Abstract. This article presents an activity in which students pool their knowledge and creativity to make a song presenting what they have learned in a unit on the rock cycle. This highly motivating, integrated performance assessment incorporates multiple intelligences, reinforces learning, and is a student favorite in the elementary and middle grades.

Keywords: assessment, Earth science, integrated learning, multiple intelligences

Over the past decade, the concept of multiple intelligences (Gardner 1993) has become a well-known learning theory. This theory holds that all learning styles are composed of eight different types of intelligence: (1) logical/mathematical, (2) verbal/linguistic, (3) visual/spatial, (4) interpersonal, (5) intrapersonal, (6) body/kinesthetic, (7) musical/rhythmic, and (8) naturalistic. An individual’s style is composed of different combinations of relatively strong and weak intelligences. To effectively facilitate learning in a diverse classroom, teaching and assessment must include a variety of methods and address various intelligences.

Assessment and teaching in science, including many inquiry-based learning experiences, often emphasize some combination of just four of the intelligences: logical/mathematical, visual/spatial, intrapersonal, and naturalistic. The other intelligences are somewhat neglected. Thus, a challenge for science teachers is to incorporate assessment strategies and learning opportunities that address body/kinesthetic, verbal/linguistic, musical/rhythmic, and interpersonal intelligences. Integrated performance assessments are one way of meeting this challenge.

These assessments require students to apply their comprehension of a concept in writing. This is consistent with the National Science Education Standards (NSES) recommendation that assessments should require students to apply knowledge rather than simply recall information (National Research Council [NRC] 1996). These assessments are referred to as integrated because they assess the knowledge of a concept and include the ability to write. Writing tasks extend student learning by requiring students to (1) convey feelings and personal experiences, (2) inform a familiar and interested audience, (3) persuade others of their viewpoints, and (4) entertain (Farr and Tone 1998).

Of course, this general form of assessment allows for many different applications. Below, we describe a type of integrated performance assessment that incorporates several of the previously mentioned intelligences.

Rock Unit

Earth science content is prominent in the NSES (NRC 1996). The Earth science standards for elementary and middle school grades focus on students' ability to (1) recognize the composition and different physical and chemical properties of rocks, soils, and minerals; (2) understand changes to the surface of the Earth, including the rapid processes of landslides, volcanic eruptions, and earthquakes; and (3) comprehend the rock cycle (NRC 1996). Teachers should devote a great deal of time to developing these concepts.

Over the years we have tried many different strategies and activities for teaching our upper-elementary students about rocks. Our rock unit has been supported by several trade books, including If You Find a Rock by Peggy Christian (2000), Everybody Needs a Rock by Byrd Baylor (1974), Dave's
Down-to-Earth Rock Shop by Stuart J. Murphy (2000), and The Magic School Bus inside the Earth by Joanna Cole (1989). Hands-on explorations have included the identification and classifications of the properties of rocks. We have discussed and used the Internet to explore the uses of rocks. Our students have made models representing the Earth’s layers and different types of rocks. We have even made edible models. However, the most successful part of our rock unit has been the culminating assessment activity “Rock Songs.”

Rock Songs

At the conclusion of our unit on rocks, students’ minds and journals are full of information. They collaborate, pooling their knowledge and creativity to write a song incorporating the information they have learned about rocks. Students can choose to write about the entire rock cycle or about one type of rock: igneous, sedimentary, or metamorphic. When the songs have been written, students prepare to perform at our rock concert.

Students do not realize that, in writing their songs, they are reinforcing and presenting their knowledge of the subject. They think they are merely reaping the reward of weeks of hard work in science. They relish this assignment and have written and performed rock songs adapted from a wide variety of artists and genres, including rock and roll, country, and hip-hop. Appendix A features three student-created songs: “Metamorphic Rocks Rock,” based on Queen’s “We Will Rock You” (1977); “Sedimentary Rocks,” based on Elvis Presley’s version of “Hound Dog” (1956; originally recorded by Big Momma Thornton in 1953); and “I Love Igneous Rocks,” based on Joan Jett’s “I Love Rock ’n Roll” (1981; originally recorded by the Arrows in 1975).

