How Can We Empower Educators To Maximize Authentic Science Learning By Florida Public School Students?
What Does Authentic Science Learning Look Like?
Table Sharing

✓ Cognitively Complex Tasks

✓ Learner Engagement

✓ Inquiry
# Depth of Knowledge

<table>
<thead>
<tr>
<th>DOK Level 1</th>
<th>DOK Level 2</th>
<th>DOK Level 3</th>
<th>DOK Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recall and Reproduction</td>
<td>Skill/Concept</td>
<td>Strategic Thinking</td>
<td>Extended Thinking</td>
</tr>
<tr>
<td>Recall a fact, information, or procedure</td>
<td>Engages mental process beyond habitual response using information or conceptual knowledge. Requires two or more steps.</td>
<td>Requires reasoning, developing a plan or a sequence of steps, more than one possible answer</td>
<td>Requires investigation, complex reasoning, planning, developing, and creative thinking (likely over an extended period of time)</td>
</tr>
<tr>
<td>Examples: arrange, list, calculate, define, draw, label, identify, illustrate, match, measure, quote, memorize, recognize, name, repeat, recall, recite, state, use, tabulate, tell who, what, when, where</td>
<td>Examples: apply, graph, categorize, classify, collect and display, determine cause and effect, compare, distinguish, estimate, infer, interpret, identify patterns, make observations, modify, organize, predict, relate, solve, summarize, use context clues</td>
<td>Examples: cite evidence, differentiate, assess, draw conclusions, formulate, construct, hypothesize, investigate, revise, solve non-routine problems, develop a logical argument, explain phenomena (in terms of concepts)</td>
<td>Examples: analyze, compose, connect, create, critique, defend, design, evaluate, judge, justify, propose, prove, synthesize</td>
</tr>
<tr>
<td>In Practice:</td>
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<tr>
<td>- Conduct basic mathematical calculations</td>
<td>- Solve routine multi-step problem</td>
<td>- Identify research questions and design investigations for a scientific problem</td>
<td>- Conduct an extensive investigation that requires defining a problem, designing and conducting an experiment, analyzing data, and reporting results or solutions</td>
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<tr>
<td>- Perform routine procedures such as measuring distance</td>
<td>- Describe the cause and effect of an event</td>
<td>- Develop a scientific model for a complex idea</td>
<td>- Analyze and synthesize information from multiple sources</td>
</tr>
<tr>
<td>- Represent a scientific concept in words or diagrams</td>
<td>- Organize, represent and interpret data</td>
<td>- Support ideas with evidence</td>
<td>- Design a mathematical model to inform and solve a practical or abstract problem</td>
</tr>
<tr>
<td>- Locate or retrieve information</td>
<td>- Formulate a routine problem given data and conditions</td>
<td>- Create a Venn Diagram</td>
<td></td>
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</table>

**Sample Teacher Roles:**
- Direct
- Tell
- Show

**Sample Student Roles:**
- Remember
- Respond
- Describe
- Memorize

**Sample Teacher Roles:**
- Observe
- Organize
- Question

**Sample Student Roles:**
- Solve
- Demonstrate
- Observe
- Organize

**Sample Teacher Roles:**
- Clarify
- Guide
- Probe

**Sample Student Roles:**
- Examine
- Argue
- Question
- Test

**Sample Teacher Roles:**
- Facilitate
- Reflect
- Evaluate

**Sample Student Roles:**
- Propose
- Design
- Create
- Modify
Levels of Learner Engagement

1. **Authentic Engagement** – assigned task, activity, or work is associated with a result that has a clear meaning and immediate value to student

2. **Ritual Engagement** – assigned work has little or no inherent meaning or immediate value to student, but student associates it with extrinsic results that are of value

3. **Passive Compliance** – student is willing to expend whatever effort is necessary to avoid negative consequences, even though student sees little meaning or value in the task

4. **Retreatism** – student is disengaged from the task and expends little or no energy attempting to comply with demands of the task/teacher, but doesn’t disrupt others or try to substitute other activities for assigned task

5. **Rebellion** – student refuses to do task, disrupts others, and/or tries to substitute other activities in lieu of assigned task

