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Analyzing NGSS Scientific Practices in Action

Robert C. Isdardi Jr, Barbara A. Crawford, Jaclyn K. Murray, James F. Ammons, Wendell F. Rogers

Abstract

This ongoing research involves the Science Practices in the Classroom Matrix (SPCM), an analytical tool used for identifying the level of sophistication of scientific practices occurring in classroom lessons and the level of student versus teacher centeredness. The SPCM was developed through iterative rounds of coding videotaped lessons and confirming and disconfirming components of the Matrix, followed by a process of discussion and consensus building. The SPCM is being used to systematically determine how science teachers enact the scientific practices in their classrooms in meaningful ways. Additionally, implications of the use of the SPCM in prospective science teacher education and practicing teacher professional development will be discussed.

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

To analyze the engagement of students in science practices, the Science Practices in the Classroom Matrix (SPCM) is used. The SPCM identifies five dimensions of engagement:

- **Planning and carrying out investigations**: This dimension involves the planning and execution of scientific investigations. Teachers guide students in planning and carrying out investigations, ensuring that the investigation is conducted with the necessary procedures and equipment.

- **Analyzing data**: This dimension involves the analysis of data. Data are analyzed through systematic quantitative or qualitative methods to create visual representations.

- **Interpreting data**: This dimension involves interpreting data. General patterns are identified in the data, and the meaning of the data is discussed.

- **Teacher guides students in interpreting data**: This dimension involves the role of the teacher in interpreting data. Teachers guide students in interpreting data and making sense of the results.

- **Teacher analyzes data**: This dimension involves the role of the teacher in analyzing data. Teachers analyze data and draw conclusions from the results.

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

<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>An investigation is planned independently</td>
<td>An investigation is carried out</td>
<td>Data analysis is conducted through systematic quantitative or qualitative methods</td>
</tr>
<tr>
<td>b</td>
<td>Teacher guides students in planning investigation</td>
<td>Teacher guides student in carrying out investigation</td>
<td>Descriptive analysis of data is conducted or visual representations of data are created</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Science Practices

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 to compare teachers' knowledge and views on inquiry and NOS, both before and after the professional development intervention.

Second, the SPCM may offer teacher educators a way to support practicing and prospective teachers in understanding the scientific practices. It can be used to analyze the classroom lessons and the level of student versus teacher centeredness. Additionally, implications of the use of the SPCM in prospective science teacher education and practicing teacher professional development will be discussed.

References


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Table 2. Background experiences of teachers studied.

<table>
<thead>
<tr>
<th>DJ</th>
<th>KN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Level</td>
<td>5th</td>
</tr>
<tr>
<td>Teaching Experience</td>
<td>4 years</td>
</tr>
<tr>
<td>Education</td>
<td>BA Int. Relations, MEd</td>
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<tr>
<td>College Science Courses</td>
<td>16</td>
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<tr>
<td># of Professional Development Workshops</td>
<td>0</td>
</tr>
<tr>
<td>Research Experience</td>
<td>None</td>
</tr>
<tr>
<td>Pre/Post NOS and Inquiry Scores (out of 24)</td>
<td>Pre = 12</td>
</tr>
<tr>
<td>Pre = 18</td>
<td>Post = 22</td>
</tr>
</tbody>
</table>