

Why the 5E Instructional Model?

The [BSCS 5E Instructional Model](#) is a research-based instructional model centered on student inquiry and constructivist learning. By promoting student-driven exploration, the model allows students to take control of their own learning. Through this process, students consistently and significantly increase their excitement and motivation to learn.ⁱ Through the 5E model, students construct their own new ways of knowing, and actively confront misconceptions through experiences. Instead of classes based in lectures and memorization, this model encourages students to learn using methods mirroring the professional scientific community. Through this process, students gain a deeper and enduring understanding of the content while also developing their scientific literacy and process skills.^{ii iii}

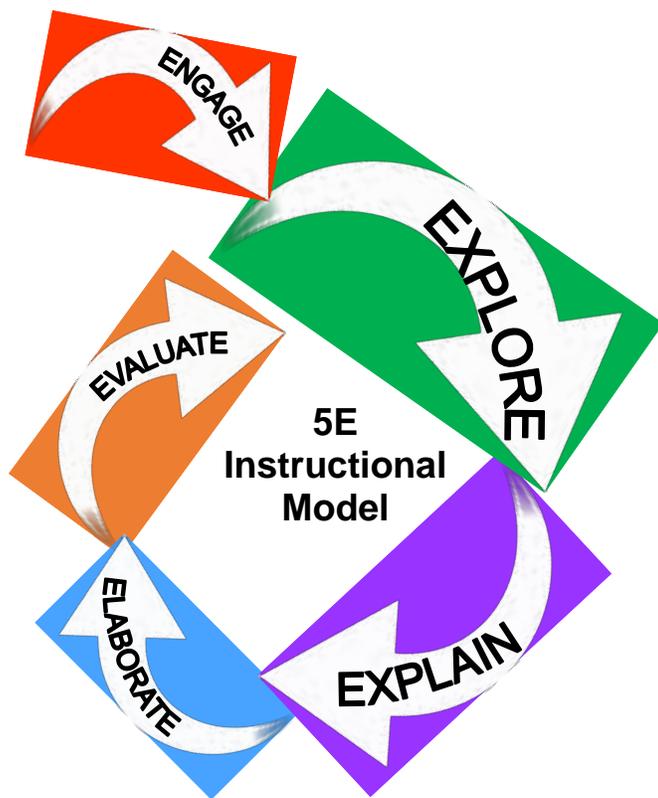
What is (and is not) the 5E Instructional Model?

The 5E Instructional Model is an accessible blueprint for an integrated instructional sequence. Ideally, each phase (with the exception of ENGAGE, which can be a 5-30-minute experience) should take *at least* a full class period. Each “E” in the model describes the active role of the student during that phase.

The 5E Instructional Model is NOT a sequence that can be authentically completed over the course of a single class period. Allotting the proper amount of time for each phase is key to the model’s success — when there is not enough time for students to genuinely explore a topic and build their own explanations, the model’s success rate decreases dramatically.^{iv} The teacher plays an integral role throughout this lesson sequence by supporting each phase. No part of the 5E Instructional Model describes a phase where the student is a passive participant in the “E” action.

What are the 5Es? ^v

- ENGAGE:** Begin each activity, lesson, or unit by mentally engaging students with a phenomenon, event, or real-world example that raises questions about the central concepts of the lesson cycle. An “Engage” activity will build student investment in the lesson cycle as students activate prior knowledge and begin to identify the limits of that knowledge in explaining the activity.
- EXPLORE:** Students work collaboratively to explore ideas related to the concepts through hands-on activities. Students genuinely struggle with the concept and are presented with authentic opportunities to make decisions about HOW to explore. Some guidance may be necessary but in most of this phase, students are authentically forming, testing, reforming, and retesting hypotheses. The teacher serves as a facilitator in this process, giving space for students to be creative, struggle and learn from their own experiences. When the teacher sees misconceptions forming or advancing, their role is to ask guiding questions that push students to confront those misconceptions, deepening their exploration of the concept.
- EXPLAIN:** Students build explanations of the concepts they are learning, recalling their exploration and accessing additional resources to research context for their explanations. The teacher introduces new vocabulary in the context of students’ explanations, encouraging students to use that vocabulary to better justify and clarify their explanations. Only after students have had the time and space to develop these explanations, does the teacher formally clarify explanations and then support students as they draw connections between different explanations in the class. This phase also provides the teacher an opportunity to evaluate students’ growing understanding.



