

Powerful Science Instructional Practices

Making sense of natural and human-designed phenomena*

Teacher Behaviors	Student Behaviors	Artifacts
Select and present relevant phenomena that motivate students to make sense of the causes of those phenomena.	Carefully observe phenomena and develop preliminary explanations and solutions.	Oral and written preliminary explanations and solutions.

Developing questions to plan and carry out investigations, design solutions and/or obtain information

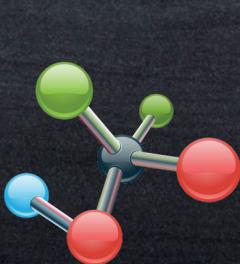
Teacher Behaviors	Student Behaviors	Artifacts
Use instructional strategies to engage students in developing useful questions to engage in the investigation of phenomena. Teachers help students refine their language and develop testable science questions.	Develop questions to use in researching information from reliable sources and/or planning experiments, observational studies or simulations to gather data. Students collaborate to ask, refine and improve their questions.	Written questions and discussions about which questions are most useful to generate empirical evidence to support or refute scientific explanations.

Gathering data and information to use in developing evidence

Teacher Behaviors	Student Behaviors	Artifacts
Develop or select a coherent series of three-dimensional student performances** to direct the gathering of relevant and accurate data experiments, simulations, observational studies and valid information from reliable sources. <i>Make deliberate connections to Powerful Math Instructional Practices.</i>	Work collaboratively to gather data and information through scientific investigation and/or engineering design. Organize data and information by developing and/or using charts, graphs and models.	Data tables, charts, models and logs that organize the relevant data and information students have gathered.

* The term *phenomena* refers to natural science phenomena as well as human-engineered phenomena.

** The term *student performances* refers to students' active engagement in making sense of phenomena, including mental and physical engagement and hands-on investigations of phenomena.



Powerful Science Instructional Practices

Reasoning how the evidence supports an explanation for the causes of phenomena*

Teacher Behaviors	Student Behaviors	Artifacts
<p>Develop and/or select a coherent series of three-dimensional student performances** that engage students in analyzing data and/or evaluating information and using mathematical reasoning to find patterns in data. Engage students in reasoning evidence-based explanations for the causes of phenomena and developing arguments for how evidence supports or refutes an explanation or a solution to a problem.</p> <p><i>Make deliberate connections to Powerful Literacy and Math Instructional Practices.</i></p>	<p>Analyze data and information to use as evidence and reason explanations supported by evidence for the causes of phenomena. Develop models, graphs and descriptions to represent their explanations. Develop arguments for how the evidence they have gathered supports or refutes an explanation. Work independently and collaboratively with other students.</p>	<p>Written and/or oral explanations, arguments, graphs or models.</p>