(Schlechty, Phillip, Shaking Up the Schoolhouse: How to Support and Sustain Educational Innovation, 2000)
More than 35 years of solid research show that inquiry is the best way for learners to construct meaning in science.
But… Who Has Time?
SC.8.N.1.1 (Experimental Design) = 10.7 %
SC.7.L.17.2 (Energy Transfer; Limiting Factor) = 7.1 %
SC.7.E.6.2 (Human Impact) = 7.1 %
SC.7.E.7.4 (Weather/Climate Differentiation) = 5.35 %
SC.7.9.11.2 (Energy) = 5.35 %
SC.912.N.1.1 (Experimental Design) = 12.5 %

SC.912.L.17.5 (Ecosystems) = 10.25 %

SC.912.L.16.17 (Mitosis/Meiosis) = 7.1 %

SC.912.L.17.20 (Cost/benefits; Human Impact) = 4 %
SC.912.N.1.1

Define a science problem and do the following:

- Pose questions about the natural world.
- Conduct systematic observations.
- Review what is known in light of empirical evidence.
- Plan investigations.
- Use tools to gather, analyze, and interpret data.
- Pose answers, explanations, or descriptions of events.
- Generate explanations that describe natural phenomena.
- Use appropriate evidence and reasoning to justify those explanations to others.
- Communicate results of scientific investigations.
- Evaluate the explanations produced by others.
What Opportunities Do You See for

- Additional Science Standards?
- Literacy Standards?
- Mathematical Practices?
- STEM?
- Engineering Design Practices?
- Other?
Brevard’s Teacher Evaluation Rubric Elements:

- Promotes a student-centered learning environment
- Manages time, space, and resources
- Creates a positive environment of respect and rapport
- Maintains a climate of inquiry
- Employs higher order questions
- Differentiates instruction
- Uses varied instructional strategies and resources
What Does Science Research Support Look Like?
District Funding Support:

- Teacher Stipends
- Fair Director Stipends
- Sub Days
- Equipment Budget
- Field Trip Budget
- Affiliation Fees
- Transportation
- Paid Summer Work
- Paid Safety Cadre
- SRC Attendance
- Pay for Guytri Still

Defining the Research Unit

- The research unit will consist of one (1) Research Teacher and 8-16 students. The research teacher will be a qualified teacher selected by the principal of the school. Qualifications should include expertise in science, data analysis, and experimental design.
- Research units will consist of one regular class period per day **AND** an average of four additional after school hours per week **OR** an after school program with an average of four after school hours per week. A regularly scheduled class period is the preferred model and is considered a priority by the Superintendent.
- Funds will be provided each year, per unit, for science research materials and supplies. A teacher supplement will be paid according to the adopted supplemental salary schedule.
- An internal account may be established for science research to provide for fund-raising activities and ancillary expenses.
**Other District Support:**

- In school classes (and before/after school)
- Annually Updated Guide
- District-wide teacher, parent and student briefings
- Approval process for chemicals and materials not on list
- Foundation “Matching Funds” Program
- Course rubrics in lieu of Final Exams (20% of grade)
- Superintendent & Senior Staff Attend Science Fair & Awards
- School Board presentations and recognitions
- Priority status and considerations (Research is valued.)
Science Research Matching Funds Program

What? Matching funds will be provided by the School Board of Brevard County, through the Brevard Schools Foundation, to support middle and high school science research programs.

How Much? Up to $5000 for high school science research programs and $2500 for middle school science research programs will be available to match school-raised funds. (As long as funds are available.)

What Can be Matched? Cash and in-kind equipment donations specifically supporting school science research programs will be eligible.

When Can Funds Be Accessed? Schools will have continuous access to their funds except for the period between May 31 and July 1. Although remaining funds will carry forward, the intent of this program is to use the funds during the school year in which they were raised and matched.

How Can the Funds Be Used? Matching funds are to be used to support original scientific research undertaken by students as part of a Brevard Public Schools science research program. Students may be enrolled in research programs that take place before, during or after school. It is expected that supported projects will display in the appropriate regional science fairs. Any equipment purchased by the matching funds will become the property of the school science research program at the conclusion of the project, or when the student leaves the school (whichever comes first). These funds may be used to purchase any items approved by the Science Research Teacher to directly support student research (e.g. chemicals, cell lines, specimens, specialized equipment, reference materials).

