

# An Earth Science Scrapbook Project as an Alternative Assessment Tool

Pamela C. Burnley

Department of Geology, Georgia State University, Atlanta, GA 30303,  
Burnley@GSU.edu

---

## ABSTRACT

A scrapbook, in which students assemble news articles, advertising images, postcards, and other flat items has been developed as an assessment tool for an introductory level Earth Science course for pre-service teachers. The students are asked to locate items that relate in some way to Earth Science and to write a relevant caption for each one that demonstrates something the student has learned in the course. The scrapbook can be used to evaluate the breadth and depth of the students' comprehension of Earth Science concepts. The assignment encourages students to relate course content to the world outside the classroom, and to become aware of the relevance of Earth Science to their daily lives.

---

## INTRODUCTION

One of the challenges of teaching introductory Earth Science, especially in required or core courses, is helping students see the relevance of geology to their lives. Another challenge is finding alternative forms of assessment that encourage students to move beyond memorization of facts (Bond et al., 1994). This article describes a scrapbook project that is used both as a means of demonstrating the connections between geology and students' daily lives and as an alternative form of assessment.

The project was developed for an introductory Earth Science class for middle school and high school pre-service teachers. The course is required for students who have not already had Earth Science course work. The students come from a wide variety of backgrounds: some have had very little science experience; others have a bachelor's degree in science and, in some cases, work experience. This semester-long scrapbook project is an opportunity for the students, who have a wide range of academic and life experiences, to work at their own level. The assignment challenges students to collect items that relate to Earth Science, such as news articles and images in advertisements and travel brochures, that can be assembled into a scrapbook and to write a caption for each item.

"Scrapbooking" is a popular hobby and as such, has found its way into educational settings, primarily in middle and elementary levels. Scrapbooks are primarily used to create connections between children and their families (eg. Naumann, 2000; Yahraus, 2001) but have also been recommended for many other applications including helping children develop humane feelings towards animals (Whitlock and Westerlund, 1975), and for helping children heal from traumatic incidents (Lowenstein, 1995). Collecting newspaper clippings is a common instructional device for helping students to relate course content to current events. It has been used in many educational settings including secondary school social science (Holmes, 1976) and in college humanities classes (Lanham and Cowan, 1990). Written analysis of

news clippings provides an even more powerful way to link course material to current events (Rider, 1992). Photo interpretation is another authentic task (Barton, 2001) that helps students make connections between course materials and "real life". (In this context, the term "authentic" is used to refer to learning experiences that incorporate real materials, data or contexts, that require students to perform real-world tasks; this is in contrast to simulated or simplified experiences typical of many traditional educational activities.) Reynolds and Peacock (1998) suggest observing and interpreting natural landscapes using slides in class helps students understand the relevance of geoscience course material and may help with development of spatial visualization skills. Analyzing images found in other formats (e.g. magazines) should have a similar effect and perhaps be even more effective in creating connections for students because the images are found by the students outside the classroom environment.

The project was designed with a number of goals in mind: 1) To make it obvious to students that the Earth is an ever present part of their daily lives and that information about the Earth learned in class can be applied in many familiar contexts. 2) To help the students make connections between course content and news and current events. 3) To catalyze discussion of course materials and to serve as a format for feedback on how course material applies in contexts outside the classroom. 4) To serve as an alternative assessment tool that allows the students to be creative and take ownership of their work while demonstrating what they have learned from the course. 5) To serve as a model for a project that the pre-service teachers could assign their own pupils.

## THE ASSIGNMENT

The students are asked to collect news articles pertaining to Earth Science and to find images of the natural world illustrating geologic features or processes, or that otherwise pertain to some aspect of Earth Science. Suggested sources for images include advertising imagery, post cards, vacation pictures, and travel brochures. The students are asked to write a caption for each item, and to provide information about its source. For some classes, I have also required that students link each item to a National Science Education Standards (1996) (NSES) content standards. This provides an opportunity for the students to become familiar with the NSES content standards and how they relate to the geoscience education. (The NSES can be found on the internet at: <http://www.nap.edu/readingroom/books/nses/html/>).