Engaging in academic discourse

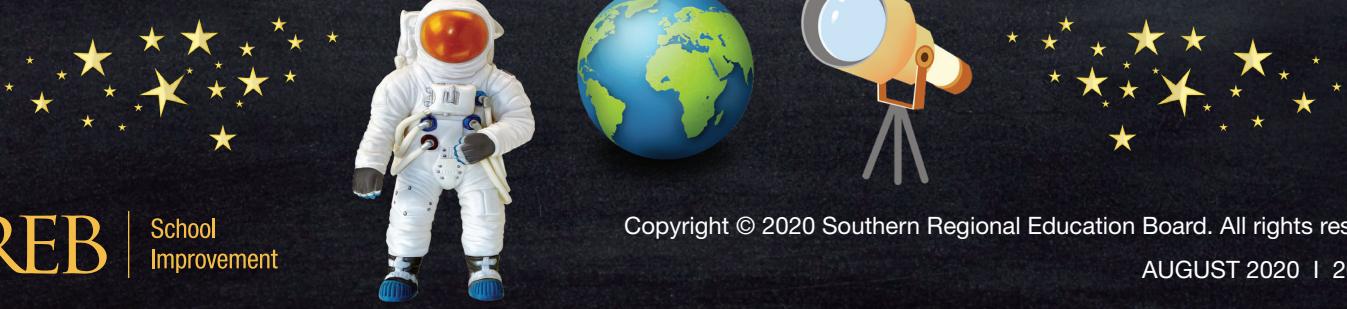
Teacher Behaviors	Student Behaviors	Artifacts
<p>Establish norms for engaging students in whole-class and small-group discourse. Develop and/or use questions and prompts to initiate and extend student reasoning and discussions. Uses crosscutting concepts to focus students' reasoning and responses. Help students synthesize the information and data they gathered and support the development of accurate scientific language and a common understanding of the core ideas and concepts that support scientifically accurate explanations for the causes of phenomena.</p> <p><i>Make deliberate connections to Powerful Literacy Instructional Practices.</i></p>	<p>Communicate the reasoning that supports explanations for the causes of phenomena. Use models, writing and speaking to support academic discourse that contributes to a common understanding of the causes of phenomena. Listen respectfully to each other's ideas and respond appropriately about the strength of the evidence supporting each other's explanations.</p>	<p>Presentation of formal and informal arguments for how the evidence students have gathered supports or refutes their explanations.</p> <p>Written and oral responses to each other's explanations and arguments.</p>

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Presenting evidence of learning		
Teacher Behaviors	Student Behaviors	Artifacts
<p>Throughout the series of student performances, use formal and informal formative assessments to monitor student learning and provide feedback. The informal formative assessment includes listening to student discourse, reading student writing, assessing models and group discussion.</p> <p><i>Make deliberate connections to Powerful Literacy and Math Instructional Practices.</i></p>	<p>Present evidence of learning to themselves and others. Provide appropriate feedback to others and reflect on the feedback received from others.</p>	<p>Oral and written presentations of explanations, models and arguments. Written and/or oral responses to the ideas of others.</p>
Communicating reasoning through an individual three-dimensional performance		
Teacher Behaviors	Student Behaviors	Artifacts
<p>Use instructional strategies to create opportunities for students to communicate their reasoning using models, writing, speaking and/or other artifacts of learning. Teachers establish clear criteria for students to develop and present artifacts of learning. Formal assessment is generally part of the “communicate reasoning” phase of instruction but may come as a separate application of learning for students to make sense of analogous phenomena.</p> <p>Evaluate the artifacts of student learning, provide meaningful feedback to students and act on evidence of learning to make instructional decisions for the next steps in the learning process.</p>	<p>Apply learning from the investigation and class discussion to communicate scientific reasoning to themselves and others. Reflect on how the new ideas and concepts they are learning relate to prior science learning. Work independently and collaboratively with other students.</p>	<p>Written and/or oral responses to the criteria described by three-dimensional teacher prompts. Writing logs and/or journals from the investigation.</p>



Powerful Science Instructional Practices

Applying science learning beyond the classroom to make sense of natural and/or human-designed phenomena

Teacher Behaviors	Student Behaviors	Artifacts
<p>Establish clear expectations and use instructional strategies to motivate students to investigate phenomena beyond the classroom. Teachers provide opportunities for students to share the phenomena they observe beyond the classroom and connect these phenomena to the ideas and concepts being learned in class.</p> <p><i>Make deliberate connections to Powerful Literacy and Math Instructional Practices.</i></p>	<p>Learn science and engineering in the classroom to apply beyond the classroom. Find phenomena beyond the classroom and apply what they have learned in the classroom to make sense of phenomena beyond the classroom.</p>	<p>Oral and/or written descriptions of phenomena students encounter beyond the classroom. Logs, journals and lists of phenomena encountered over time and the explanations and evidence students have developed.</p>

Learn more about SREB's powerful instructional practices:

- Literacy: sreb.org/publication/powerful-literacy-practices
- Mathematics: sreb.org/publication/powerful-mathematics-practices
- Project-Based Learning: sreb.org/publication/powerful-project-based-learning-practices

References

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