ASCDEXPRESS | IDEAS FROM THE FIELD

Unleashing Problem Solvers
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Creating Problem Solvers in Science and Beyond
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Problem solving is a key 21st century skill. Yet in my 6th grade science classes, many students declared challenging problems "too hard" and gave up. When they did persevere, they had difficulty writing concise conclusions for their scientific investigations no matter how many times I showed them how.
One way I have helped students unleash their inner problem solver is by incorporating Claim-Evidence-Reasoning (CER) assessments into our science classes. CER helps students describe their scientific observations and experiences from an investigation or activity by structuring their responses into sections that answer three questions:

- **Claim:** A statement that answers the question or problem. What do you know?
- **Evidence:** Data and observations from the investigation that support the claim. How do you know?
- **Reasoning:** An explanation (using science ideas and terms) that states why the evidence supports the claim. Why do you know?

Essentially, students using the CER framework work backward from an answer or hypothesis to provide the data, observations, and analysis (based on scientific rules or principles) that informed their response. By making evidence-supported claims, students connect scientific knowledge to events and observations in the real world.
When I first introduced the CER framework, it did not exactly go as planned. As I graded the CER assessments and provided feedback to students, I intended them to learn from the experience, rewrite their CER, and turn it in again. However, once students received a grade, they accepted it and didn't want to do a rewrite. Even worse, some students shut down, believing they could not successfully write a CER at all.
Here are a few lessons I learned to help students acclimate to responding to CER assessments—and grow to love them.
1. Provide graphic organizers. Even after I provided a detailed introduction to the CER process, students still had difficulty with it. So at the beginning of the year, I now give each student a graphic organizer that clearly outlines the process. Teachers can decide on the level of scaffolding to include in these graphic organizers. For example, they can include sentence stems for stating evidence, key words to be included in the reasoning section, and a restating of the criteria for each entry item (claim, evidence, and reasoning). After students get the hang of responding to scientific problems via

the CER framework, we stop using the graphic organizer, and students write CER statements on their own. Here's the basic outline for these organizers:

Question/Problem:

_____

_____

Claim:

_____

_____

+

Evidence: ("According to the data _____, I observed _____.")

_____

_____

+

Reasoning: ("This should include key scientific terms provided by the teacher.")

_____

_____

= A Scientific Explanation

2. Let students revise their work. During the first quarter of the school year, I do not give any grades on CER assessments. Instead, I provide suggestions for improvement and ask students to rewrite their summaries. Giving students an opportunity to improve before assigning a grade makes them feel like they can improve. Through the process of rewriting, students also become better at explaining their reasoning in a concise way.

3. Establish a routine and provide opportunities for collaboration. I always begin the CER process by presenting a scientific question or problem to my students. Then I create heterogeneous groups based on students' skill sets and ask each group to solve the problem. As students conduct hands-on investigations, read, and explore vocabulary words associated with the problem, they are constantly referring to the essential question "How does this help us solve the problem?" This helps keep them focused.

Creating diverse groups not only builds students' collaboration skills, but also gives all students a chance to participate in problem solving. For example, last year in one class we had a student with special needs who was also an English language learner. During the hands-on investigations, he carefully listened to his peers and then helped manipulate variables and collect evidence with them. He liked contributing and his classmates enjoyed working with him. Even though he didn't speak much, his peers felt like they got to know him better, which helped him socialize outside of class as well.

4. Reinforce the CER approach. We often discuss the CER process as a class. When a student turns in an exemplary CER assignment, we review each element and discuss why it works so well and if there are any ways to improve it. Students enjoy sharing their work and discussing their thoughts for improvement, which deepens their understanding.

The Benefits of CER Assessments

Writing CER statements allows students to do what scientists do: answer a question or solve a problem based on their observations, collect and use scientific data, and explain why the evidence

supports the claim. Instead of simply regurgitating facts, students provide explanations based on evidence and reasoning. This allows me to better measure their understanding of scientific principles and gauge their depth of knowledge while promoting an environment of inquiry and discourse.

With CERs, my science classes have undergone a remarkable transformation. At the beginning of the year, students came into my class thinking they hated science, because they were used to reading a textbook, memorizing facts, and answering questions. With the CER process, science has become intriguing. Students care about the problems we solve, and they like that they are responsible for solving them. They even complain when it is time to stop class, because they're so engaged in their work and passionate about science.

The CER framework also helps students develop perseverance, which has transferred to other subject areas. In my math classes, students are now better able to work through problems on their own. They know they can ask for help, but they don't expect me to give them the answers.

Students can take these skills with them to middle school, high school, and beyond. When faced with a problem in college or in their careers, they are not going to be scared and think, "I can't do this, because I don't know the answer off the top of my head." They will face it head-on, because they have the skills and confidence to do so.

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