The captions are the core of the assignment, where the students demonstrate the depth and breadth of what they have learned in the course. The handout for the assignment (Figure 1) gives students guidance on how to write captions and emphasizes the importance of including Earth Science content that connects to the item but is not provided by the item. For example, although a

### Earth Science Scrapbook Assignment

In order to demonstrate to your students that Earth Science is relevant to their lives, you will need to make connections between things that are familiar to your students and the concepts that you are going to teach them. One way to do this is to make your students aware of Earth Science in the news. Other ways to make these connections involve finding the "Earth science" in familiar objects. You may find it useful to collect things as you run across them so that you have them handy when you want to use them in your teaching. This is a chance for you to start your collection. For this assignment, I want you to focus on the things you can "clip" and put in a scrapbook. So that you can have some feedback before the assignment is due, I am asking you to turn in your "in progress" scrapbook midway through the semester. One of your items will be graded at this point.

#### Scrapbook Items:

Over the course of the semester, collect news articles, postcards, photos, advertisements and other images that illustrate one aspect or another of Earth science. The assignment is to find the "geology" in things that will be familiar to your students, things that will help your students see the connection between the outside world and their Earth Science lessons. For this reason, you must not use materials from textbooks and other prepared curriculum materials including those found on government and university web sites. Some magazines, like Scientific American, National Geographic and Discover, have articles that look and sound very much like text books. They are nice resource materials, but for this assignment no more than 50% of your captioned items should be articles of this nature. To discourage the use of textbook photos, the backside of all clipped images must be accessible. Electronic images are not permitted, with the exception of those that are contained in news articles and those that you can demonstrate are your personal photos (e.g. they contain you or a close family member).

#### Captions:

Each item must have a caption that contains: 1) Earth Science content information - pretend you are explaining what the item depicts to a colleague who does not know any Earth Science, 2) information about the source of the item. Figuring out what Earth science content belongs in the caption may seem difficult at first. However, it usually only requires a bit of brainstorming. For example, when looking at a picture, ask yourself: "what do I see?". If the answer is "a lake", then brainstorm on what you have learned about lakes in this class. You might remember that a lake represents an area where the water table is above the ground's surface. You could then incorporate this information into your caption. Newspaper articles already have headlines and consist of lots of words, but they often don't give much in the way of geologic background information. For example, they won't tell you where Turkey is relative to the plate boundaries and what tectonic process probably caused the recent large earthquake there. An article might focus on the plants and animals living in a swamp but it won't mention what type of geologic environment it is or what type of rock is forming there. The information regarding the source of the item should include the title of the publication, a volume and page number if appropriate, and a date. If a news item was found on the web, then you must include the web address, the name of the organization responsible for the web site and the date the item was downloaded.

#### Organization and Binding:

The scrapbook must be organized into sections by topic; it's OK to have only one item under a topic heading. Each caption must be numbered to facilitate my counting them. You may put your captions or portions of your captions on a separate page as long as they and the items they belong to are numbered. You can use a scrapbook, composition book, loose-leaf binder or any other binding system that you like. My only requirement is that your scrapbook be a single

coherent item with no chance of its "scraps" getting loose and mingling with other peoples "scraps" while they are in my possession. As mentioned above, the backside of clipped images must be accessible. Therefore, do not glue them to the pages of your scrapbook. You can use tape loops, double-sided tape on corners, photo corners or any other means to attach clipped images that will allow the backside to be viewed.

#### Grading Guide

	Best	Good	Passing
<b>Number of captioned items: (15%)</b>	17*	14*	11*
<b>Variety: (20%)</b>	at least 6 topics** 4 or more sources*** a mix of pictures and news stories or articles	at least 5 topics** at least 3 sources*** heavily articles or news stories; only pictures	at least 4 topics** at least 2 sources*** all articles or news stories
<b>Percent of content correct: (25%)</b>	90%	70%	50%
<b>Quality of content: (35%)</b>	Earth science content information unfamiliar to lay persons is applied to each item, in many cases caption includes information about geologic processes. Caption is in student's own words and it is clear that ideas have not been cribbed from item's source.	Earth science content information unfamiliar to lay persons is applied to each item, in some cases caption includes information about geologic processes. Caption is in student's own words.	Two thirds of the captions include Earth science content information unfamiliar to lay persons. Caption is in student's own words.
<b>Professionalism of presentation: (5%)</b>	Items are neat and aesthetically presented, organized by topic, captions typed, all items are fully referenced.	Items are neat, most items are referenced, captions are typed.	Captions are legible, most items are referenced, some items missing parts of references.