Materials

The material demands of this activity are minimal. Each group needs a stereo, a copy of the teacher-approved song, and space and time to work.

Procedure

1. This activity is designed to serve as a summative assessment, so the first step is for the teacher to deliver the entire rock unit.
2. Students’ writing, science, and art abilities are all facets of this assessment, so this must be reflected in the associated evaluation rubric (for an example, see Appendix B).
3. Share the evaluation rubric with students.
4. Ensure that students remember that, although this is a fun assignment, it is still a school assignment. Neat and appropriate work is expected.
5. Share an example. Perhaps perform your own rock songs for your students, or present a video of prior classes’ creations.
6. Students either choose or are assigned a rock type (igneous, sedimentary, metamorphic) and then conduct research on their rock type.
7. Tell students to write their rock songs. The amount of science information in early drafts is often somewhat limited, as students insert science ideas into the lyrics of the original song. Encourage students to make their science knowledge the focus and to increase the science content and vocabulary in their songs.
8. Songs are made for singing. After the song has been written, let students perform their songs. Prior to the rock concert, provide each student with a copy of the lyrics to each song and then, during the performances, encourage audience participation. Allow the students to teach each other their songs.

Teacher Tips

There are a few things to consider when planning the production and performance of rock songs. First, to help students stay focused, each group needs a stereo and space to create and practice their song. Either find a big space and stereo for all or alternate rock song work time with other school work.

Time is another consideration. Give students a limit—one week with several opportunities to work in class is generally sufficient. We have found that students are highly motivated to complete this assignment, so they come in early, stay late, sacrifice recess, and even work at home.

Once students have a rough draft, let them perform in front of their classmates and ask each other for advice. This helps generate a spirit of cooperation, keeping competition among groups from becoming a factor. Also, require every student to learn each song and cue them to join in during the performance. This serves to reinforce the science learning that is embedded in other groups’ songs. Finally, some students may be initially reluctant to perform their songs. Try to create a safe environment where performing is seen as “cool.” You can establish this through modeling. Sing a song as an example. Dance around. Have the principal join in. Be outrageous. You can use one of the songs that our students have created, or better yet, make your own.

References

Appendix A
Three Examples of Student-Composed Rock Songs with Accompanying Artwork

Metamorphic Rocks Rock!
Metamorphic rocks are really cool
They are the ones that make us drool
Metamorphic rocks are really neat
They are formed under pressure and heat

Singin, Met-a-morphic rocks are
Formed from heat and pressure
Rocks Rock, Rocks Rock

Marble is a kind of metamorphic rock
Metamorphic rocks are rocks that have changed
Metamorphic rocks are least common of
3 kinds of rock:
3 kinds of rocks

Met-a-morphic rocks
Are formed from heat and pressure
ROCKS ROCK ROCKS ROCK

Metamorphic rocks where igneous and sedimentary
Slate is used in blackboards
We use to have them in our school.

Met-a-morphic rocks
Are formed from heat and pressure
ROCKS ROCK ROCKS ROCK

Met-a-morphic rocks
Are formed from heat and pressure
ROCKS ROCK ROCKS ROCK

(appendix continues)
Appendix A—Cont.

Sedimentary Rocks

Sedimentary Rocks Now
Sedimentary Rocks
They're formed in layers
For years and years
Fossils, plants and animals are found inside of them.

We learned in science class
All about rocks
We learned in science class
All about rocks
Sedimentary rocks are the most common type of rock

Limestone is used in fiberglass and bubble gum
Limestone is used in fiberglass and bubble gum
Thanks to water we have sedimentary rocks

Sedimentary Rocks Now
Sedimentary Rocks
They're formed in layers
For years and years
Fossils, plants and animals are found inside of them.

Sedimentary Rocks Now
Sedimentary Rocks
They're formed in layers
For years and years
Fossils, plants and animals are found inside of them.

