Developing 21st Century Skills Through Issue-oriented Science

John Howarth
Barbara Nagle
SEPUP - Lawrence Hall of Science
UC Berkeley
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<table>
<thead>
<tr>
<th>Category</th>
<th>20th Century</th>
<th>21st Century</th>
</tr>
</thead>
<tbody>
<tr>
<td># jobs/lifetime</td>
<td>1-2</td>
<td>10-15</td>
</tr>
<tr>
<td>Job requirement</td>
<td>Mastery of one field</td>
<td>Simultaneous mastery of many rapidly changing fields</td>
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<tr>
<td>Competition</td>
<td>Local</td>
<td>Global</td>
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<tr>
<td>Work model</td>
<td>Routine; hands-on; fact based</td>
<td>Non-routine; technical; creative; interactive</td>
</tr>
<tr>
<td>Organizational Culture</td>
<td>Top down</td>
<td>Multi-directional</td>
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</tbody>
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From Partnership for 21st Century Skills
Summary of 21st Century Skills

Four main skill areas

- Literacy Skills
- Cognitive Skills
- Metacognitive Skills
- Interpersonal Skills
Literacy Skills

- Language
- Mathematical
- Scientific
- Informational
- Technological
- Media
- Economic
- Multicultural
- Civic & Social
- Environmental
- Health
Cognitive Skills

• Critical thinking
• Problem solving
Metacognitive Skills

- Self management
- Learning/Study
Interpersonal Skills

• Communication
• Collaboration
• Social
Personal Qualities

• Ethics
• Accountability
• Adaptability
• Intrinsic motivation
• Leadership
• Creativity
• Productivity
enGauge 21st Century Skills

<table>
<thead>
<tr>
<th>Digital-Age Literacy</th>
<th>Inventive Thinking</th>
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</thead>
<tbody>
<tr>
<td>Basic, scientific, economic, &amp; technological literacy</td>
<td>Adaptability, managing complexity, &amp; self-direction</td>
</tr>
<tr>
<td>Visual &amp; informational literacy</td>
<td>Curiosity, creativity, &amp; risk taking</td>
</tr>
<tr>
<td>Multicultural literacy &amp; global awareness</td>
<td>Higher-order thinking &amp; sound reasoning</td>
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<table>
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<tr>
<th>Effective Communication</th>
<th>High Productivity</th>
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</thead>
<tbody>
<tr>
<td>Teaming, collaboration, &amp; interpersonal skills</td>
<td>Prioritizing, planning, &amp; managing for results</td>
</tr>
<tr>
<td>Personal, social, &amp; civic responsibility</td>
<td>Ability to produce relevant, high-quality products</td>
</tr>
<tr>
<td>Interactive communication</td>
<td>Effective use of real-world tools</td>
</tr>
</tbody>
</table>

www.ncrel.org/engauge
Scientific and Engineering Practices

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and information and computer technology
6. Developing explanations and designing solutions
7. Engaging in argument
8. Obtaining, evaluating, and communicating information
The Full Course

From the unit, “Cell Biology and Disease,” from SEPUP’s middle school life science course, Issues and Life Science
The Full Course Activity Context

• The Full Course falls late in the Cell Biology and Disease unit from Issues and Life Science, SEPUP’s middle school life science course.
• Students have studied cell structure and function, microbes, causes of disease, and disease prevention.
• In this activity, students investigate how a population of bacteria is impacted when a patient does not take the full course of prescribed antibiotics.
The Full Course

• **Challenge**
  – Why is it important to take an antibiotic as prescribed?

• **Investigate**
  – Examine how the proportions of different types of bacteria change in a population.

• **Procedure**
  – Count out the plastic chips as per Procedure Step 1.
  – Roll the die & use the table to adjust the number of chips.
  – Allow the bacteria to reproduce! (Procedure Step 3)
  – Repeat until 8 days have passed.
  – Graph the results.
The Full Course - Review

• What is the content?
• What is the issue?
• Which 21st Century Skills can be applied in this activity?
• Which Scientific and Engineering Practices can be applied in this activity?
• How did the context of an issue lend itself to the application of Skills and Practices?
Contact

• Questions and comments can be addressed to:
  john_howarth@berkeley.edu

• More information, including this presentation, can be found at
  sepuplhs.org