

Developing Pre-K-6 Educators as Teachers of Writing in Science

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Why write during science lessons?

- helps students learn science content
 - forces writer to clarify thoughts for oneself and/or others
 - this is harder to do through writing than talking
- is a permanent record
 - can be reflected upon to show new learning
 - can be revised to show new understanding

What are science notebooks?

- place for students to record/write prior knowledge, questions, data, scientific explanations, and reflections of learning
- all of this information is kept in one place so helps students make sense of science experiences and build understanding of science concepts
 - can see their own learning over time
 - can use what was previously recorded to write new ideas

What are science notebooks?

Grade 3
Student
Sound

observations during
hands-on activity

November, 16, 2010 Alexia

1. How does the ruler make sounds?
2. I think it makes sounds because the ruler hits the table.
3. Cup 4 sounds empty, but with something in it like green beans. The plastic container needs to be hit like every thing else. The pink lid needs to be pulled back. Cup 2 has a bunch of coins. The plastic container is like a percussion instrument. Cup 1 sounds like pasta or rice. The yellow lid looks like a guitar and sounds like a guitar. The elastic on the yellow lid look stretchy. Cup 5 is empty. Cup 6 sounds like bells in it.
4. I know that the ruler vibrates against the table because it bounces back because it's meant to be straight but, the force makes it bounce more times and make a sound.
5. Today I learned how a ruler makes a sound.

question

prediction

claim

reflection

What are science notebooks?

Grade 5 Student Rocks & Minerals

Sedimentary Rocks

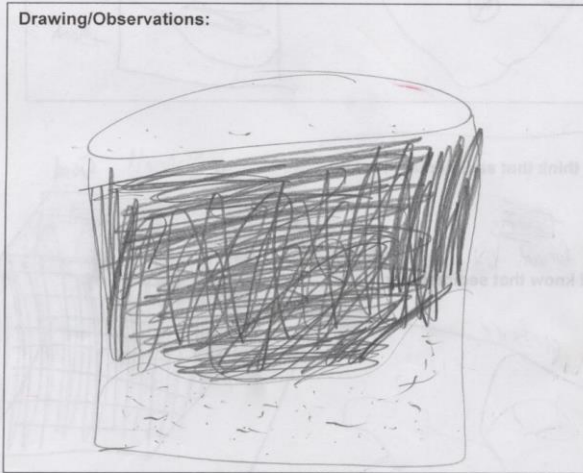
Question: How do sedimentary rocks form?

"I think that sedimentary rocks form by a mixture because ~~the~~ rocks have ingredients like a cookie that has ingredients."

Materials: Soil sand rocks jar water

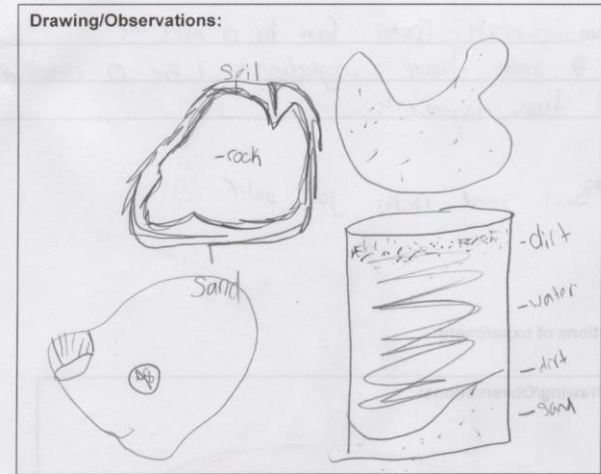
Observations of experiment:

Drawing/Observations:



Observations of Sedimentary Rocks:

Drawing/Observations:

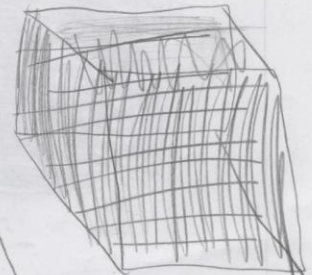


I used to think that sedimentary rocks...

were ~~formed~~ formed by mixtures but now I know that sedimentary rocks...

have layers by pressure

Small Good



Writing and Scientific Inquiry

- scientific inquiry:
 - asking and answering questions about the natural world
 - collecting data through experiments and observations
 - using this data as evidence to support answers to the questions asked
 - creating explanations
 - communicating these answers and explanations to a wider audience

Writing and Scientific Inquiry

- writing in science notebooks allows a permanent record of information gathered during inquiry
- writing allows students to think through and write out their scientific explanations using information from experiments
- students' science explanations can be revised
- writing in notebooks serves as a draft for what students can communicate to others ⁷

Science Notebooks and the ELA Common Core State Standards

- the new Common Core State Standards (CCSS) expect students in K-5 classrooms to write arguments to support claims using valid reasons
 - scientific explanations = claims (answers to scientific questions) + evidence (data from experiments/observations) + reasons (why the evidence supports the claims)
 - scientific explanations are a commonly written part of science notebooks