4. **ELABORATE:** Students apply their new knowledge to new, but similar situations in other scientific contexts and the real world. This phase can be an opportunity for students to practice and reinforce the skills gained through exploration and explanation. Through this phase, students deepen and build on their understanding as the teacher challenges them to reach further and insists on students using new vocabulary and formal explanations.
5. **EVALUATE:** This phase is primarily centered around students' self-reflection. Students evaluate their own knowledge, skills, and abilities by answering open-ended questions and completing activities that require them to demonstrate their understanding. Students assess how much their understanding has grown over the course of the learning cycle and identify areas for further investigation (this can cycle back to another EXPLORE phase). This is an opportunity for students to review, reflect and provide evidence of learning. While the teacher will also use this phase to formatively or summatively assess students' understanding, that assessment should be conducted via artifacts anchored in the students' self-evaluation.

When should the 5E Instructional Model be used?

For the majority of elementary- and middle- school science education, the 5E model, is one of the most accessible educational models that will improve performance and excitement in science when implemented with the necessary time and space! However, in some parts of all science curriculum, students need to memorize specific vocabulary or focus directly on learning a complex skill. In these situations, a more traditional teaching approach may be more effective.^{vi}

Why does the Chemical Educational Foundation use the 5Es in the *You Be The Chemist* programs?

CEF believes the 5Es are a great way to think through and plan out interactive science experiences with students of all ages. The 5Es have been repeatedly tested and proven to improve student performance and increase educational equity.^{vii} It is an accessible, effective, and memorable way to bring learning to life for educators of all backgrounds and experience levels. Every *You Be The Chemist* Activity Guide is organized into the 5Es so you can easily build out a quality learning experience centered around interactive science exploration.

ⁱ Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well being. *American Psychologist*, 55(1), 68–78. <http://doi.org/10.1037//0003-066x.55.1.68>

ⁱⁱ Wilson, C. D., Taylor, J. A., Kowalski, S. M., & Carlson, J. (2009). The relative effects and equity of inquiry-based and commonplace science teaching on students' knowledge, reasoning, and argumentation. *Journal of Research in Science Teaching*. <http://doi.org/10.1002/tea.20329>

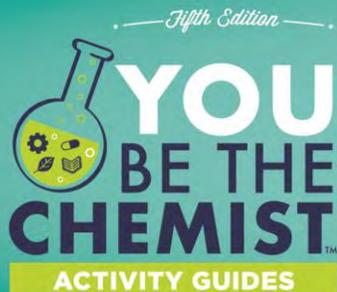
ⁱⁱⁱ Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). The BSCS 5E Instructional Model: Origins and Effectiveness. *BSCS*. Retrieved from https://bscs.org/sites/default/files/_media/about/downloads/BSCS_5E_Full_Report.pdf

^{iv} Carlson, J., & Landes, N. (2014, December 9). BSCS On Topic: The BSCS 5E Instructional Model (Part 2): How the 5Es Evolved Over Time. *BSCS*. Retrieved October 17, 2018, from <https://www.youtube.com/watch?v=c242mIDLgUE>

^v Bybee, The BSCS 5E Instructional Model: Origins and Effectiveness.

^{vi} Carlson, BSCS On Topic: The BSCS 5E Instructional Model (Part 2): How the 5Es Evolved Over Time.

^{vii} Wilson, The relative effects and equity of inquiry-based and commonplace science teaching on students' knowledge, reasoning, and argumentation.



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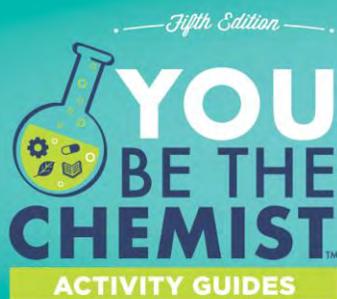
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4. give children under age 13 the ability to publicly post or otherwise distribute personally identifiable contact information without prior parental consent.
5. entice any child by the prospect of a special game, prize, or other activity, to divulge more information than is needed to participate in the activity.

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- To provide the parents with notice and to seek consent for communications with the child. Note: this may require collection of the parent's e-mail address as well.
- To protect the safety of a child who is participating on the site; i.e., in a chat room.
- To protect the Website or to respond to law enforcement; i.e., in the case of a Website compromise.

Personal information pertaining to children will be destroyed immediately upon completion of its intended purpose. On rare occasions, it may be determined that a communication from a child under 13 years old should be maintained for historical purposes. Should such an occasion occur, CEF will obtain the necessary consent from the child's parent.

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