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What Science Process Skills Do Middle School Children Need

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Indiana STEM Network (I-STEM)
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It Could be a Joy if

- Students came to you having the process skills needed to do science in your classroom.

- What process skills would you like them to have?

- Perhaps we could design PD for elementary teachers so that students learned those process skills.
Process Skills?

- Karen Ostland: (current NSTA president)
  - Observation
  - Measurement
  - Experimentation
  - Communication

- I think we need to be more specific
- What would your list include?
Our Process

- Please form groups of 3 or 4.
- Each person spend five minutes writing a list of the science process skills
  - needed to do science that incoming students should have.
- Discuss in your group for five minutes and be prepared to report a rank-ordered, more or less, list.
- One person please be the group reporter.
Step 2 in Our Process

- When asked please read the first item on your group’s list.
- I write it on a master list and give it a number.
- If your item is already on the master list, give the number and I will place a check mark by it.
- We repeat with your next time and continue until all ideas are on the master list.
- Please no comments or questions during this work.
### Master List of Process Skills

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<th>1 Complete Sentences</th>
<th>13 define variables</th>
<th>25 measurement skills</th>
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<td>x2 Risk taking</td>
<td>14xx work cooperatively</td>
<td></td>
</tr>
<tr>
<td>3 written communicati</td>
<td>15x recognize good and bad data</td>
<td></td>
</tr>
<tr>
<td>x x4 follow instructions</td>
<td>16x active listening</td>
<td></td>
</tr>
<tr>
<td>5 define a problem</td>
<td>17 careful observation</td>
<td></td>
</tr>
<tr>
<td>6xx use metric scale</td>
<td>18 form accurate conc.</td>
<td></td>
</tr>
<tr>
<td>7 observation/inferenc</td>
<td>19 acc documentation</td>
<td></td>
</tr>
<tr>
<td>8 willing to ask quest</td>
<td>20 units conversion</td>
<td></td>
</tr>
<tr>
<td>9 label numbers</td>
<td>21x use evidence</td>
<td></td>
</tr>
<tr>
<td>10xx tables and graphs</td>
<td>22 modeling</td>
<td></td>
</tr>
<tr>
<td>11x will discuss</td>
<td>23 justify from data</td>
<td></td>
</tr>
<tr>
<td>12 evaluation</td>
<td>24 respect process</td>
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Step 3

• If an item is not clear, now anyone can ask about it, and anyone can answer.

• Discussion continues until all are satisfied.
  • Please raise your hand to speak.
  • Please listen carefully to what others are saying.

• So many ideas...let's group similar ones.
What Do We Find in Standards?

- We consider three:
  2. Frameworks for the Next Generation Science Standards
  3. Indiana State Standards for 5th Grade.

How do these compare with our list?
Essential Features of Inquiry

1. Learner engages in scientifically oriented questions.
2. Learner give priority of evidence in responding to questions.
3. Learner formulates explanations from evidence.
4. Learner compares explanations to scientific knowledge.
5. Learner communicates and justifies explanations.

Frameworks of the Next Generation Science Standards (NGSS)

1) Asking questions (for science) and defining problems (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 from evidence

8) Obtaining, evaluating, and communicating information
Indiana Process Standards: Grade 5

- Students gain scientific knowledge by observing the natural and constructed world, performing and evaluating investigations, and communicating their findings. These principles should guide student work and be integrated into the curriculum along with the content standards on a daily basis.

- Make predictions and formulate testable questions.

- Design a fair test.

- Plan and carry out investigations as a class, in small groups or independently, often over a period of several class lessons.

- Perform investigations using appropriate tools and technology that will extend the senses.

- Use measurement skills and apply appropriate units when collecting data.

- Test predictions with multiple trials.

- Keep accurate records in a notebook during investigations and communicate findings to others using graphs, charts, maps and models through oral and written reports.

- Identify simple patterns in data and propose explanations to account for the patterns.

- Compare the results of an investigation with the prediction.
Indiana Science Initiative
Indianascience.org

- Students in k-5, k-6, or k-8

- Learn science by guided inquiry:
  - Professionally designed and tested instructional materials.
  - Activity based and student centered.
  - Materials provided and maintained externally.
  - Aligned to the Indiana content and process standards.

- Systemic professional development available for all teachers.

- Learning enhanced by scientist notebook strategy.
Indiana Science Initiative
Notebook Strategy for Investigations

Engage to Generate interest
- Focus Question - Guides toward a standard
- Predict - I think... because....
- Plan - What shall we do to answer the question?

Investigate to Answer the Question
- Data: Observations and measurements.
- Initial response to focus question.
- Claims/Evidence - So what happened; what is the evidence?

Making Meaning Conference Whole Class Conversation
How we do make sense of our results; what have we learned?
- Revised response to Focus Question.
- Conclusions
- New questions
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