What Are the Procedures? First, participating school science research programs will establish an account with the Brevard Schools Foundation. All monies raised can be sent by courier or hand delivered to the Foundation office at E.S.F. Checks should be written payable to BSV/School Name/Science Research. (Any cash collected should be placed in an internal school account, and a school check in that amount sent to the Foundation.) For in-kind donations, the Gift In-Kind Form should be submitted along with documentation to support the value of the gift(s). (See GIK Policy and GIK Form). For every dollar deposited into the BSF School Science Research account (up to $5000 for high schools and $2500 for middle schools), one dollar will be added to the account. (A high school that raises $5000 will be eligible for $5000 in matching funds; a middle school that raises $2500 will be eligible for $2500 in matching funds). These matching funds are provided by the School Board, through the Foundation. In order to access money from the account (match or initial deposit), the school science research teacher will submit the attached check request form to the Foundation. A check payable to the school or designated agency will be sent by courier to the teacher as soon as possible. This process will be ongoing throughout the year. Note: A copy of all matching funds forms and correspondence must also be sent to Ginger Davis, Office of Secondary Programs, E.S.F., Viera. This requirement is at the request of the Foundation, in order to better serve you.

For More Information: Contact Ginger Davis, 633-1000, ext. 314.
# Brevard Public School Science Research Rubric Assessment

## Assessment Rubric for Experimental Science 3 Honors (#2023540)

<table>
<thead>
<tr>
<th>Score</th>
<th>Design a Scientific Investigation</th>
<th>Evaluate Relevant Information</th>
<th>Conduct Systematic Observations</th>
<th>Conclude, Analyze, and Interpret Data</th>
<th>Communicate Results of Investigation</th>
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<tr>
<td>5</td>
<td>Identifies a scientifically valid question or hypothesis, identifies variables, and lists specific variables relevant to the question or hypothesis, and designates the hypothesis and specific variables in a clear and concise manner.</td>
<td>Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.</td>
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### Scoring Guidelines

1. **Design a Scientific Investigation**
   - **5 Points:** Identifies a scientifically valid question or hypothesis, identifies variables, and lists specific variables relevant to the question or hypothesis, and designates the hypothesis and specific variables in a clear and concise manner.
   - **4 Points:** Identifies a scientific question or hypothesis, identifies variables, and lists specific variables relevant to the question or hypothesis, and designates the hypothesis and specific variables in a clear and concise manner.
   - **3 Points:** Identifies a scientific question or hypothesis, lists variables, and designates the hypothesis and variables in a clear and concise manner.
   - **2 Points:** Identifies a scientific question or identifies variables, lists variables, and designates the hypothesis and variables in a clear and concise manner.
   - **1 Point:** Identifies a scientific question or identifies variables, lists variables, and designates the hypothesis and variables in a clear and concise manner.

2. **Evaluate Relevant Information**
   - **5 Points:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.
   - **4 Points:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.
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   - **1 Point:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.

3. **Conduct Systematic Observations**
   - **5 Points:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.
   - **4 Points:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.
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   - **1 Point:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.

4. **Conclude, Analyze, and Interpret Data**
   - **5 Points:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.
   - **4 Points:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.
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   - **1 Point:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.

5. **Communicate Results of Investigation**
   - **5 Points:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.
   - **4 Points:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.
   - **3 Points:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.
   - **2 Points:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.
   - **1 Point:** Uses relevant information from a variety of sources on the topic, identifies key concepts and vocabulary relevant to the selected scientific area.

### Total Points

5 Points (out of 5 maximum)
Community Support:

- Free use of malls for regional fairs
- Volunteer mentors
- Volunteer Judges
- Funding for Judge lunches
- Special awards
- T-shirt funds
- Project shipping to ISEF
- Research Rules event
- Press coverage
What We Do: PR

✓ Press releases
✓ School Board Updates
✓ Public displays (mall)
✓ Community presentations
✓ Always Seek Support *

* Funds, expertise, equipment, labor, etc.
What Do Our Empowered Science Research Leaders Look Like?
How Do You Already Empower Educators in Your District To Maximize Authentic Science Learning?

What New Ideas Might You Be Able To Try?