Standards Awareness Workshop

Science seeks to explain the complexity of the natural world and uses this understanding to make valid and useful predictions.

Engineering creatively applies scientific principles to analyze events, design processes, develop materials, and construct objects that benefit society.

Technology utilizes innovative tools, materials, and processes to solve problems or satisfy the needs of individuals, society, and the environment.

Science, Engineering and Technology use Mathematics to explore questions about the natural and human-made worlds.

Summer 2008
The Inquiry and Technology and Engineering Standards are optional and can be taught as stand-alone topics or embedded in the content.

The state’s new focus on classroom assessment is likely to improve student science learning.

Making informed decisions about adopting curriculum materials should be based on an analysis of numerous types of data.

To keep pace with scientific advances and understandings about how children learn, standards must be revised at regular intervals.

Because of its global and economic implications, the state should take the lead in raising public awareness of K-12 STEM Education.
PART ONE: Gathering the Data

- Review the Survey items carefully.
- Decide on your responses.
- Use one color-coded post-it for each response to the Survey.
- Place your post-its in the selected rating column for each response to the survey.

PART TWO: Analyzing the Data

- What important points stand out?
- What patterns or trends emerged in the data?
- What information is surprising or unexpected?

PART THREE: Generating Ideas

- What possible inferences, explanations, and conclusions can be drawn?
- How does this data compare with information in current literature?
- How can this data inform this workshop?
“From Galileo to today’s scientists ..., notebooks have been used to document scientific discovery. Science notebooks are also effective tools in the classroom. They make science experiences more meaningful and authentic for students as they observe, record, and reflect on what they've learned.”
# Standards Awareness

## Day One Agenda

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<th><strong>DAY ONE: LARGE GROUP</strong></th>
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<tr>
<td><strong>MORNING</strong></td>
<td>Pre-Assessment Consensogram</td>
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<td>Scientist’s Notebooks</td>
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<td>Science Curriculum Framework</td>
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<td>Embedded Inquiry</td>
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<td><strong>12:00 - 12:30</strong></td>
<td>Brown Bag Lunch: St. Louis Arch</td>
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<td><strong>AFTERNOON</strong></td>
<td>Embedded Technology and Engineering</td>
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<td></td>
<td>Engineering Design vs. Inquiry</td>
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<td>K-12 Learning Progressions</td>
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<td>STEM Assessment Collection</td>
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</table>
GRADE/ COURSE LEVEL EXPECTATIONS represent the fundamental goals for student learning and are used by teachers as the principal guide for instructional planning.

Course Level Expectations.

Grade or Course Level Expectation.

# New Science Curriculum Framework

## Grade 7: Standard 4 - Heredity

<table>
<thead>
<tr>
<th>Conceptual Strand 4:</th>
<th>Plants and animals reproduce and transmit hereditary information between generations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guiding Question 4:</td>
<td>What are the principal mechanisms by which living things reproduce and transmit information between parents and offspring?</td>
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<table>
<thead>
<tr>
<th>Grade Level Expectations</th>
<th>Checks for Understanding (Formative/Summative Assessment)</th>
<th>State Performance Indicators</th>
</tr>
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<tbody>
<tr>
<td>GLE 0707.4.1 Compare and contrast sexual and asexual reproduction.</td>
<td>√0707.4.1 Classify organisms according to whether they reproduce sexually or asexually.</td>
<td>SPI 0707.4.1 Classify various methods of reproduction as sexual or asexual.</td>
</tr>
<tr>
<td>GLE 0707.4.2 Demonstrate an understanding of sexual reproduction in flowering plants.</td>
<td>√0707.4.2 Label and explain the function of different reproductive parts of a flower.</td>
<td>SPI 0707.4.2 Match flower parts with their reproductive functions.</td>
</tr>
</tbody>
</table>
Beliefs About Inquiry

Easy to implement!

Eats up valuable time and money!

For all students!

Chaotic!
Draw a Scientist - Visualization

- Picture a scientist at work.
- Picture the details of the scene. What is the scientist wearing? What is the scientist doing? With what tools does the scientist work?
- Draw a picture of the scientist. It’s important for you to capture all the little details that you imagined.
- You will not be judged on your artistic talent!
Children don't think like grownups. After thousands of interactions with young people often barely old enough to talk, Piaget began to suspect that behind their cute and seemingly illogical utterances were thought processes that had their own kind of order and their own special logic.
## CURRICULUM MATERIALS: LEVELS OF INQUIRY

