to associated land features such as meanders and deltas.
(3) Students will be able to describe their model landform features by using proper landform names.
(4) Each student participant will be able to demonstrate their understanding of absolute and relative locations using a map and comparing the map to direct observation from park overlooks.

(5) Students will also be able to discuss how roads, economic development, and local communities have adapted to and overcome local landforms. Through hand-on experiences, student will be able to demonstrate their knowledge of mapping, contour lines, and map scale.

(6) Students will also be able to explain how landforms have affected the local community's development.

(7) Students will be able to describe how goods come into the local community and how location impacts the movement of goods, people and ideas. Both scientific and social studies standards will be addressed through the use of direct observations from mountain vistas, hands-on modeling, and mapping.

3rd Grade Earth Systems Landforms

North Carolina Essential Standards and Clarifying Objectives

Science Standards

3.E.2 Compare the structures of the Earth's surface using models or three-dimensional diagrams.

3.E.2.1 Compare Earth's saltwater and freshwater features (including oceans, seas, rivers, lakes, ponds, streams, and glaciers).

3.E.2.2 Compare Earth's land features (including volcanoes, mountains, valleys, canyons, caverns, and islands) by using models, pictures, diagrams, and maps

Social Studies Geography and Environmental Literacy

3.G.1 Understand the earth's patterns by using the 5 themes of geography: (location, place, human-environment interaction, movement, and regions).

3.G.1.1 Find absolute and relative locations of places within the local community and region.

3.G.1.3 Exemplify how people adapt to, change and protect the environment to meet their needs.

3.G.1.4 Explain how the movement of goods, people and ideas impact the community.

3.E.1 Understand how the location of regions affects activity in a market economy.

3.E.1.2 Explain how locations of regions and natural resources influence economic development, industries developed around natural resources, rivers and towns.

3.C.1 Understand how diverse cultures are visible in local and regional communities.

Pre-site Activity

Mountain Glacier Model

Procedure

1. (a). Set up your classroom smart board or projector and load the landforms movie into your computer so it is ready to start. (b). Make all of the activity supplies available and ready to use. (c). Locate the north wall in your classroom, and place the north poster on that wall. (d). Select two or three students to help pass out the Play-doh canister boxes, plastic map sheets, and Popsicle sticks (optional) to each of the students.

2. Explain to your classroom students that they are going to be making landforms out of Play-doh, so they will need to clear their desk.

3**.** Begin projecting the virtual landforms glacial video on you classroom smart board. http://www.youtube.com/watch?v=kD5BWgJVR3w *This will be played while you are distributing the activity materials*. Ask the classroom students to look carefully at each of the landforms identified in the video while the activity boxes are being distributed. This may be a boisterous few moments while the activity supplies are being passed out. Remind the students not to open the boxes until the instructions are given to do so. Each box holds four to six canisters of assorted colors of Play-doh. (Canisters each hold 1oz. of Play-doh) "Do not open yet" is printed on each canister box.

4. Ask the students to place the *plastic map sheet* flat on their desk where they are sitting. Ask the students to place the sheet with the North arrow pointing toward the north side of the classroom room. The north wall should be determined prior to asking the students to orient their plastic sheets.

Concrete Experience

5. Ask your students to carefully open their boxes and remove only the brown Play-doh. Ask the students to think about the mountains that they have seen and make their own chain of mountains on the east side of the blue ocean and west of the yellow dry area. In other words ask the students to build their mountain between the blue and the yellow areas on the plastic map sheet - (Blue = Ocean) (Yellow = Dry desert)

Explain to the students that the mountain ridge they are building would likely catch the wet air that continually blows in from the ocean. That moist air drops on the mountain and very little rain from the ocean makes it over and beyond the mountains. That is why the yellow area is dry. In this latitude the wind comes for the west and blows east just about all the time (just like the lower 48 states).

Because these Play-doh mountains are around 14,000 feet above sea level, it is very cold at the mountain tops, so snow and ice have been accumulating up there for a long time. These mountain tops are where you will form your own glacier.

6. Ask the students to make several a small indentions or small dents in the top of their mountains. Now ask your students to remove the white Play-doh, this will be your ice and snow. Ask the students to find the white Play-doh and make a glacier that is cutting its way down the mountain. Make your glacier in a way that you think the glacier would form. Explain that their glacier is long and advancing all-the-way down the mountainside. Ask the students make at least one glacier flow down and out to the ocean. They can make a few ice bergs that float off into the ocean.

Student Reflection

7. Play a recording of glacier calving and mountain winds. Ask your students to put all Play-doh down. Now ask your student to get up and walk around the room and look at the other student's models and think about similarities and differences between the different glaciers. Students can either look from their desks or walk around the classroom.

Abstract Conceptualization

8. Ask the student to think about how high the mountain is, and how far down the glacier has traveled to reach the ocean. What types of plants and animals live near these places? Ask the students to write a few words about their mountain, glacier and ocean. Are the glacial icebergs made up of fresh or salt water? Why?

9**.** Ask your students to think about the following questions: Has the glacier physically changed the mountain? Where the brown and white Play-doh meet what might be piled up along the sides of the glacier? What landform would you think we might see on the mountain, when the glacier is melted away?

Active Experimentation

10. Ask your students to pick-up their white Play-doh from off their mountain (remove their glacier). Now they are going to make a new glacier, but this time use the end of the Popsicle stick as if it were the front of the glacier. Now where your first glacier was, make a trench down the brown mountain and place the white play doe in the trench as you dig down the mountain side. Because a real glacier will weigh millions of tons it would really scour away the rock and soil.

Now with your glacier Popsicle stick, dig a U-shaped valley. The popsicles stick will act like the front of the glacier and dig a trench down the mountain. So, did the glacier and the mountain form another landform? Would the glacier remove rock, plants, and soil as it advances down your mountain? Reflection question to ask students*:* Will glacier and mountain interaction cause other landforms to evolve? Can glaciers cause valleys, lakes, streams, and moraines to form?

Green Mountain Stream

1. Open the green Play-doh. Make a green mountain at the far eastern side of the plastic sheet (the edge of the green). Also make two small hills in the green prairie area on your plastic sheet.

2. Find your blue Play-doh and open it so you can make a stream that makes its way down from your mountain. Make your stream meanders all the way to the ocean. The river should also cut through one of the small hills. The cut through the green hill is forming a canyon. Just like the New River, with its twists and turns make your river twist and turn. It should look like a long line swaying back and forth. Each time you make a meander say, "meander" aloud!

3. Next make two fresh water ponds away from the base of the mountain. They should be about the size of a nickel. Connect one of the ponds to the river.

4. Next make one bigger body of water "called a lake." It should be the size of a quarter and place it away from the mountain. It does not have to be connected to the river. Now make sure that your stream meanders and links to at least one of your ponds.

Student Reflection

5. Play recording of mountain stream, ask your students to put all Play-doh down. Ask your students to think about their models and then take a few minutes and look around at each other's ponds and streams.

(Teachers may read each reflection option)

Reflection Option 1: Where is the stream water flowing from, the green mountain to the ocean or from the ocean to the mountain?

Reflection Option 2: Ask the students to just think about the green mountain, the stream and the lake. What types of plants and animals live near these places?

Reflection Option 3: Do you think that there would be smaller streams that feed the larger stream with additional water somewhere on this model?

Abstract Conceptualization

6. Ask your students to think about the following ideas. Because of gravity, the stream flows down the mountain where sometimes meanders form, as do ponds and lakes. Is your stream carrying sand, silt, and clay particles downstream? Where did these particles come from? Where will all of these particles go? Let's identify the mouth of the river and a make a Delta.

Active Experimentation

7. Ask your students to pick up the Popsicle stick and use only the edge of the side to make a narrow valley that is “V” shaped because this is a river valley. After the “V” shaped valleys are formed place the blue stream along the mountain valley and link it to the rest of the stream. After the mountain valley and stream are completed then we should investigate “Erosion.”

8. Ask your students to break off a few tiny little bits of the green mountain and move them down the stream. All those bits will make their way down stream toward the ocean. Some may even find their way to place where the stream feeds into the ocean. This is called the mouth of the river. Here the fresh water flows into the saltwater. Here we may find a delta. A delta is where all of the tiny particles that were eroded by the river are carried downstream and suddenly drop into the ocean and form a triangle shaped landform called a delta. Try to make a small triangle at the mouth of the river. The particles get carried and spread out into the ocean so the top of the triangle is at the river’s mouth and the base of the triangle is out away from the shoreline.