(appendix continues)
I love Igneous Rocks!

Igneous rocks are our favorite kind of rock. We thought that rock was the prettiest kind of rock. The coolest rock that I have ever seen.

Pumice is full of air pockets and it floats.

Oh Yeah!

Pumice is full of air pockets and it floats.

Oh Yeah!

I love Igneous rocks
So put in the rock collection baby
Lava makes my rock
They form when super hot lava cools.

Igneous rocks crystallize from molten rock. Igneous rocks are the oldest type of rock. Igneous rock form—deep inside the earrrth.

Pumice is full of air pockets and it floats.

Oh Yeah!

Pumice is full of air pockets and it floats.

Oh Yeah!

I love Igneous rocks
So put in the rock collection baby
Lava makes my rocks
They form when super hot lava cools.

Pumice is used, as an abrasive material in hand soap.

Pumice is full of air pockets and it floats.

Oh Yeah!

Pumice is full of air pockets and it floats.

Oh Yeah!

I love Igneous rocks,
So put in the rock collection baby
Lava makes my rock
They form when super hot lava cools.

(appendix continues)
### Appendix B

**Sample Scoring Rubric for Song-Writing Assignment**

<table>
<thead>
<tr>
<th>Category</th>
<th>Score 4</th>
<th>Score 3</th>
<th>Score 2</th>
<th>Score 1</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scientific information</strong></td>
<td>Song presents a great deal of supporting information. Several scientific facts are incorporated into the song. There is no incorrect scientific information.</td>
<td>Song presents some supporting information. Some scientific facts are incorporated into the song. There is no incorrect scientific information.</td>
<td>Song presents some supporting information. Some scientific facts are incorporated into the song, but information is incorrect.</td>
<td>Song presents little supporting information. Few science facts are incorporated into the song. There is incorrect scientific information.</td>
<td></td>
</tr>
<tr>
<td><strong>Vocabulary</strong></td>
<td>Lyrics include several science vocabulary terms, all used correctly.</td>
<td>Lyrics include some science vocabulary terms, all used correctly.</td>
<td>Lyrics include some science vocabulary terms, mostly used correctly.</td>
<td>Lyrics include few science vocabulary terms, mostly used incorrectly.</td>
<td></td>
</tr>
<tr>
<td><strong>Grammar and spelling</strong></td>
<td>Lyrics contain no errors in grammar or spelling.</td>
<td>Lyrics contain one or two errors in grammar or spelling.</td>
<td>Lyrics contain three or four errors in grammar or spelling.</td>
<td>Lyrics contain more than four errors in grammar or spelling.</td>
<td></td>
</tr>
<tr>
<td><strong>Rhythm and flow</strong></td>
<td>All sentences sound natural and are easy on the ear when read aloud.</td>
<td>Almost all sentences sound natural and are easy on the ear when read aloud, but one or two are awkward or difficult to understand.</td>
<td>Most sentences sound natural and are easy on the ear when read aloud, but several are awkward or difficult to understand.</td>
<td>The sentences are difficult to read aloud because they are awkward, distractingly repetitive, and/or difficult to understand.</td>
<td></td>
</tr>
<tr>
<td><strong>Stage presence</strong></td>
<td>Student has superior stage presence with outstanding facial expression and body movement.</td>
<td>Student has a good stage presence with pleasant facial expression and body movement.</td>
<td>Student has fair stage presence with relative lack of facial expression and body movement.</td>
<td>Student has poor stage presence with awkward facial expression and body movement.</td>
<td></td>
</tr>
<tr>
<td><strong>Penmanship</strong></td>
<td>Paper is neatly written or typed with no distracting corrections.</td>
<td>Paper is neatly written or typed with one or two corrections (e.g., words crossed out or written over).</td>
<td>The writing is generally readable, but the reader has to exert significant effort to figure out some of the words.</td>
<td>Many words are unreadable, or there are several distracting corrections.</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL SCORE:**