<table>
<thead>
<tr>
<th>INQUIRY LEVEL</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Confirmation</td>
<td>Students confirm a principle or concept through an activity for which the results are known in advance.</td>
</tr>
<tr>
<td>2</td>
<td>Structured Inquiry</td>
<td>Students investigate a teacher-presented question through a prescribed procedure.</td>
</tr>
<tr>
<td>3</td>
<td>Guided Inquiry</td>
<td>Students investigate a teacher-presented question using student designed/selected procedures.</td>
</tr>
<tr>
<td>4</td>
<td>Open Inquiry</td>
<td>Students investigate topic-related questions that are student formulated through student designed/selected procedures.</td>
</tr>
</tbody>
</table>
My dad taught life sciences to junior high students and college students for more than 30 years. He also taught science in the backyard, from the front seat of his car, and at the family dinner table. His insatiable curiosity and boundless enthusiasm for any scientific subject propelled his need to teach his students and his children in whatever method they could understand...
Embedded Technology & Engineering

12. Evaluate the results.
   - What works, what doesn't, and how could the product work better?

13. Improve the design.
   - How can the product design be modified to make it better?

   - How effective is the redesigned product?

1. Define the need or problem.
   - What is the exact need to be met or problem to be solved?

2. Conduct research.
   - What is already known or previously been done?

3. Sharpen the focus.
   - What are the time, cost, and safety constraints?

4. Brainstorm ideas.
   - What are some possible solutions?

5. Analyze the options.
   - Which potential solution is the best?

6. Draw a model or build a prototype.
   - What does the best possible solution look like?

7. Make a materials list.
   - What materials are needed to test this solution?

8. Delegate responsibilities.
   - What team members will complete what work tasks?
Embedded Inquiry versus Embedded Technology and Engineering
Embedded Inquiry versus Embedded Technology and Engineering
**K-12 Learning Progressions**

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**Learning Progressions: Cornerstone of Formative Assessment**

Dr. Popham explains “...why today's teachers really need to understand learning progressions and the pivotal role they can play when teachers assess their own students.”

*Dr. W. James Popham*
Next Generation Tools: Assessment Collection

Pre-Assessment

activates

Student Prior Knowledge

exposes

reveals

Misconceptions

Knowledge Gaps

confronted by

addressed by

Conceptual change approaches

Targeted content-based instruction
# Standards Awareness Day Two Agenda

## DAY TWO: GRADE BAND GROUPS

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<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tr>
<td>MORNING</td>
<td>Next Generation Tools for STEM Education</td>
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<tr>
<td></td>
<td>Fact Finding Mission: STEM WebLinks</td>
</tr>
<tr>
<td></td>
<td>Embedded Engineering Standards: Curriculum Materials</td>
</tr>
<tr>
<td>12:00 - 12:30</td>
<td>Brown Bag Lunch</td>
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<tr>
<td>AFTERNOON</td>
<td>Embedded Engineering Standards: Curriculum Materials</td>
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<td>K-12 Articulations for T&amp;E</td>
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<td>Standards Awareness Survey</td>
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</table>
Next Generation Tools for STEM Education
STEM WebLinks: Fact Finding Mission

SCIENCE TEACHER RESOURCES
- Standards
- Test Item Analysis
- Inquiry
- Safety
- Curriculum Development
- Learning Cycle
- Science Trade Books
- Inquiry Teaching Strategies
- TN Science Education Organizations
- Curriculum Weblinks
- Podcasts
- Mathematics
- Technology & Engineering

TECHNOLOGY & ENGINEERING
1. Boston Museum of Science: Engineering Is Elementary
2. Discover Engineering
3. Enchanted Learning
4. History of Invention (Canadian Broadcasting Corporation)
5. How Stuff Works
6. IEEE Virtual Museum
7. Innovative Lives (Smithsonian Institute)
8. Invention At Play
9. Invention Dimension (MIT)
10. Inventive Kids
11. Invent Now
12. Junior Engineering Technical Society
13. Massachusetts Curriculum Frameworks
14. National Engineer's Week
15. National Society of Professional Engineers (Engineering Insights)
16. Project Lead The Way
17. Slinky Science
18. Teach Engineering K-12
19. Try Science
20. U.S. Patent Office
STEM Curriculum Materials

- Leif Catches the Wind
- Building Math: Stranded!
- Engineering the Future
African Proverb:  
The Race at Sunrise

Every morning in Africa, a gazelle wakes up. It knows that it must run faster than the fastest lion or it will be killed.

Every morning a lion wakes up. It knows that it must outrun the slowest gazelle or it will starve to death.

The moral: It doesn't matter whether you are a lion or a gazelle. When the sun comes up, you had better be running.

“In most cases, teachers need 3-5 years to polish their inquiry teaching techniques.”  
Lleleullyn