Islands

Concrete Experience

1. Explain to your students that islands can form in a variety of ways. Our first island that we will make is called a point bar island. These are found along rivers like the New River and other meandering rivers. Point bars form within the meanders. They are along

the inside of the curve of a meander across from the cut bank. So ask your students to locate some of the black Play-doh and make an island in the inside curve of a meander. (Show students a photo of the inside curve of a meander). Is the New River fresh or salt water?

Mangrove Island

2. Some islands form in shallow bays near oceans because plants like the mangrove. The mangrove's roots hold-on to sediments like sand and silt and allow small island also called keys to form. These islands grow bigger as more plant seeds become lodged on the mangrove island. Ask your students to place a few small green play-doh islands near the shoreline of the ocean.

Volcanic Islands

3. Islands like the Hawaiian chain of islands were formed because of lava rock that is forced upward and out of a volcano. As these underwater volcanoes erupt they spread lava that cools; then after each eruption the volcano grows higher until it reaches the surface of the ocean and then plants drift to the island and grow. Build one volcanic island in the middle of the ocean.

Reflection

4. Listen to waves and water on a shore. Ask your students to put all play-doh down. Remind your students that islands are found in rivers, oceans, lakes and bays. Look at your islands and then look around at the islands that the other students have made.

(After a minute +/-) Ask your students to close their eyes and imagine an island surrounded by Saltwater, what kinds of fish and animals would live near your island? (After a minute +/-) Ask your students to imagine an island in a freshwater river. What kinds of animals would you see there?

Abstract Conceptualization

5. Explain brackish water. What would it be like if the fresh and salt water mixed together? What kinds of fish and animal would live there? Is there another type of water besides fresh and salty? Explain estuaries, places like some bays in the outer banks.

Active Experimentation

6. Let’s make another body of water that is the size of a quarter. And call this brackish Bay. It is near the mouth of the river and is connected to the ocean. This bay is a place where the fresh water from the stream mixes with the saltwater from the ocean. This bay’s water is called brackish and that means that it is it’s a mix of fresh and salt water. Ask your student to make an island in this brackish bay with any color of Play-doh they want. This island is in an area where the saltwater and fresh water mix.

Lava Tubes &Caves

Concrete Experience

1. Explain to your students that a Lava Tube sometimes forms when lava flows out of a volcano. The tube forms when the outer part of the lava cools and turns to solid rock. Inside of the cooled rock there is still melted hot lava flowing through the hardened lava

tube. The tube gets longer and longer as the lava stays hot on the inside. Finally the hot lava stops flowing out of the volcano but what remains in the tube still continues to flow out of the other end of the tube. This finally leaves the tube empty in the middle of a rock solid lava tube. After some time goes by, animals and people can explore them.

2. Ask your students to look at their volcanic island. Now ask them to make a small tube out of Play-doh. This will be their lava tube. Lava tubes do not have stalagmites on the ground and stalactites on the ceiling. Lava tubes form without the chemical process that causes stalactites and stalagmites.

Solution Caves

3. Solution Caves are made through a chemical weathering process that dissolves or melts the inside of the rock or mountain. This takes a long, long time. Solution caves can only form if the rock is made of special kinds of rock like limestone. Because we do not have a long, long, time, ask your students to use their Popsicle stick to make a small cave in the green mountain.

Sea Cave

4. Another type of cave is called a sea cave. Sea caves form along the coast of an ocean or sea. The waves and tide from these bodies of water erode away bit by bit parts of the rocks near the ocean. Some of these caves are underwater at high tide. Ask your students to make a small sea cave in the brown mountain at a location where the mountain is close to the ocean.

Reflection 5. Ask your students to put all Play-doh down. Think about your caves and imagine you are visiting a cave. What would be inside the cave? Play cave sounds recording.

Abstract Conceptualization

6. What kind of water would be inside a solution cave on Green Mountain? Would the water in a sea cave be the same kind of water? Do you think it would be fresh or salty? Do caves offer good examples of physical, chemical, or both types of weathering?

Active Experimentation

7. Use your Popsicle stick to make a small “V” shaped valley starting from the front of your cave. If you have any blue Play-doh you can make a small stream called a tributary that feeds water to your meandering river. Many solution caves do have streams that flow out from a cave entrance. The water that flows out often feeds into other creeks and streams. They contribute water to the stream system, and these small streams are called tributaries.

On-site Landforms Activity Third Grade

Mapping our Local Mountain Community

Essential Standards and Clarifying Objectifies

Third Grade Social Studies

Geography and Environmental Literacy

3.G.1 Understand the earth's patterns by using the five themes of geography: location, place, human-environment interaction, movement and regions.

3.G.1.1 Find absolute and relative locations of places within the local community and region.

3.G.1.3 Exemplify how people adapt to, change and protect the environment to meet their needs.

3.G.1.4 Explain how the movement of goods, people and ideas impact the community.

3.E.1 Understand how the location of regions affects activity in a market economy.

3.E.1.2 Explain how locations of regions and natural resources influence economic development (industries developed around natural resources, rivers and coastal towns).

3.C.1 Understand how diverse cultures are visible in local and regional communities

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Activity Preparation

Make two squares out of red traffic cones at the first overlook parking lot. Each square should be approximately 20 feet long and 20 feet wide. 2 (20 x 20) squares. The facilitator should place several pieces of colored chalk inside the two squares. Draw the public library in each square. This will be a point of reference for the mapping activity.

Upon arrival of students to first overlook

1. Board the bus and welcome the students to Mt. Jefferson State Natural Area. Explain that this park is one of many public lands that the students own. Explain the park safety rules to the students.

2. As the students leave the bus have the students count off 1,2,1,2 ask the “ones” to step to the 1’s square and the “twos” to step toward the 2’s square. Allow the students several minutes to become familiar with their new location as they take in the view and find their square. (This should be a boisterous 2-3 minutes, with no running or horseplay).

3. While the students are standing near their square, ask the students to make some observations of the town of west Jefferson that is below them. Ask the student to locate Paddy Mountain. Point it out if they have trouble. Next ask the students to locate Mc Donald's and Ingles. Ask the students to try and find WKSK's Radio tower on Radio Hill. Ask the students to find and point to the public library.

4. Have the students team-up into groups of two or three. Then pass out a compass to each team. Explain that they are going to make two big maps, but we need to have some directional information first. Explain how to hold the compass and then show the students that the red needle points north. Then ask the students to turn the compass dial so North on the dial in lined up with the red arrow.

Each team is given a piece of chalk and asked to draw North, South, East and West arrow below and outside their box. Then the entire square team votes on the most accurate and best drawn compass arrows. The team from each square that wins the compass vote is selected to draw their compass on the blacktop inside the square map in a corner of map.

5. Ask all of the students from the two squares to stand in a line along the east side of their assigned square. Then choose two students from each square to place the yardstick down and begin measuring the distance of the east side between the cones. Once the yard stick is set down for measuring, ask the rest of the students along the line to place a tic or dash at every one foot increment. Students should wait for the yard stick to come to them along the line. Now ask the students to go to the north side of the square and repeated the process. These tic marks will be used later when we discuss scale.

6. Ask the students to get back into their compass teams and line up on the west side of their square. At this time pick up the compass and give each team some chalk and a map card. Explain that they need to draw and label the location that circled on the map printed on their map card. Remind the students that they should look down at the town to find the location of features. Some students may be assigned to draw a road. They can make their drawing as close to the edge of the map as possible without going outside the cone lines. Each structure drawing should be no bigger than a loaf of bread. Draw and label only the circled feature. Try to use the North arrow and Mt. Jefferson to help you find the place you should do your drawing. Remember to look down out at the town below to help you find the location.

Reflection

7. Ask the students to set down the chalk and then they should be seated. This will be a time for discussion and introduction to vocabulary and terms. Ask the students if they know the address or street name of any of the buildings that were drawn? If not then ask a few questions about each of the buildings. Such as, what buildings are on the north side of town? What buildings do you know about on south side?

Explain that places can be described using an absolute location description like a numeric address, street, city, and state. An absolute location could also be a latitude & longitude coordinate.

8. Remind the students that places can also be described using what is known as a relative location. For example we can see the library from here on Mt. Jefferson. So we know the library is west of Mt. Jefferson. The relative location describes where one place is in comparison to some another place. Begin a discussion about relative location and absolute location. Students may look at map cards and identify several street names. Discuss the difference between relative location verses absolute location.

Abstract Conceptualization

9. Introduce the concept of scale in map making and usage. Ask the students to look again over the overlook at the town below and guess how far the Ingles and McDonald's buildings are from the WKSK radio tower on radio hill? After the students respond, explain that those two places are about two miles apart. Now how can they show distance on their maps.

10. Ask your students to go back to their squares and have the compass teams count the number of tic marks that are on the two measured sides of each square (there will be 20 tics or feet on each side of each square).

