March 5th, 7:00 PM - 9:00 PM


Robert C. Idsardi Jr  
*University of Georgia, boidsardi@gmail.com*

Barbara A. Crawford  
*University of Georgia, barbarac@uga.edu*

Jaclyn K. Murray  
*University of Georgia, jakspiel@hotmail.com*

James F. Ammons  
*University of Georgia, ammons.james@gmail.com*

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How can we systematically analyze the ways in which students in the classroom are engaging in science practices?

Can we use the Science Practices in the Classroom Matrix to enhance practicing and prospective teacher knowledge of the scientific practices?

Scenarios from classrooms participating in Fossil Finders

From DJ’s Class:

Analyzing Data – a1/b2

I (Instructor): Alright gentlemen, what’d you ever just do?
S1 (Student): Umm, we took the information from these (has raw data sheets in hand)
I: And what was that information that you took?
S1: All the fossils that we found.
S2: And then we had to write down how many fossils we got from each type of organism. (Students are organizing their data into a data table).

Planning Investigations – a1/b1

I: So we are going to be taking measurements for the rest of this investigation. We’re going to be looking at length and width. When we get out actual specimens, and I’ll show you how to measure these organisms that we have. We are going to be taking a look at a measurement this way and also a measurement this way. And when we record those then the database will multiply them together to get a number the database can use.

From KN’s Class:

Interpreting Data – a2/b1

I: What did they find? Can someone tell me what this graph is telling us?
S5: They have brachiopods and clams here but, I think we see they don’t have any crinoids. They have trilobites. So they are missing some organisms that we have… And then, you can see that these two (taxa) were flourishing because they have relatively about the same number of fossils (students looking at pie graph).

Interpreting Data – a2/b3

I: What did they find? Can someone tell me what this graph is telling us?
S5: They have brachiopods and clams here but, I think we see they don’t have any crinoids. They have trilobites. So they are missing some organisms that we have… And then, you can see that these two (taxa) were flourishing because they have relatively about the same number of fossils (students looking at pie graph).

Overviews of DJ’s and KN’s classrooms

<table>
<thead>
<tr>
<th>Teacher</th>
<th>DJ</th>
<th>KN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Level</td>
<td>5th</td>
<td>7th (Earth Science)</td>
</tr>
<tr>
<td>Teaching Experience</td>
<td>4 years</td>
<td>5 years</td>
</tr>
<tr>
<td>Education</td>
<td>BA Int. Relations, MId</td>
<td>BS Biology, MA in Education</td>
</tr>
<tr>
<td>College Science Courses</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td># of Professional Development Workshops</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Research Experience</td>
<td>Pre/Post NOS and Inquiry Scores (out of 24)</td>
<td>Pre = 12 Post = 22</td>
</tr>
</tbody>
</table>

Table 2. Background experiences of teachers studied.

NGSS Sciences Practices

1. Asking questions (for science) and designing solutions (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument form evidence
8. Obtaining, evaluating, and communicating information

The SPCM is being used to systematically determine how the use of the SPCM in prospective science teacher education and practice teacher professional development will be discussed.

Theoretical Framework

• Teaching science as inquiry is engaging students in the practices of science, where learners grapple with data and use evidence to justify explanations to make sense of the natural [and material] world with the expert guidance of a teacher (Crawford, 2014).
• Situated cognition is a learning perspective that describes knowledge as a product of the activities, context, and culture in which the learning is situated (Brown et al., 1989).

Implications for research and teacher education

The SPCM has multiple uses. First, the SPCM will be used to differentiate teachers’ enactment of the science practices through the Fossil Finders professional development project. Recordings of their enactment of the Fossil Finders curriculum will be analyzed with the SPCM then compared to teachers’ knowledge and views on inquiry and NOS, both before and after the professional development intervention.

The SPCM will offer a new tool educators can use to support practicing and prospective teachers in understanding the science practices, bringing research into practice. Prospective teachers may have difficulty differentiating between features of inquiry and student-centered pedagogy (Forbes, 2011). A proposed study is in development to see if an intervention on the scientific practices and use of the SPCM enhances teachers’ knowledge and views on inquiry and NOS, both before and after the professional development intervention.

Table 1. An portion of the SPCM. The full SPCM covers all eight of the NGSS Science Practices

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<table>
<thead>
<tr>
<th>Planning investigations</th>
<th>Carrying out Investigations</th>
<th>Analyzing data</th>
<th>Interpreting data</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>b</td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>An investigation is planned in light of new evidence</td>
<td>An investigation is carried out</td>
<td>Data analysis is conducted through systematic quantitative (e.g. statistics) or qualitative methods to create visual representations</td>
<td>Limits of the interpretations are evaluated and data is reinterpreted through an iterative process</td>
</tr>
<tr>
<td>Teacher guides students in planning investigation</td>
<td>An investigation is carried out that accounts for variables</td>
<td>Teacher analyzes data</td>
<td>Teacher guides students in interpreting data</td>
</tr>
<tr>
<td>Emerging</td>
<td>Absent</td>
<td>Planning investigations not present</td>
<td>Teacher interprets data</td>
</tr>
</tbody>
</table>

References

Georgia Lead States. (2013). Next Generation Science Standards: For States, By States. Achieve, Inc. on behalf of the twenty-six states and partners that collaborated on the NGSS.

Acknowledgements

We thank The University of Georgia for their support. This material is based upon work supported by the National Science Foundation under Grant No. NSF 1248537. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of The National Science Foundation.