\* Items from textbook, prepared curriculum materials, government or university web sites and electronic images (with exceptions discussed above) are not permitted.

\*\*Examples of topics: streams, soil, sedimentary rocks, metamorphic rocks, igneous rocks, volcanoes, minerals

\*\*\*Examples of sources: magazine add, travel brochure, magazine article, newspaper, worldwide web, personal travel photos, postcards, national park brochures.

**Figure 1: Assignment handout for Earth Science scrapbook project and grading guide.**

news article about an earthquake will typically provide a death toll and magnitude, it will not describe the plate tectonic setting. For most earthquakes, the students can deduce this information using figures in their textbook. The assignment handout also gives them some hints about approaching image interpretation. During the course when images of geologic features are shown, the students are asked to discuss what they see in the image before there is any input from the instructor (this technique is described by Reynolds and Peacock, 1998) which gives the students practice in image interpretation. Slides shown in class can also be used as an opportunity to explicitly model the creation of captions for the students. Alternatively, one could have students write a caption for an image or article in class and discuss the results (e.g. Rider, 1992).

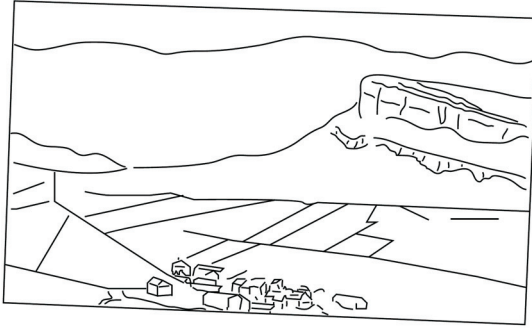
The scrapbook assignment is structured to discourage students from using items that require no interpretation on their part (e.g. text books and other educational resources). The backsides of all clipped images are left accessible so that the instructor can monitor the source of items. In the first year this assignment was used, some students made extensive use of images downloaded from government and university web sites and simply paraphrased information from the web sites for their captions. Therefore, in subsequent years electronic images have not been permitted, with the exception of those accompanying news articles and personal photos. Other assignments can be used to give the students an opportunity to explore Earth Science teaching resources available on the web. Recently, "cut and paste" plagiarism from web sites has become a common phenomena on college

campuses (Clarke-Pearson, 2001). One of the advantages of using advertising images is that it is not possible to find geological interpretations of them by searching the web.

To provide feedback before the assignment is due and prevent surprises at the end of the semester, the students are asked to turn in their "in progress" scrapbooks midway through the semester. One completed item is graded at this point. This midway check is also very important in that it provides a strong motivation for students to seek one-on-one time with the professor. In addition, students have the opportunity to share what they have found so far with each other, which helps students who are still unclear about the nature of the assignment.

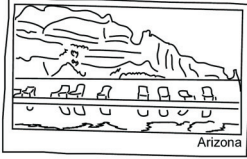
The scrapbooks are graded using a grading guide that is given to the students along with the assignment at the start of the semester (Figure 1). The use of a guide that is shared in advance helps students understand the nature of the assignment and is generally agreed upon to be the most fair procedure (Mabry, 1999). However, it has a drawback of stifling creativity and may interfere with the grader's ability to exercise professional judgement (Mabry, 1999). A grading guide containing easily quantifiable criteria can deter from the assessments' ability to measure higher order thinking skills (Baxter, 1993). The grading guide developed for this project attempts to strike a balance between concrete criteria (e.g. number of items, diversity of sources), that define the assignment and form the "rules of the game", and standards (e.g. quality of content) designed to create room for professional judgment. The grading guide

a)




In the upper right corner of this picture is a cliff. Cliffs can be produced by eroded rock.