11. Explain that on this map scale every 10 feet equals one mile, so ask the students to look at the middle of the map. (1/2 way between Mc Donald's and Radio Hill) that distance is ten feet from either side on the map.

12. Now look down to the town and find the halfway point between the real McDonalds and the real radio hill tower. (The real halfway point is one mile on the ground.) So, one mile on the ground will be ten feet on our map.13. Ask your students to get into teams of three again. They are all going to make a map scale indicator anywhere outside of the map. This scale indicator will show what a ½ mile would look like on the map. Remind the students that a mile is ten tics or ten feet, so what would a ½ mile be? It would be half of ten, so ½ mile is five ticks. The scale box should have a line that is five feet long and it should symbolically show that 5 feet equals ½ mile. Use photos of scale if needed.

14. Ask the entire class to look at all of the scale boxes and they should vote for the best scale box. The winning scale box should be placed onto the maps at the bottom.

While the scale boxes are being put into the maps ask all of the students to form two lines and go over to the other map and be seated. The students have now switched map squares. Remember to ask the scale drawers go back to their group and be seated too.

Active Experimentation

15. Explain that they are going to begin a mapping scavenger hunt. The students should follow the directions on the card in order to win the hunt. Ask all the students to get into teams of three, and form a line on the south side of each map.

16. Explain that each team will be given a card with an address on it and a map with their building or landform circled on it. The students must look at the map and the relative direction on the back side of the address card to find the correct building. Then they should use chalk and write the address near their assigned building and then return to the east line. The students can get help reading the card and can ask general questions

17. The object of this activity is to see which map team correctly labels their map square and has all their team members return to the east line first. (No Running)

18. Hand the students their cards and map, allow a minute for reading then say “Begin mapping.”

Cards Types

Library Address, West Side WKSK Radio Tower, north side Ingles parking area, south side, Paddy Mountain, Bluff Mountain, GE Plant, Cemetery by Library, Road from Ingles parking lot to WKSK, Good Old Days Ice Cream Shop, Road from library to good old days.

Contour Mountain Hike

Preparation: Use a GPS unit to determine elevation change up the three tenth of a mile Rhododendron Trail. At every 40 foot increment along the trail place a line of blue flagging across the trail /road. Furthermore at each tenth of a mile place a red flagging marker. These will be used as tangible reminders of scale on elevation during the uphill section of the hike.

1. Ranger meets the bus at picnic area parking lot. Ranger boards the bus and welcome the bus driver, students, and teachers. Explain safety and weather issues and lead students toward map kiosk near the trailhead. *Give each student a small park map and a small pencil or crayon for notes.*

2. Explain to the students that they are going be hiking to a beautiful place called Luther Rock. But in order to get there, we need to hike up the mountain. Ask the students to take a look at the map. Ask if the map seems to look flat, but the mountain is not flat. So how do we know how high we are going to be hiking? How do people communicate elevation on maps? How do we know how far up the mountain we are going to be hiking?

3. Point to the contour lines on the kiosk map. Explain that each line represents a 40-foot change in elevation. Ask the students to notice that the trail they are going to hike up crosses the brown contour lines. What does this mean?

Concrete Experience

4. Inform the students about the red and blue markers that are on the trail, and how they represent two things. The red flagging marks each tenth of a mile we have walked, and the blue represents a contour line. The blue markers are places at every 40 foot change in elevation. Ask the students to count and record the flagging markers they pass as they hike.

5. Begin the hike at a brisk pace up the Rhododendron Trail. Ask the students if they can feel the elevation in their muscles as they climb? As the students reach the first contour line ask the students to explain what this line represents. Do the same with the Red tenths markers. Ask the students to keep track of the number of flagging markers we encounter along our way.

Reflection

6. Upon arrival at the ridge. Ask the students to find their maps and point out the contour interval again and the description on the map that states contour interval 40 feet. Explain again briefly that each time you cross a contour line on this map that that line is a change in elevation of 40 feet. Point out where the lines are close together the mountain is steep and where the lines are spread out the mountain is gentle. Ask the students if they noticed the change in elevation?

Abstract Conceptualization

7. Point out that we are almost on the ridgeline. Explain that the ridge and the trail do not go up or down until we go out onto Luther Rock. Ask the students to point out the trail on the map. Does it cross any contour lines? Ask the students if they think we will see any more blue contour flags on the trail.

Experimentation

8. Using the student's maps ask the students to give a report about the number of red flagging tapes they had counted so far? How many blue flags have they counted so far?

9. Ask the students to calculate the elevation that we have gained from our hike up from the parking lot to this ridgeline? Forty multiplied by the number of contour lines counted will be our elevation gained. Formula: CI x CL = E thus "CL" number being contour lines and "E" being elevation difference. "CI being Contour Interval set at 40 feet.

10. Remind the students that they started at the parking lot where the elevation was 4300 feet. Ask the students to calculate our current elevation. Add 4300 plus elevation gained. That will give us our elevation in feet above sea level? Ask the students to determine the distance that we walked from the kiosk to the ridgeline.

11. Add the number of red flagging markers. Each of these is a tenth of a mile. Remind the students that five tenths is one half of a mile. Document the elevation results for gained elevation and distance walked. Put results on the student map data sheets.

People and Landforms Hike

Concrete Experience

Begin a new hike at the ridgeline trail. Each stop allow for a discussion about how people had to overcome and adapt to the physical characteristics of this area 100 or even 1000 years “ago.” Remind the class that this was once an isolated region known as the Lost Province.

1. Begin the hike by pointing out the new tower. Explain this mountain because of its height was a great place to have a fire tower. Distant communities like Lancing, Beaver Creek, Orion, Ore Knob, and Crumpler could all be seen from the fire tower and if a fire was spotted then authorities were notified.
2. Explain that ridge is the top of the mountain, asks the student to notice that there are several valleys on both sides of this mountain. Ask the students to think about living here in this region 100 years ago. Where would they rather live back then, on the mountain top or in the valley?
3. Point out that the water tank and the mountain landform allows rangers to use gravity as tool carry water down to our old bathhouse.
4. Ask the students to think about the things that they would need to find to live if they lived here 100 years ago. How would these mountains impact their lives?
5. Ask the students to look out into the distant valleys and imagine not having a car or a bus but still needing to visit family and friends across the mountains.

6. Upon reaching Luther Rock spur trail allow the students to draw in several mountain details on their maps. (rock outcrops, alcoves, hills, old trees, vistas)

7. Explain the safety rules for hiking out onto the rocks. Ask for two volunteers to help as junior rangers. Ask the two junior rangers to stand at the side of the trail and stop each student and make sure each student can see the meanders of the new river.

Reflection

8. As each student makes their way to Luther Rock they will all be seated and there will be a one or two minute moment of silence. Ask the students to look down at the mountains and valleys surrounding the town of Jefferson and ponder why this area was once called "The Lost Province"

Abstract Conceptualization

9. Read a small excerpt from *Dr. Elijah Mitchell's* diary and Moravian Bishop, *August Gotlieb Spangenberg*, the Moravian Bishop in America or play recording of the reading with digital voice recorder. Ask the students to look down and notice the motion of traffic around town.

- What seems to be the greatest barriers to connecting this place to other people and places? (Mountains)
- Ask the students if the mountains would have affected the ways that this community had grown and developed over the years?
- Was there a train that traveled from Abington to Todd that passed through West Jefferson?
- Why was the train called the Virginia Creeper?
- Notice the roads and how they follow the sides and edges of the mountains.
- Mention that from this place we can see Virginia, Tennessee, and North Carolina.

Active Experimentation

Pass out transparencies and pens to each of the students. Some mountains and landmarks are on already printed on the transparency. Ask the students them to hold up their transparencies and line them up with the landscape below. Once they are lined up, have them draw in some of the mountains, valleys, streams, and the river.

10. Ask the students to look for ways that people have adapted to use landforms, for their advantage (water tank on hill, antenna on mountain, cows grazing on steep hills, ponds for recreation, fields for Christmas trees, valleys for stores and roads) mark these things on the transparency.

11. Next ask the students to look at the mountains and rivers as landforms that have isolated our community.

- How did people in Ashe County overcome the isolation that was caused by the mountains? Examples include: roads, the small airport, helicopter pad, horses, and canoe on river.
- Draw an arrow to show how food other goods come into our community from this side of the mountain. What kind of places do most people get their food and clothing today? Draw in and label if you can see any. Where did food and clothing come from 100 years ago when the area was the lost Provence?

Wrap up activity

Gather up all materials and lead group back to main trail.

If time allows begin a discussion with several stops to discuss how the mountain landforms provided people with food, medicine, shelter, and clothing long ago when this was the Lost Province.