Science Notebooks and the ELA Common Core State Standards

- CCSS expects students in K-5 classrooms to write informative/expository texts to convey information and ideas and to gather information/evidence from multiple sources
 - science notebooks are a place for students to convey data from experiments and observations, and record ideas from classmates, teachers, and other sources that support their claims

Science Notebooks and the ELA Common Core State Standards

- CCSS expects students to write routinely on a short-term and long-term basis
 - science notebooks are a way for students to attain the writing skills and expectations of the CCSS in a discipline-specific way

Context of this Study

- preservice preK-6 teachers take a science education methodology course for 1 semester as part of their professional sequence of courses
 - this course is typically taken the semester before student teaching
- science notebooks are used by the preservice teachers in the course during science lessons that model both pedagogy (e.g. scientific inquiry and students' formation of scientific explanations) and science content
 - science notebooks are typically the only writing tool modeled during the course, and preservice

Context of this Study

- preservice teachers plan and teach a 5-day science unit to K-5 students; co-teach with 2-3 preservice teachers
 - must use the pedagogy of scientific inquiry
 - must have the K-5 students create scientific explanations
 - use of science notebooks is optional
- the 5-day science units typically teach between 2-4 concepts during the week
 - concept = factual information related to each part of the unit plan topic
 - unit plan topic is sound; concepts = sound being vibration, sound traveling through matter, pitch, volume = 4 concepts

Context of this Study

- preservice teachers were asked to be participants in the study at the end of the semester
- data collected and used:
 - 5-day science unit lessons
 - example science notebook entries from a high-level K-5 student (if they used notebooks)
 - daily reflections from their science unit
 - culminating personal reflection/survey on their use and understanding of science notebooks
 - preservice teachers' personal science

Findings

- most of the participating teachers in the study chose to use science notebooks during their 5-day science unit
 - 32 unit plans used science notebooks
 - 2 unit plans did not

Findings

- when science notebooks were used, the most often used purpose for science notebooks was to record data and observations
 - every unit plan had K-5 students recording this type of information in science notebooks at least once during the unit
- writing predictions and questions were the second most often written component in students' science notebooks

Findings

- none of the science notebook use had K-5 students writing scientific explanations (claims, evidence, and reasons) for all of the concepts taught during the unit
 - 7 unit plans had all 3 of these components of a scientific explanation for one of the concepts taught
 - 1 unit plan had all 3 of these components for two concepts taught
- when components of scientific explanations were written (this included about $\frac{1}{2}$ of the unit plans), the explanations most often were claims only or claims supported with evidence

Reflections from Teachers

What is your definition of a science notebook?

What do you see as the role of science notebooks in the elementary classroom?

- place to keep components of science investigations, including questions, predictions, observations, data, claims, evidence, reflections, notes, charts/graphs, facts, definitions...
- majority of reflections mentioned observations as a key thing recorded

Reflections from Teachers

What is your definition of a science notebook?

What do you see as the role of science notebooks in the elementary classroom?

- helps keep students organized; “a place to keep their work”
- formative assessment for teacher (reflections weren’t usually specific about what was being assessed; e.g. “learning” and “progress”)

Reflections from Teachers

What is your definition of a science notebook?

What do you see as the role of science notebooks in the elementary classroom?

- students can direct their own learning; record information how they want; “take ownership”
- reference tool to look back at things recorded (not usually specific about what was being looked back to)

Reflections from Teachers

What is your definition of a science notebook?

What do you see as the role of science notebooks in the elementary classroom?

What was rarely said:

- notebooks are interdisciplinary (e.g. learn reading, writing, and math skills)
- place for students to understand what they learned; self-assessment
- what teachers can/should assess about them
- role of claims/evidence/reasoning and the creation of scientific explanations

Implications and Next Steps

- preservice teachers need a better understanding of the role of writing to aid learning generally, and then how science notebooks can support this
 - need a class session specifically about this
 - focus on how the generation of scientific explanations shows student learning and understanding
 - explain how this can/should be assessed

Implications and Next Steps

- preservice teachers need a better understanding of assessment of science knowledge
 - it's students scientific explanations that should be assessed to determine if students understand the concept or not, yet if these are not being written in science notebooks then teachers are assessing students' learning in perhaps ineffective ways
 - show examples of science notebooks and what they can tell the teachers about K-5 students' knowledge

Implications and Next Steps

- more attention to what CCSS says and why/how science can easily support this
 - show during class, bring up whenever it occurs
- better understanding of what the reasoning part of a scientific explanation is
 - this was the least used aspect of scientific inquiry, written or not, during science units
 - show examples, read specific articles about this

Thank you!

For questions, comments, and/or references
please feel free to contact me at:

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