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# Turning the Tables: Assigning Reflective Writing in an Introductory Earth and Space Science Course with Pre-Service Teachers Who Don't Like Science


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# Turning the Tables: Assigning Reflective Writing in an Introductory Earth and Space Science Course with Pre-Service Teachers Who Don't Like Science

## **Abstract**

Political officials in some states are beginning to recognize the need for Earth and Space science education across the K-12 curriculum. Case in point: In 2010 Iowa changed teacher certification requirements of K-5 education so that they include a three-credit Earth and Space Science (E&SS) course. In response to this requirement, we developed a hybrid course consisting of a two-credit online component and a one-credit, two-hour lab that could serve as a model for others. The students enrolled in this introductory-level course are primarily freshman and sophomore elementary education majors. Because of lab space limitations and in order to ensure a manageable student-to-teacher ration, enrollment is limited to 48 students. The focus of the course was on engaging the students using multiple learning techniques such as active learning simple experiments using low budget materials, and the use of Google Earth Geotours.

## **Keywords**

earth science, space science, writing assignment, science-literate

## **Disciplines**

Educational Assessment, Evaluation, and Research | Educational Methods | Elementary Education and Teaching | Junior High, Intermediate, Middle School Education and Teaching | Science and Mathematics Education | Secondary Education and Teaching

## **Comments**

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# TURNING THE TABLES

## Assigning Reflective Writing in an Introductory Earth and Space Science Course with Pre-Service Teachers Who Don't Like Science

Political officials in some states are beginning to recognize the need for Earth and Space science education across the K-12 curriculum. Case in point: In 2010 Iowa changed teacher certification requirements for K-5 education so that they include a three-credit Earth and Space Science (E&SS) course. In response to this requirement, we developed a hybrid course consisting of a two-credit online component and a one-credit, two-hour lab (Cervato et al., in press) that could serve as a model for others. The students enrolled in this introductory-level course are primarily freshman and sophomore elementary education majors. Because of lab space limitations and in order to ensure a manageable student-to-teacher ratio, enrollment is limited to 48 students. The focus of the course was on engaging the students using multiple learning techniques such as active learning, simple experiments using low budget materials, and the use of Google Earth Geotours (Wilkerson et al., 2012).

Mediated online discussions were used to reinforce course content. We sought to emphasize the societal relevance of E&SS by posing questions relevant to future teachers. For example, when we discussed water, the weekly question was:

Your team is advising the Board of Regents regarding funding possible improvements to Hilton Coliseum to prevent flood damage from occurring again. One of the regents

says that the USGS classified the flood in 2010 as a "500-Year" flood so ISU is OK for a long, long time. Another regent then points out that a similar flood in 1993 was also classified as a "500-Year" flood. The puzzled regents now look to your team to sort out the confusion: what do you say?

Unfortunately, we found that typical answers tended to be short and often missed the key point of the question, e.g.:

I think the 500 year flood is a flood that doesn't occur very often but when it does, it is huge, devastating, and memorable. The phrase "500 years" doesn't mean it happens every 500 years specifically, but rather the floods take place a long time apart; and since they were both huge floods they are both able to be considered "a 500 year flood."

Perhaps more worrisome was that even students who answered the questions correctly still saw no reason why an E&SS course was required as part of their teacher preparation, as is reflected in this end-of-semester comment from one student:

I did not see how it [the course] helped us with our future career as an elementary teacher.

After using this format for two semesters, we found that this negative attitude was a major obstacle to students' success in the course. We needed to make a change.

### Dear Mr. President...

We decided to replace the online discussions with a writing-to-learn pedagogy (e.g., Reynolds et al., 2012). After considering several writing options, we decided the most appropriate strategy was to directly

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address the negative student perceptions that were apparent in earlier online discussions. Students were asked to write a letter to the president of the United States to convince him of the need to support E&SS education in K-5 classrooms across the country. We asked students to use appropriate examples from class to argue why it is important to the nation that young children learn about Earth and space science. They were also charged with explaining why training of science-literate teachers is essential to reaching such learning goals.

Students were required to submit the approximately 1,000-word assignment through the SafeAssign tool in BlackBoard. The tool is designed to prevent plagiarism and educate students on the importance of original contributions. SafeAssign matches submissions with content found on the Web and a growing institutional database of assignments. Students receive a preliminary “plagiarism score” and have the chance to revise their document before completing the submission. We decided that a plagiarism score of <10% would be acceptable. We developed a detailed rubric adapted from an online resource (iRubric, 2012) that was shared with students in advance of the submission. Students were asked to submit a draft or detailed outline six weeks after the beginning of the semester. This allowed us to provide them with feedback on their drafts and further guide them in their progress. Students were free to choose the most appropriate formatting, line spacing, and font to ensure optimal readability. We required them to cite their sources of information and data.