Post-site Activity

Third Grade Landforms

Concrete Experience

1. Watch the official New River /Mt. Jefferson film *A Long and Winding Journey*, http://www.youtube.com/watch?v=-jLAkzZsNZ8 This eleven minute award winning film uses beautiful images to tell the story of Ashe County from a landform perspective. The film explains the history of the new river and explores the impact that the mountains had in isolating the region from the rest of the world.

Reflection

2. Lead a discussion about the film and ask the students to think about and list the ways that people entered into this once very remote place (foot, canoe, train, car).

Abstract Conceptualization

3. Explain to your class that the mountains have changed greatly in the minds of many people. Today mountains like Mt. Jefferson are considered to be valuable for development. But 100 years ago mountaintops were considered to be too difficult to live on because of weather and lack of roads.

Active Experimentation

4. Ask the students to compose a poem or a story about a place that is isolated by several landforms. This may be a fictional place so the students may us as may landforms as possible in their narrative.

5. Ask your students to consider talking with their grandparents or parents about how mountains and other landforms affected their lives when they were growing up. If the student's grandparents are local they might ask what they remember about the area before there were so many roads. Students may take notes about their conversations or record their talks. Students' who are not local should be encouraged to call their grandparents or other relative and ask them about how landforms like, mountains, rivers, glacier, oceans, have affected their lives years ago.

Third Grade: Soils & Plants

Third grade activities and outcomes Soils & Plants

These third grade activities were developed to introduce students to Mt. Jefferson's natural resources and to encourage environmental literacy. Using an interdisciplinary approach these activities consistently address the 2012 North Carolina Essential Standards, while they encourage each student to explore and experience the natural world here in Ashe County.

The target class size and duration of each activity are flexible. The time that will be required for each activity will depend on the educator's requirements and objectives. This section offers several films and model building activities that may be used multiple times prior to and after the park field trip. These lessons are labeled as pre and post-site activities. The park fieldtrip section includes on-site activities that are designed to build on concepts addressed in the classroom prior to the park visit. However, each lesson may be used as a stand-alone activity in order to meet various pedagogical goals.

Outcomes

Third grade students who participate in these activities will be able to:

(1) Describe the basic parts and function of plants.
(2) Each student participant will be able to demonstrate through a skit the function of roots, stems, leaves and flowers.
(3) Students will also be able to discuss the life cycle of plants as well as the environmental factors that contribute to healthy plant growth.

(4) Through hand-on experiences and field data analysis, student will be able identify and scientifically describe soil characteristics such as color, temperature, moisture, pH, and texture.
(5) Students will also be able to explain how soils differ from one another as they experiment with a range of local soil and plant communities.
(6) Each student will plant several seeds and compare their soil properties to their seed's growth.
(7) Students will be able to analyze and describe several soil samples from different elevations using various measuring tools.
(8) Students will determine several soil samples' relative water holding capacity and compare that to the soil's sand, silt, and clay content.
(9) Students will be able to compare and describe soil samples from diverse elevations, slope angles, and geological environments.

North Carolina Essential Standards and Clarifying Objectives

3.L.2 Understand how plants survive in their environments**.**

3.L.2.1 Remember the function of the following structures as it relates to the survival of plants in their environments:

• Roots – absorb nutrients

• Stems – provide support

• Leaves – synthesize food

• Flowers – attract pollinators and produce seeds for reproduction

3.L.2.2 Explain how environmental conditions determine how well plants grow.

3.L.2.3 Summarize the distinct stages of the life cycle of seed plants.

3.L.2.4 Explain how the basic properties (texture and capacity to hold water) and components (sand, clay and humus) of soil determine the ability of soil to support the growth and survival of many plants.

Pre-Site Activity

Concrete Experience

Facilitator note: Because this is a plant activity there will be need to have sunlight available for the solar panel to function. Panel and location should be tested prior to doing the activity. Explain to the class that we are going to be building a plant model to learn about the different parts and functions of plant parts.

1. Begin by selecting four students to be the soil. These four students will be sitting on the ground. They will each have a soil sign that says sand, silt, clay, or humus.

2. Next will be the plant's root system. Select four more students. These four students will sit in chairs behind the soil students and will each hold a long straw that has long strands of yarn strings taped to the straw.

3. Once in place instruct each root student to pass their root strands to the soil and the soil will hold the roots. The roots then say, "yummy, nutrients, yummy water yummy, nutrients, yummy, water." Explain that the roots are absorbing nutrients and water from the soil.

4. Next are the four students who play the stems. The stem students will be standing above the sitting roots. These students will hold long tubes up. The tubes represent the plant's stems (wrapping paper tubes would be great) The stems are support the plant and allowing for water movement. The stems say, "I'm here for you"," You have all my support", "I'm here for you."

5. Finally, select four to six students to become leaves. These students will be holding green cardboard shaped leaves. Some leaves in this model will have solar panels that have wires attached to the panels. These wires are attached to the flowers.

6. Each leaf student holds onto the stem with one hand and their leaf with the other and they say; "Chlorophyll makes food and oxygen using light." "Chlorophyll makes food and oxygen using light."

7. Finally, choose three students to be flowers. These three students hold the cardboard flower that is attached to the solar panels on the leaves. The flowers have a small bug attracting flashing light in the center that is connected to the wires from the solar panels. Explain that the flashing flowers hold seeds and pollen and the flower attracts insects. Seeds are also carried by the wind.

Reflection

8. Lead a discussion about each part of the plant. Begin with the roots. Ask the students to think about how the roots take in nutrients from the soil. Next the stem is reflected on, and its ability to support the plant and transport water.

9. Discuss the leaves and why we used solar panels in this model. Ask the students to think about how wonderful it would be if we could convert light into food. The facilitator might demonstrate this by saying that she/ he is hungry and then the facilitator opens their mouth toward a window in an attempt to get food from the sun. I just can't get food from the sun. Finally lead a discussion about the flowers and ask the students why flowers are so important to plants. (Seeds, pollen makes more plants)

Abstract Conceptualization

10. Using the smart board show the class the You Tube links that show the growth of a seed.

Film 1. Time lapse http://www.youtube.com/watch?v=eDA8rmUP5ZM

Film 2. Seed lapse

http://www.youtube.com/watch?NR=1&v=fPTJ3qD1ikk&feature=fvwp

Explain that plants go through several changes during their life cycle. Seeds have a shell and water activates the inside growth of the seed causing germination that turn into seedlings and then plant grow and make flowers that make more seeds and more plants.

11. Ask the students to notice the differences between the plant environments in the two time lapse videos. Look at the different types of environments that the seeds are growing in. The soils in the videos are not same; explain that different environmental conditions affect the health and growth of plants. Some differences are more extreme than others.

Active Experimentation

Preparation: A few days prior to this pre-site program experiment, ask each student to bring in a small bag of soil from his or her yard at home. Teacher may distribute labeled zip-lock bags or cups with the students name on them in order to limit the amount of soil that comes to school.

12. Prior to planting the seeds for the experiment, the facilitator with help from the students will demonstrate soil-testing methods on several of the soils samples that the students have brought from home. These soil-testing methods will be used on the field

trip. This pre-site activity will identify some of differences between the student’s soils and also prepare the students for the field trip soil-testing activities.

13. Each of the students should have time to examine the other soils with hand lenses. A regional map may also be created on smart board to display the general areas that the soils come from. A map may help to identify any similar environmental factors that may exist between soils that demonstrate similar properties. This should be a very basic generalized local map using common landmarks and topographic features.

14. Students then carefully plant two bean seeds in their labeled cup. Next place the cups in the same general location. After the seeds are planted ask the students to take a few moments and walk around and look at the different soils in the cups. Do they detect any visible differences in the soil like color or soil particle size?

15. Over the next week the students should water all the plants at the same time with the same amount of water. The only different factor should be the soil types in the cups.

16. Next, the facilitator reviews the student’s hypothesis regarding environmental factors and plant growth.

- How many students think there will be little difference between plants?
- How many students think one particular soil will make a particular plant thrive?

17. Gather as much detail about the students’ hypothesis as possible. Then using the smart board, show the class the two short seed films again. Show the time lapse growth of a seed.

18. Point out during the video that pants go through several changes during their life cycle. Seeds have a shell however water activates the growth inside of the seed. This begins germination. The plant flowers, grows, and makes more seeds.

19. After a few days begin watching the cups and look for the first sign of germination and growth. Record the day and cups that sprout first. Discuss the hypotheses and results.

- Ask the students if they think that the environmental factor, soil had an impact.
- Ask the students if they think a lack of water, or light would affect the growth results.