This is a picture horizontal bands of sedimentary rocks with lots of erosion and visible cliffs.




b)



**Picture 3**  
**Content:** Relative Dating and geologic time. The Grand Canyon illustrates the principle of original horizontality, (sediments were deposited horizontally), principle of superposition, (the older rocks are at the bottom on the canyon; younger rocks are at the top) and principle of lateral continuity (the rock layers extend laterally in all directions until it reaches the end of the depositional basin). These principles aid geologists in dating the rocks and fossils found in the rock.  
**Source:** Smithsonian magazine  
**Content:** D 9-12 The Origin and Evolution of the Earth System. Geologic time can be estimated by...

c)



Soil Profile  
 Cosmopolitan Magazine (ad for clothing)

Unsorted clastic materials that could have been transported by a landslide or mud flow. Can be used to discuss classification and sorting of sedimentary particles.

D(5-8) Structure of the Earth System: Soil consists of weathered rocks and decomposed organic materials from dead plants, animals and bacteria. Soils are often found in layers, with each having a different chemical composition and texture.

**Figure 2: Hand renderings of several student's scrapbook pages. Each page displays different levels of interpretation and integration. a) This page contains two items and their captions. The upper item is a photo, clipped from a magazine, which shows a village nestled in a cliff rimmed valley. Mountains are seen through haze in the background, roads and the boundaries between agricultural fields dissect the valley floor. The cliffs to the right are composed of tan and red strata, the cliffs to the left are shrouded in shadow. The second item on the page shows a poolside scene in Arizona with red sandstone cliffs in the background. In addition to providing very simple captions, this student has failed to identify the source of the clipped images. b) This student's item consists of an advertisement for a radio with a black and white photograph of a canyon in the background. The photo is shot below the rim and shows alternating terraces and slopes typical of canyons in the Colorado plateau. The river can be seen at the bottom of the canyon on the right side of the photo. c) This item contains a photograph of a fashion model standing in front of what is probably a roadcut consisting of unsorted sediments that range in size from below the resolution of the photograph to both angular and rounded cobbles. Roots can be seen dangling from small plants that are growing at the top of the outcrop. A soil profile can be seen in the upper right hand corner as well as a bit of sky and bare branches.**

values the correctness of the caption content rather leniently, in order to encourage students to take some chances with their image interpretation; which in some cases can be quite difficult. Fewer points are taken off for the misinterpretation of images than for mistakes within captions revealing a true lack of understanding. The grading guide has a strong influence on the final product. For example, before the words "geologic processes" were added to the guide, many students' image captions were very short - consisting primarily of labels for identified features.

## STUDENT SCRAPBOOKS

The majority of students take the scrapbook assignment very seriously. Perhaps due to their training in the teacher education program, most students invest substantial effort into creating an aesthetically pleasing and professional looking document. Often "scraps" are presented on layered, colored construction paper, edges are cut with patterned scissors, and covers and section dividers are decorated with clip art and colorful word art. Some examples of pages from student scrapbooks are shown in Figure 2.

Student scrapbooks display different levels of ability to interpret images and news articles and various degrees of sophistication in applying course content to the items they have collected. For example, some scrapbooks rely heavily on summarized news articles, advertisements for jewelry and images of familiar landforms, such as mountains, cliffs and waterfalls. The captions are rephrased from the textbook and are connected to the item only by virtue of the fact that the item and the caption share the same noun. Even though the author of such a scrapbook may, perhaps through memorization, do reasonably well on multiple choice tests, the scrapbook shows the students' understanding is superficial. In contrast, other students are able to apply their new knowledge not only to writing captions but also as they are searching for items. For example, one student observed differential weathering of feldspar phenocrysts in granite captured in a calendar photo. Another student noticed poorly sorted sediments in a road cut behind a fashion model (see Figure 2c), and one student used her newfound understanding of the effect of climate on weathering, to explain the preservation of an ancient adobe structure pictured in a travelogue. Some students have found images containing landforms not covered in the class (e.g. wave cut terraces, sea stacks, aretes, and cirques) and correctly identified and discussed them. In these cases the students were able to apply content from the text without the aid of class discussion.