Overall there was no significant change in their course performance compared to earlier cohorts. On average, the letters submitted earned close to a 65 percent score in the assignment, with the content achieving an acceptable level in the rubric (3 out of 5). While the overall workload in grading the letters versus the guided weekly discussions was comparable, we found it more practical to focus the grading in two periods during the semester, one at midterm time and one at the end of the semester. The rubric was easily implemented through the Rubric tool in the BlackBoard course management system that displayed the assignment while allowing the instructor to select the appropriate level in the rubric (Figure 1). The Rubric tool allows the instructor to also give written feedback to the student in addition to the detailed and cumulative score.

We are encouraged that this new writing assignment is forcing our students to reflect on the role of E&SS in their education and the education of their future students.

We end this essay with an excerpt from one of the submitted letters as an example of how this student’s attitude towards science has changed as a result of this writing assignment:

As a sophomore on my first day of Geology 106x class, I sat in my seat trying to figure out the meaning and use of a strange object sitting in front of me. At first my peers and I rolled our eyes and huffed heavily at the activity soon to be explained. But, as we came to understand the importance and relevance of the activity, my eyes were open to the endless teaching possibilities ahead of me. We were presented with an unknown object and we were supposed to figure it out; just like in life, we as people are constantly trying to figure out our purpose and our meaning. Science isn’t just about plants, rocks, and space; it’s about life and how to learn from it. Science goes much farther than a test or quiz; it helps explain our history and how our universe works.

Well put.

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**Figure 1: Adapted Rubric**

Criteria	Excellent	Good	Acceptable	Weak	Unacceptable
<b>INTRODUCTION</b>	Introduction shows impressive originality. Engages the reader from the beginning. Includes a clear claim and arguments. Establishes the focus of the letter very well. Maintains the complexity of the issue. Well organized and smooth flowing.	Introduction shows originality with a nice greeting and attention getter. Makes a clear claim and establishes the foundation and focus for the rest of letter. Acknowledges arguments. Flows smoothly for the most part.	Somewhat grabs the reader's attention with a greeting or a hook. Claim is clearly stated, but arguments are not. May need better organization and flow.	Introduction states the claim clearly, but arguments are not specified. Lacks an attention-getter or greeting.	Introduction is confusing and does not make the claim clear. Missing arguments. Does not grab the reader's attention with a greeting or a hook.
<b>CONTENT</b>	The central ideas show original thinking and are well woven throughout the letter. Support reflects clarity and substantial insight in the scientific significance of Earth and Space science education. Position is extremely well supported. Letter is extremely thoughtful and engaging.	The claim of the letter shows some original thinking. Support is somewhat clear, but there is good insight throughout letter. Position is well supported. Letter is thoughtful and engaging.	The main idea is clear. Support is there, but does not create a clear connection to the position or main idea. Scientific ideas and details stay on the surface and provide weak support.	The main idea lacks clarity. Support is kind of related to the topic and may not create a clear connection to the position. Confusing.	The main idea is not clear. There is no support of the claim. Very confusing.
<b>ORGANIZATION AND FLOW</b>	Paper shows excellent organizational skills. Paragraphs are well defined and flow smoothly. Moves skillfully from idea to scientific evidence to discussion to conclusion.	Paper is well organized and the ideas, scientific evidence, and discussion connect well in their organization and flow. A few sentences may seem awkward or out of place.	Paper is organized in places but the ideas, evidence, and discussion need better organization and smoother flow. Some sentences are awkward or choppy. Some paragraphs are somewhat disorganized.	Paper has some organization, but the flow of ideas is lacking. Some evidence is found. Sentences are awkward or choppy. Paragraphs lack good organization. Overall structure is disorganized.	Paper lacks organization and flow of ideas. No evidence if found. Sentences are awkward or choppy. Paragraphs lack organization. Overall structure is disorganized.
<b>CONCLUSIONS</b>	The conclusion contains original thinking, depth, and insight. It is well crafted and provides a sense of closure. Leads reader to further thinking about the central idea.	The conclusion provides insight into the overall purpose of the letter with some originality but it may lack sufficient depth. Provides a sense of closure.	The conclusion provides some insight into the purpose of the writing but demonstrates little originality. May summarize key points providing some sense of closure.	The conclusion may be abrupt or missing. May be loosely or unconnected to the central idea.	The conclusion is missing or is unconnected to the central idea.
<b>FORMATTING, STYLE AND GRAMMAR</b>	Contains no errors in grammar or spelling. Is neatly written using font, spacing and formatting that suggest a high level of professionalism. Very easy to read.	Contains a few errors in grammar or spelling, but they do not interfere with the reading. Is neat and easy to read.	Contains several significant errors in grammar and/or spelling that interfere somewhat with the reading. Somewhat neat and legible.	Contains numerous spelling and/or grammar errors that make it difficult to follow. Sloppy, but still legible.	Contains so many spelling and/or grammar errors that make it too difficult to follow. Sloppy and illegible.