Third Grade Soils

On-Site Activities

Upon arrival at the park the bus will proceed to the First Overlook. The facilitator will board the bus and explain the purpose of this stop and the methods that will be used to conduct soil research. As the students leave the bus they are to be dived up into teams of four students. Each team of four students will be given a pouch and a clipboard.

The students will then hike into the forest along the park trail. Their elevation is approximately 3700 ft. above sea level. They will find the established soil test stations on the west-facing slope of the mountain. Each team of students will be responsible for collecting data from their own station. Data collected should at least include soil color, moisture, temperature, possible soil texture, and a description of plants, roots, and rocks found in test soil area.

Upon returning to the bus the ranger will explain that our soil research fieldtrip will continue near the summit of the mountain. The summit is approximately 1000 feet higher above the First Overlook and our test area is on a slope that faces northeast. The students will hike to the Second Overlook soil test location near the mountain top, 4683 feet above sea level. Once we have collected all of our data we will compare our results briefly at the picnic shelter and then in more detail during the post-site activity in the classroom.

Concrete Experience

1. Use only 1/3 of the total field trip time at the First Overlook. Lead teams of students along the trail to soil test areas. At each sample location assign a team to that sample area and continue hiking on the trail until all teams are assigned. Remind the students to record their soil data on data sheets located on their clip boards.

2. As soon as the soil data is collected lead the students back to the bus. Remind the students to keep track of their team members and the equipment that they are using.

3. Upon arrival at the picnic parking lot lead the students to the kiosk for a brief trail orientation and explain where the teams are going to be collecting additional data.

4. Lead the students to the higher soil test sites at 4683 ft. on the northwest slope and begin testing soil and recording data. The students will be conducting the same test at the summit area as they did at the First overlook trail area.

5. Monitor student progress and be attentive to questions and teachable moments.

6. Conduct each test and record data collected on data sheet or notebook page during fieldtrip. Soil color: students observe soil sample’s dominant color and compare it to a

soil color sheet and record soil color Mussel number listed on the sheet. All sheets will be provided upon arrival to State Natural Area.

7. Soil texture: determine what particle sizes are in the soil sample. Use the soil texture by feel method. This is a method uses a dichotomous key provided on fieldtrip. Soil texture method and settling method may also be discussed.

8. Soil moisture may be determined by using a school or park office microwave oven and a scale. The park ranger may facilitate this method during field trip.

- Locate a microwave safe container, weigh the empty container and record data.
- Collect a soil sample and place in container. Weigh the container with soil sample together and record data.
- Microwave the sample for several minutes. Remove and use caution the sample will be hot, allow for cooling visually inspect for moisture.
- Microwave again until dry. Measure container with dry soil.
- The difference between the recorded weight and the current weight is the moisture content that was in the soil sample.

9. Record soil density and moisture. This will be a good way to compare soil characteristics in high traffic and low traffic areas. Is the soil loose, friable, firm, and very firm?

10. Record soil temperature use the provided thermometer. Record Number of roots, rocks, worms in sample area. Record elevation, slope direction, plant cover and types.

11. Collect one sample from the 1st overlook and the summit area for the final experiment.

Reflection

12. Upon completion of the data collection at the summit area ask the students to leave their equipment at the site and hike to the rocky outcrop Luther Rock. Point-out the

weather tower and explain to the students that soil temperature and soil moisture are constantly being measured and posted on the internet at http://www.nc-climate.ncsu.edu/cronos/index.php?station=JEFF&temporal=H The student will be able to compare their data to the tower data back at school online.

13. The facilitator begins the hike to Luther Rock. During the hike the students should be asked to think about the different locations where soil samples had been taken today. What words can be used to describe the environmental factors in each site?

14. Upon the safe arrival and seating of students at Luther Rock allow for a few moments of quiet to reflect on the view and elevation.

Abstract Conceptualization

15. Lead a discussion at Luther Rock that may include; the ability of soil textures, sand, silt and clay and the ability to hold water. Also discuss some of the effects that slope, elevation, and aspect may have on the environmental factors of plants and soil. Discuss Catawba Rhododendron as an example of a higher elevation plant. Discuss Amphibolite and soil acidity. Also discuss the sun its effect on the different sides of the mountain. Return to the picnic shelter and return test pouches.

Active Experimentation

16. Begin the experiment by using a chart and ask the students to help list the differences between the two sample locations. The students should identify the different environmental conditions. Introduce the students to the soil chemistry test kits. Explain that various minerals are in soils and these are also environmental factors that impact plant growth. These kits will help us identity differences between the soils that are not always visible. Ask for eight volunteers to conduct the chemical testing. The tests will include pH (acidity) Nitrogen, Phosphorus, and Potash.

The students should be asked to hypothesize, based on their experience if either location seemed to have the richer soil.

Remind the students that plants will compete for survival based on environmental factors and those plants that cannot tolerate various soil conditions will not be able to out compete those plants that can tolerate a variety of soil conditions.

17. Divide the eight students into two teams: sample #1 (First Overlook soil) and sample #2 (Summit Soil). Select two students to conduct each test. There are eight tubes, each student team will put their soil sample into the plastic test tube and add test powder and water. This will be done by each of the student teams.

18. The soil sample #1 students and their test tubes should be at their own picnic table and the soil sample #2 students and their test tubes should also be at their own table. All tubes should be labeled either #1 or #2. Also each tube will have a different color lid that corresponds to the type of test that is being conducted.

19. After the soil samples are in the tubes with the activator and water, place the labeled tubes in a plastic box and explain that the test tubes will need to sit for 24 hours or more in order to see the results clearly. The labeled soil texture settling tubes will also need to sit in an undisturbed location for at least 24 hours also.

20. Explain that the results will be discussed in the classroom during the post-site activity. Allow time for questions and present a park field trip conclusion. Remind the class about viewing to the park's tower's web page to see real time and recorded soil and weather data at:

http://www.nc-climate.ncsu.edu/cronos/index.php?station=JEFF&temporal=H

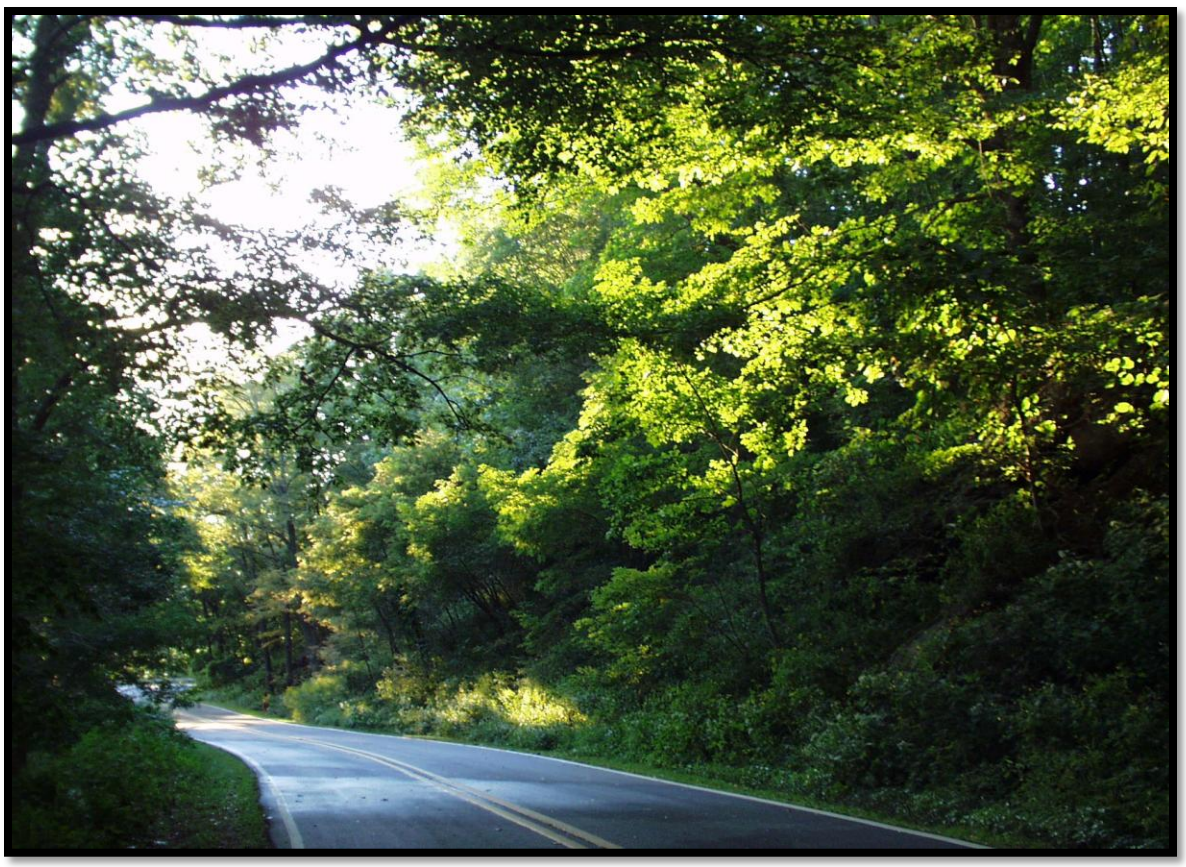
Post site Activity

Third Grade Soils

Concrete Experience

1. Carefully display the sample area test tubes from the First Overlook and the summit area. Establish two display stations, one for the Sample #1 from First Overlook sample test tubes and one for the sample #2 Summit Area test tubes. The soil in all tubes should be settled and indication colors will be present to identify the test being conducted in each tube.
2. Display the soil texture test tubes and the soil chemistry tubes. However keep Sample #1 First Overlook test tubes separated from the Summit Area Sample #2 test tubes. Place the tubes on a table securely and allow the students to come up and observe each station's soil results.
3. Make sure that there is a ruler near the sediment test tubes so the students can measure and estimate the amount of sand, silt and clay is in each sample. Remind the class that the material on the bottom of the sediment tube is likely to be sand because those are the largest particle sizes. The next will be silt, and finally clay will be at the top. Ask the students to observe and then estimate the percentage of each layer in the tube.
4. Ask the students to bring a pencil and paper and record each of the soil chemistry results. Remind the students to keep the results in two separate sections of their paper. Section #1 will be the First Overlook and section# 2 will be the Summit Area.

5. As the students make notes of what they observe and remind the class to use the color key beside each test tube in order to interpret the colors into low, medium, or high. Ask the students to record the pH or acidity of the soil. Remind the class that that seven is neutral and numbers lower the number are the stronger the acids and numbers above 7 are a base. When the students have completed their data interpretation ask them to be seated, and be ready to communicate their recorded observations. List the results on the smart board in two columns First Overlook vs. Summit. Use tower web page data also at http://www.nc-climate.ncsu.edu/cronos/index.php?station=JEFF&temporal=H



Reflection

6. Ask the students to look for any big differences in the results of two test areas. Why do you think there are any differences in the test results?

7. Lead a discussion about the environmental factors and differences between soil test areas. Use the smart board to diagram and discuss aspect. Draw a mountain with North, South, East, and West. Explain that aspect has a big influence on the amount of sunlight and severity of weather that a location mountain side receives. Point out that south and west slopes are hotter and dryer. The First Overlook is a west south-west slope. Explain that ridge line soils tend to lose water and bottom lands tend to hold water.

Abstract Conceptualization

8. Review the soil texture sand, silt, clay and humus. Remind the students that clay and humus hold the most water; silt holds less, while sand holds the least amount of water.

9. Begin a discussion about the test tube results starting with soil texture percentages. Based on the students' findings which of the Mt. Jefferson soil samples should hold the most water?

10. Explain that Nitrogen and Phosphorus are very important plant nutrients. Ask the students to discuss their test tube Nitrogen, Phosphorous and Potash results. Compare the results from the two test sites.

11. Remind the class the mountain's geology is dominated by Amphibolite, and this rock makes the soil less acidic.

12. Ask each student to compile their data sheets, and notes into team packets. Ask each student to make a drawing or map of the Mt. Jefferson soil test sites and staple this packet together to be used for future discussion.

Active Experimentation

13. Continue to monitor classroom plant growth. Test the nutrient levels of the best growing plants and compare those to the plants that do not grow as well. Depending on the results of the nutrient tests, hypothesize if you think there is a relationship between environmental conditions such as soil nutrients and plant growth.

Fourth Grade: Landforms and Rocks

Landforms & Rocks science and social studies activities

All of these fourth grade activities were developed to introduce students to Mt. Jefferson's natural resources and to encourage environmental literacy. Using an interdisciplinary approach these activities consistently address the 2012 North Carolina Essential Standards while they encourage each student to explore and experience the natural world.

The target class size and duration of each activity are flexible. The time that will be required for each activity will depend on the educator's requirements and objectives. This section offers several films and model building activities that may be used multiple times prior to and after the park fieldtrip. These lessons are labeled as pre and post-site activities. The park fieldtrip section includes on-site activities that are designed to build on concepts addressed in the classroom prior to the park visit. However, each lesson may be used as a stand-alone activity in order to meet various pedagogical goals.

Outcomes

Fourth grade students who participate in these activities will be able to:

(1) Describe erosion and weathering and correctly describe the differences between the two different processes.
(2) Each student participant will be able to kinesthetically demonstrate how weathering breaks the rock and then erosion moves those materials away. Students will conduct experiments that explore chemical and physical weathering using models.
(3) Each student will construct a model and then cause weathering to break down various three dimensional models using baking soda, Play-doh and vinegar. Students will conduct simple pH experiments and then discuss the pH scale.

(4) Each participant will be able to explain some of the differences between physical and chemicals weathering.
(5) All participants will be able to list the three basic rock types, and describe the basic process that formed each of those rock types. Through hand-on experiences, student will be able to discuss the importance of silt fences in regards to human activity and environmental stewardship.
(6) Students will be able to list several natural resources known to be available to humans that have lived in this region during the past 7000 years.
(7) Students will be able to describe various uses of natural resources that are in the area and can be seen from the park overlook.
(8) Each student will have the opportunity to then discuss various natural resource uses and environmental modifications that have made in the area and are visible from the park.

North Carolina Clarifying Objective Science and Social studies

4.E.2.3 Give examples of how the surface of the earth changes due to slow processes such as erosion and weathering, and rapid processes such as landslides, volcanic eruptions, and earthquakes.

4.P.2.3 Classify rocks as metamorphic, sedimentary or igneous based on their composition, how they are formed and the processes that create them.

4.G.1Understand how human, environmental and technological factors affect the growth and development of North Carolina

4.G.1.2 Explain the impact that human activity has on the availability of natural resources in North Carolina.

4.G.1.3.Exemplify the interactions of various peoples, places and cultures in terms of adaptation and modification of the environment.

Pre-site Activity

Fieldtrip Vocabulary Introduction and Discussion

- Erosion is the process that causes earth materials to exit a location. Exit and Erosion both begin with the letter "E" Erosion is the exiting of materials from one place to another. Erosion can be caused by wind, water, and gravity.
- Weathering is a process that breaks, splits, dissolves, or loosens a earth material. Weathering breaks down the rocks, and minerals, but it does not move the material.
- There are two main types of weathering: *chemical and physical*.
- Chemical weathering is a process that chemically dissolves a rock or other earth materials. It may include dissolving the materials that incase and surround other rocks. An example of chemical weathering includes the process that dissolves rock outcrops and makes some caves. Slightly acidic water dissolves rocks over eons of time to form caves. Chemical weathering also include acid rain and oxidation, or rusting of metals in the rock.
- Physical weathering is a natural process that physically breaks rocks, minerals and soils into smaller particles.
- Examples of physical weathering include Frost Wedging. Frost Wedging happens when water seeps into a space in a rock. The ice freezes and expands and physically breaks the rocks. Frost Wedging is common on Mt. Jefferson SNA.

Concrete Experience

1. Begin by explaining to your students the difference between physical and chemical weathering. Tell your class that we are going to look at chemical weathering. Most chemical weathering is commonly caused by acids, like acid rain, but there are other types of chemical weathering like oxidation commonly known as rust. Pass around a rock or red soil with signs of oxidation.

2. Introduce acids. Using the smart board show your students some photos of examples of chemical weathering like caves.

3. This lesson on acids may include an introduction to the pH scale and litmus paper. Write the numbers 0-14 on the board and explain that every number below 7 is an acid and every number above seven is a base. Seven is in the middle between zero and fourteen. Seven is called neutral. How do we measure acids and bases? One way is litmus paper. When we dip this paper into a liquid it will change colors. The colors tell us if something is an acid or a base. Other tests include a liquid pH indicator solution and digital pH indicator devices.

4. Ask a several students to test some samples of different liquids from around the classroom. Perhaps the water from the classroom faucet, fruit juice, and water from someone's drinking bottle. Also test the pH of the vinegar in the activity kit.

5. Write a list of the things you test and record the pH numbers. You may establish teams to take samples, to test, and teams to record. *All materials that will be tested must be safe* ***non-toxic*** *household materials.*

6. Next demonstrate physical weathering. Ask for several volunteers to come up to the front of the class. Give each student an earth tone crayon and a pencil sharpener.

7. Ask the students to sharpen the crayons over a pie pan. Explain that the process that is breaking down the crayon is physical NOT chemical.