## STUDENT FEEDBACK

In general, student feedback has been very positive. The students are required to assemble portfolios for their teaching certification program; most of the students reuse items from the scrapbooks in their portfolios and find the assignment helpful for that reason. The scrapbook is worth 20% of the course grade, which appears to be a good balance considering the effort the students put in to the assignment. Some students find the thought of obtaining magazines and newspapers an excessive financial burden. This can be seen as an opportunity to encourage the students to be resourceful or to educate them about their community recycling

center. When they become teachers, these students will face similar challenges in providing resources for their classroom, so this aspect of the assignment can also be a valuable learning experience. However, the issue can also be circumvented by providing the class with boxes of old magazines and newspapers.

Students who took the pre-service teachers class in the fall of 2000 were asked by e-mail to comment on the usefulness of the scrapbook project after they had completed a semester of student teaching. Out of 19 students, 6 responded. The students were asked: "How was the scrapbook project useful or not useful for you as a student learning geology content?" and "How was the scrapbook project useful or not useful for you as a person preparing to become a teacher?" One student felt the assignment was not useful for her as a student but that the assignment was useful for her as a pre-service teacher. The rest agreed it was useful for them as students, in that it helped them connect what they learned in the course to their everyday lives. For example one student shared: "The scrapbook really tied geological processes to our practical world." and another responded: "A lot of obvious images and experiences are geologically-related (is that a word?) but you might not consider it." From a teacher's perspective, the students felt the scrapbook project was useful because they anticipated the assignment would accomplish the same thing with their own students and because it was a novel assignment: "It was good to see a scrapbook could be used, since none of our other education courses used this as a learning tool. I believe that anytime you can get students to think about applying what they have learned about science everyday we have done something and I think scrapbooks do this." Another student pointed out that the assignment could be adapted to other courses: "As a teacher it gave me some great ideas for "scrapbook"-type assessment in my future chemistry classes. With some modifications, the idea/outline of the project can easily be translated. It also offers students some freedom and flexibility in their assessment instead of the typical right-and-wrong or number-crunching associated with science classes."

## EFFECTIVENESS OF SCRAPBOOK

Although scrapbooks are recommended for use in many educational settings, there appears to have been no effort to formally evaluate their effectiveness as a teaching tool. Similarly, the use of newspaper clippings is believed to be effective for increasing student's appreciation of relevance (Holmes, 1976; Lanham and Cowan, 1990; Rider, 1992), but these claims have not been formally studied. There have been studies of the effectiveness of portfolio assessments (e.g. Slater, 1997; Johnson et al., 2000; Shultz, 1998; Herman and Winters, 1994) and portfolio assessments have become a very popular alternative assessment used in many settings including science classes (Collins, 1992; Hamm and Adams, 1991; Brunkhorst, 1996; Phelps et al., 1997; Slater and Astwood, 1995). However, a scrapbook is different from a portfolio because a portfolio should contain work samples collected over a period of time illustrating the student's intellectual development (Mabry, 1999) and demonstrating the range of a student's knowledge (Slater and Astwood, 1995; Slater, 1997). Ideally a portfolio should also contain students' reflections on their learning process (Slater and Astwood, 1997). The scrapbook project described here does not contain these

elements. However, it is an authentic assessment like a portfolio (e.g. Mabry, 1999; Slater and Astwood, 1997) in that the tasks involved, such as interpreting images of natural features, are real world tasks that a geoscience professional would do, perhaps without even thinking about it. A scrapbook can be used as a performance assessment as part of a portfolio. Many of my students have included their scrapbooks in their science education portfolios and my colleagues and I have recently used a shortened version of the scrapbook as part of a portfolio assessment in an integrated science course for pre-service middle school teachers at GSU. In light of the similarities between the Earth Science scrapbook project, portfolios and other authentic assessments, it is not unreasonable to assume that further studies will find it is also an effective teaching and assessment tool.