8. Show the class the pie pan and explain that the particles may now be moved and that is the erosion of a physically weathered rock or a crayon.

Reflection

9. Ask the students to think about differences between physical and chemical weathering in nature. Explain that Mt. Jefferson is made of a rock that does not react to chemicals, so most of the weathering on Mt. Jefferson is physical. Show the original film about frost wedging (see Frost Wedging DVD included).

Abstract Conceptualization

10. Explain to your class that some types of rocks do react to acids and other rocks and materials do not, at least not very much. So if there was a mountain made of rocks that were made of limestone, or some other acid reactive material, then there would likely be chemical weathering occurring there.

11. If you would like to expand into more chemistry, then explain to your class that acids do form naturally in the sky as water (H2O) and Carbon Dioxide (CO2). These chemically combine to form Carbonic acid.

13. This would be similar to a person blowing our breath into a straw that is in a bottle of water. The H20 combines with the CO2 and forms H2CO3 Carbonic acid.

Active Experimentation

14. Ask your students, what do they think would happen if there was a mountain that was partially made up of an acid reactive rock and was also made up of a non-reactive rock? Let’s find out what might happen.

15. Begin this activity by having your students' to pair up into teams of two or three. Pass out to each team (1) Petri dish, (1) Play-doh cup, (1) one plastic dropper, (1) Pack of backing soda.

16. Explain to your students that they should to make a mountain with the play-doh using all of their Play-doh. Then set their Play-doh mountain on the plastic lid that the play doe came in. Next ask one student from each team to go to the sink or an established bucket and get only 2 or 3 drops of water and put it in their dropper (just 2 or 3 drops) If any student uses too much then they will have a long wait to do the activity. The water is going to be mixed with the baking soda to make a thick paste.

17. Making the baking soda paste. Place one or two drops in the Petri dish and mix the water with the baking soda. You can use the other end of the dropper or a pencil to mix the baking soda with the water. What you want to make is a thick paste. Once you have the paste on one side of the dish then put your Play-doh Mountain in the center of the Petri dish.

18. Using a sliver of paper, the end of the dropper, or your fingers smear, pile, or just dump, as much of your baking soda paste as you can on your play-doh mountain. This paste will dry and become the outer rock layer of your mountain. Allow 2-3 min. to dry.

19. While the paste is drying, one student from each team should bring their plastic dropper up to the teacher and get two or three drops of Acetic Acid – Vinegar. Once the baking soda paste is a dry shell over your mountain you are ready to begin. Drop only one drop of vinegar. Next drop another drop. Watch what happens. Think about chemical weathering. Notice if the reaction happens in one place or many. Do you think the material on a real mountain, once loosened might move down slope?

What force is already acting on the mountain before the chemical weathering happens? (Gravity) What type of weathering is this? (Chemical)

Repeat the dripping process and then ask the students to report what they saw.

4th Grade Landforms

On-Site Activity I

The onsite program at Mt. Jefferson partially focuses on landform related activities that address both 4th grade science and Social Studies Clarifying Objectives.

1. This field trip begins at the park entrance. At this point the teacher is asked to announce that they have entered the park, this is public land and we will find out later why this land is not being developed. Welcome the students to their park.

2. At the First Overlook the bus will stop and park.

Introduction: The facilitator will board the bus and welcome the class to the park and will explain to the students that they do not need to bring anything except cameras and jackets. When the students leave the bus, they are asked to stay between the red cones and the overlook. Students are also asked not to climb on the guardrail. Before the students leave the bus ask them to look for any signs of human impact.

Concrete Experience

3. As the students leave the bus allow them to have time to look out at the awesome view. This is an opportunity to view a variety of mountain valley and peaks from a high elevation. Lead the students on a short hike up the trail and allow the students to see the park's use of land and allow the students touch the rock outcrops and experience the mountain forest then return to the overlook.

Reflection

4. When the group seems ready for a question, ask for a student volunteer who might want to be a researcher or a journalist for an activity. Once you have your volunteer, explain to that student that they are going to interview some of the other students to see what human impacts they see.

This may be done with a digital voice recorder or a fake microphone. Each class will have an option to record the brief interviews to be used for a post site activity later.

EXAMPLE:

Student Interviewer: "What human impact do you see?"

Student Interviewee: "I see those cows on a hillside."

Abstract Conceptualization

5. This part of the program may be conducted by a guest speaker who meets the students and explains in a 10 minute lecture about how their company that is visible from the overlook helps the community and is a responsible steward of North Carolina's Natural Resources. A Suggested speaker may include Tri-County Paving, or construction companies, local factories, hotels... This may also be conducted by a ranger. There should be time for Q&A.

Active Experimentation:

Background: Explain that soil erosion, is often a concern when any new construction happens in a undisturbed location. Clarify that the parks function is to protect the natural resources that are in the park, while private companies often change the land in order to benefit from the lands resources. This is where responsible behavior, sustainability, and regulations come into play.

6. Move the group of students over to the grassy area by the kiosk. Point out that grass and trees help hold and stabilize the soil. Ask the students to hypothesize what might happen to the soil if a bulldozer removed the plants and trees here during some type of construction.

7. Ask for two volunteers to hold up the silt fence at the edge of the grass. Hold it up like a fence. Explain that this type of fence is required by law in North Carolina during construction when soil is being disturbed.

8. Now put the fence down and ask three students to lift the plastic up board at an angle onto the edge of the blue plastic strip provided (this is a blue stream). Next ask the students to place some soil near the top of the angled plastic board.

9. Ask one or two students spray and pour water on the soil and observe what happens. Because the soil was loose, the water erodes the soil and takes it down into the stream.

10. Next hold the silt fence out in front of the soil pile on the plastic board, and notice if less soil makes its way to the stream. The silt fence is not perfect, but it has a positive impact.

11. Another test would be to hold the silt fence like a hammock and pour another cup of soil and water into the silt fence. Notice what happens to the soil? If the silt fence is working properly the soil will stay in the fence material while the water passes through. By using a silt fence in a construction site, the soil is prevented from being eroded down into streams. This is a responsible way to disturb soil without causing added unnecessary disturbances to water quality in streams and rivers.

As the students prepare to board the bus ask the students to watch along the road for rocks, and signs of weathering. Are there any places that you might see physical weathering? Board the bus for the trip to the picnic shelter. The shelter is reserved for your class; lunch, water and rest rooms breaks are options at this time.

Fourth Grade Landforms

On-site Activity II

Upon the busses arrival at the picnic area the two teams of students will split up. There should be 35 students for the hike and 35 students for the picnic area activities. The dividing of the students should be predetermined prior to arrival

Concrete Experience

Landform Hike: Start at the park map kiosk where the students will be introduced to topographic lines as well as the direction that they will be traveling on the mountain.

1. Explain that the topographic lines are in intervals of 40 feet on the map, so as we hike up the trail we will be gaining several hundred feet. Ask the students to notice the frequency of contour lines that are on the trail. How many lines do they see on the first trail section to the ridgeline?

2. Begin the hike at a brisk pace and announce the first 40 ft. gain in elevation, the first topographic line crossed. **NOTE:** Prior to the hike the ranger will place bright flagging at 40 foot increments. These are locations along the trail that demonstrate each 40 feet of elevation that are gained. Ask the students if they notice the gain in elevation. Watch for teachable moments.

3. As the hike continues ask the students think about how people coming into this area might feel about this hill and other local landforms. Would this hill be an obstacle?

Reflection

4. People use this mountain as a park today, but years ago it has had other uses and has changed in many ways. Point out the water bars on this steep trail and explain that the park is responsible for preventing erosion on this land. The water bars slow the water down and redirect it in order to prevent erosion during heavy rain events. Also remind the students to watch their step. Don't trip on the water bar.

Abstract Conceptualization

5. Once you arrive at the ridgeline point out the Rock outcrop alcove. Explain that there have been several studies done on Mt. Jefferson to investigate if the mountain was once a hiding place for slaves on the Underground Railroad. Point out that the steepness of this landform was possibly used as protection from slave hunters and the rock alcove features would have been good places for escaping African Americans to hide and take shelter on their flight toward freedom. Underground Railroad research and reports are available at the park office. There is as of yet, no conclusive evidence to confirm or deny the Mt. Jefferson Underground Railroad stories. Continue on hike.

6. Stop on Rhododendron trail toward Luther Rock to discuss how ancient humans visited Mt. Jefferson and hunted on this unique land feature. Explain that Mt. Jefferson is an isolated peak, and island in the sky and it is easily recognized from a distance. Show the students laminated photos of the spear points found on Mt. Jefferson. The three spear points found were dated from 3000 to 7000 years old. Continue on hike.

7. Upon arrival at the steep trail edge that is marked with a danger sign, explain that some earth surface changes are very slow while others are very rapid. Before the group passes the steep area read the account of the February 1827 landslide that caused ¼ of a mile of Mt, Jefferson to slide down toward the town of Jefferson at 3:00 am. This was a rapid event that rattled windows below. The location that the group is passing is where we believe the slide happened.

8. Upon arrival at Luther Rock spur trail introduce the Heath Bald concept. Explain safety rules about hiking again and lead students out. Upon arrival at viewing location ask each student to be seated.

9. Once all students are seated, welcome them to their mountain and allow for a one or two minutes of silence. Enjoy the view!

Active Experimentation

10. Ask the students to begin to look around for various landforms. Ask the students to Identify places where there may have been human related impacts on the land below.

11. Pass out several clear clipboards with transparencies and markers: one clipboard for each of the directions that are visible to the students from a seated position. Ask the students to slowly pass the boards around and draw-in one human impact or landform feature that they can find below. Some features will already be on the transparencies, so the students should try to line up those features with the ones that they see.

12. Lead a discussion about the locations and features that the students drew, and bring transparencies back for further discussion. Allow for questions and quiet time if time is available.

13. Prepare to return to the main trail. Select section of just a few students at a time to stand up and move toward the trail. Once you are on the main trail, return to picnic shelter.

14. Upon reaching the restroom area consult with teachers about need for restroom break. The hike will end at picnic shelter. The students had been at the shelter will now go on landforms hike. Basically, the students will be trading place at this time.

Onsite Activity III

These Picnic Shelter activities will be conducted by second ranger or a teacher who is prepared to conduct this unit at the shelter while the other half of the class is on the hike. Then the two classes will trade places. Both activities will be conducted by each presenter twice.

Pre-arrival set-up:

Place Igneous, Metamorphic and Sedimentary rocks on the tables. Label each table as Igneous, Metamorphic, and Sedimentary. Have 10-15 pencils and note pads just in case students forget them. Set up a table with Streak plates and rocks with numbers and corresponding colors**.** Set up a table with Rock hardness kit. Rocks should be arranged in a one through ten sequences.

NOTE: The park staff should build a nice fire in fire place and have a bucket up water by the fireplace for safety.

Place a dozen pie pans on a table with crayons, sharpener, foil, wood blocks, metal vices, and a metal pan with pot holder. Set up a flip chart if desired.

Activities and Procedures:

Concrete Experience

1. The students will meet at the Mt. Jefferson picnic shelter with a ranger or a teacher. After an introduction explaining the three types of rock the students will be given a pencil and a clip board with paper in order to record the data gathered from this activity.
2. Each student is asked to walk around each of the three tables touching all of the rock samples while reading the labels that specify if the rocks are Igneous, Metamorphic, or Sedimentary. The rocks will be organized into the three groups Igneous, Metamorphic, and Sedimentary, so students can differentiate between rock types as they examine the samples. As the students make their way around the tables they should use hand lenses to observe the rocks. Each student should make note of several observation for each of the rock types.
3. A Streak plate table will also be set up with ten numbered rocks and each student should scratch the rocks on the streak plate and then make observations of rock streak and make a notation of the color of each rock on their data sheet. A category will also allow students to test magnetic properties with a magnet.

4. A Mohs hardness scale table will be set up to allow each student to observe each rock and note the hardness of each rock on their data sheet. Each rock will be labeled and set in place according to hardness starting with Talk at 1 and ending with Diamond at 10

5. Students will make note of each rocks color and luster.

Reflection

6. Next ask the students to discuss the differences that they noticed between the rocks they examined. Lead a discussion about the ways that rocks can be described (color, hardness, streak, magnetic, conductor.) Explain that all of these rocks can be classified into one of three rock type classifications. Remind the class that each rock is Igneous, Metamorphic, or Sedimentary.

Abstract Conceptualization

7. Explain the geological story of Mt. Jefferson this narrative may be read.

It is hard to imagine that this mountain was once a part of a group of buried rocks that were buried miles beneath the surface of the earth. While these rocks were under the ground they were heated and put under great pressure. During this time the rocks changed from one rock type to another because of heat and pressure. The rocks became a metamorphic rock called Amphibolite. The word Metamorphic sounds a lot like metamorphosis. Both words are describing change. Like a caterpillar that turns into a butterfly a metamorphosis is a change.

So, for millions of years these metamorphic rocks waited beneath the earth until around 300 million years ago. Geologists estimate that nearly 300 million-years-ago, the *continental plates of North America and Africa gradually met due to continental movement called Plate tectonics. This process exerted great pressure on parts of earth's crust. Great areas of land were moved laterally, or sideways many miles due to the force of thrust faults. Entire regions were folded, uplifted and then eroded into rocky peaks and plateaus that towered more than 15,000-feet above sea level.*

All of this was happening before the time of the dinosaurs. Finally, the continents began to separate and move apart and over millions of years, the basin that was formed is known today as the Atlantic Ocean, and by this time the ancient New River was set in its course to flow north and west.

Today, those once colossal mountains are much smaller. Because of 300-million years of weathering Mt. Jefferson is smaller and full of life. The mountain we see today is teaming with a variety of over 700 different kinds of plants. The dark rocks that you see here are called Amphibolite, which is made of the minerals Hornblende and Feldspar. Amphibolite often produces a neutralizing effect on the pH or acidy of the mountain soil. This allows hundreds of plant species to thrive on Mount Jefferson and on many other surrounding mountains- quite a stark difference from the fractured world of folded rocks long ago. Adapted, from Mt. Jefferson SNA interpretive and education program

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Active Experimentation

The following activity is based on the Rainbow Rock Activity featured in Mt. Jefferson's *Metamorphic Mountain (1994),* an Environmental Education Learning Experience.

8. The students will work in teams of three. Each team will be given a crayon, a pencil sharpener and an empty pie pan. The students are asked to think of the crayon as igneous rock sitting at the base of a volcano.

9. Explain that physical weathering breaks the rock into pieces. At this point ask the students to sharpen the crayons. The students are simulating the physical weathering of rock into pieces. As the small shaved bits fall off have the students put them into the pie pan. Notice that the crayon is getting smaller and the pieces are piling up. The pieces represent weathered rock that may later become sedimentary rock.

10. Ask the students to move the shaved pieces of crayons inside the pie pan. This movement simulates erosion. Next the students will make Sedimentary rocks. The students place their shavings onto a sheet of foil. Then the student should fold the foil into a packet.

11. The foil packet with the shavings is placed between two flat wooden blocks.

12. Next the blocks are put under pressure with a vice. The teacher may start the pressure process by placing the wood blocks into the vice. Allow only moderate pressure as this is a sedimentary rock we are making.

13. The students open the foil and examine the contents. The shavings should be somewhat cemented together. The students are asked to compare this process with what happens in the bottom of a lake where sediments gather and form sedimentary rocks.

14. Finally, the students place their compressed crayons back into a foil sheet, this is placed into a vice again and tightened very tightly and then sit it near a fireplace or heat source if it is available in the fireplace. This demonstrates the formation of metamorphic

rocks. Heat and pressure are used in nature. Deep under the earth the rocks are changed and in our experiment the crayon shavings are a little melted and under pressure.

15. Remind the students that this process takes great epochs of time to accomplish.

16. After the crayons have set for a few minutes the students then look at the contents again and are asked to describe what they see. Metamorphic rocks are often folded or foliated and even bent. This would be a good time to pass around a few Amphibolite rocks, so the students can see the folds and bent rock.

17. Now suggest that the rocks are sub ducted down under the earth and completely melted. Their rocks are sub ducted deep into the earth and melted into magma. To demonstrate this, the crayons are then dumped into a cooking pot and then melted in the pot using the fire in the shelter fireplace. This is done by the teacher or ranger. Soon you will have a brown wax; this is the magma.

18. The wax may be rapidly cooled with water and ice. Thus the rock cycle has cycled. Lead a discussion to investigate the rock cycle and discuss the parts of the activity.

Post-Site Activity

Concrete Experience

1. Watch the New River / Mt. Jefferson 11:00 min. Park Video

You Tube link http://www.youtube.com/watch?v=-jLAkzZsNZ8

Reflection

2. Have a discussion about the formation and changes in local landforms.

Abstract Conceptualization

3. Listen to the CD that features a variety of poems written about Mt Jefferson. Poem topics on CD include Geology, Underground Railroad, Nature, and Stewardship.

Active Experimentation

4. Make up your own poem about Mt Jefferson; remember the things that you have learned about the park. Have an open mike poetry reading for your class and Principal.

5. Draw and label a sketch that shows some type of weathering and erosion.

Present a conclusion based on student questions and academic goals.

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