## ACKNOWLEDGEMENTS

The author would like to thank Rebecca Wilson and Cookie Hanna for helpful ideas and feedback on the assignment and Stephen K. Boss, Randy Gabrys Alexson and an anonymous reviewer for helpful feedback on the manuscript.

## REFERENCES

- Barton, K.C., 2001, A picture's worth: Analyzing historical photographs in the elementary grades, *Social Education*, v. 65, p. 278-283.
- Baxter, G.P., 1993, Analysis of Cognitive Demand in Selected Alternative Science Assessments, Analysis of Structures and Processes Assessed in Science, Project 2.1 Alternative Approaches to Assessment in Mathematics and Science, Cognitive Theory as the Basis for Design of Innovative Assessment, Office of Educational Research and Improvement, Washington D.C., 78p.
- Bond, L., Herman, J. and Arter, J., 1994, Supporting educational improvement: in "Improving Science and Mathematics Education: A Toolkit for Professional Developers: Alternative Assessment" Regional Educational Laboratory Network Program in Science and Mathematics Alternative Assessment, 574p.
- Brunkhorst, B. J., 1996, Assessing Student Learning in undergraduate geology courses by correlating assessment with what we want to teach, *Journal of Geoscience Education*, v. 44, p. 373-378.
- Clarke-Pearson, M., 2001, Download. Steal. Copy. Cheating at the University, *The Daily Pennsylvanian*, November 27, 2001.
- Collins, A., 1992, Portfolios for science education: Issues in purpose, structure and authenticity, *Science Education*, v. 76, p. 451-463.
- Hamm, M. and Adams, D., 1991, Portfolio assessment, *Science Teacher*, v. 58, p. 18-21.
- Herman, J.L. and Winters, L., 1994, Portfolio research: A slim collection, *Educational Leadership*, v. 52, p. 48-55.
- Holmes, E., 1976, Labor Studies Units, Ontario Federation of Labor, Toronto, 815 p.
- Johnson, R.L., McDaniel, F. and Willeke, M.J., 2000, Using portfolios in program evaluation: An investigation of interrater reliability, *American Journal of Evaluation*, v. 21, p. 65-80.
- Lanham, M and Cowan, M.C., 1990, Learning Logic in the Global Arena through Telecommunication, Harford Community College, 36 p.
- Lowenstein, L., 1995, The resolution scrapbook as an aid in the treatment of traumatized children, *Child Welfare*, v. 74, p. 889-904.
- Mabry, L., 1999, Portfolios Plus: A Critical Guide to Alternative Assessment, Corwin Press, Thousand Oaks, California, 195p.
- National Research Council, 1996, National Science Education Standards, National Academy Press, Washington, D. C., 262p.
- Naumann, S., 2000, Crafts: Strengthening family ties with scrapbooking, *What's New*, v. 33, p. 40.
- Phelps, A.J. and et al., 1997, Portfolio assessment in high school chemistry: One teacher's guidelines, *Journal of Chemical Education*, v.74, p. 528-531.
- Reynolds, S. J. and Peacock, S. M., 1998, Slide observations-promoting active learning, landscape appreciation, and critical thinking in introductory geology courses, *Journal of Geoscience Education*, v. 46, p.421-426.
- Rider, E., 1992, Understanding and applying psychology through use of news clippings, *Teaching Psychology*, v. 19, p. 161-162.
- Slater, T.F., 1997, The effectiveness of portfolio assessments in science, *Journal of College Science Teaching*, v. 26, p. 315-318.
- Slater, T.F. and Astwood, P.M., 1995, Strategies for using and grading undergraduate student assessment portfolios in an environmental geology course, *Journal of Geoscience Education*, v. 43, p. 216-220.
- Whitlock, E.S. and Westerlund, S. R., 1975, *Humane Education: An Overview*, National Association for the Advancement of Humane Education, Tulsa, Oklahoma, 92 p.
- Wolfe, E.W., 1996, A Report on the Reliability of a Large-Scale Portfolio Assessment for Language Arts, Mathematics, and Science (Clearinghouse: TM025512).
- Yahraus, J., 2001, Craft project: The arrival of scrapbooking, *What's New*, v.34, p. 12-14.