



## 5-E Model for Teaching Inquiry Science

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A very approachable model for teaching inquiry science, is the 5-E Model.

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A companion presentation, “5-E Model for Teaching Inquiry Science” is available at:

<http://www.bioedonline.org/videos/supplemental-videos/5e-model-for-teaching-inquiry-science/>

## 5-E Model for Teaching Inquiry Science

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- Developed by BSCS (a curriculum development group); based on Learning Cycle approaches.
- Follows the natural patterns of problem solving.
  - Initial ENGAGEMENT
  - EXPLORATION of related ideas and gathering of information
  - Development of an EXPLANATION
  - ELABORATION by extending the explanation to other situations
  - EVALUATION of the explanation, based on its usefulness and use by others
- This thought process is similar to scientific inquiry.



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The 5-E Model was developed by BSCS in Colorado, and is designed to follow the way we solve problems natural in life.

Initially there is curiosity or engagement which leads to an exploration of related ideas. After gathering some information, we try to develop an explanation. We can also extend this explanation and apply it to other situations, a process which is called elaboration. Finally, we evaluate the quality of our evaluation.

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## 5-E Model: ENGAGE

- Connects students' past and present experiences.
- Creates interest and generates curiosity.
- Uncovers students' current knowledge and misconceptions.
- To begin, teacher asks a question, shows something interesting, or poses a problem.

Adapted from Bybee, R. 2002. In *Learning Science and the Science of Learning*.



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The engage phase allows students to connect what they already know with a question or idea which they have just been presented with. Hopefully this will lead to a curiosity to know more.

In this phase, teachers can also get a better understanding of any misconceptions the students might have, and determine how much they do or do not know.

Teachers may ask a question, present something interesting, or pose a problem to the students to get things started. It is important to note that the 5-E Model may be used for a single lesson or be presented in parts over several lessons.

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## 5-E Model: EXPLORE

- Provides students with one or more actual experiences.
- Offers opportunities for creative thinking and skills development.
- Students make observations, record observations and ideas, make connections and ask questions.
- Students usually work in groups.
- Teacher acts as a coach or facilitator.

Adapted from Bybee, R. 2002. In *Learning Science and the Science of Learning*.



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The next step, explore, involves students in actual experiences with physical materials. Students may do experiments, collect data, make observations, make connections, and ask questions. Students usually work in groups, and the teacher acts as a coach or facilitator, simply guiding the students who themselves conduct the investigations.

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## 5-E Model: EXPLAIN

- Students:
  - describe their observations and come up with explanations;
  - listen critically to others' explanations;
  - develop vocabulary; and
  - learn to apply and interpret evidence.
- Teacher guides students' reasoning, asks appropriate questions and directs students to additional helpful resources.

Adapted from Bybee, R. 2002. In *Learning Science and the Science of Learning*.



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The third step in the 5-E Model is the explain phase. During this phase students begin to make sense of their data, describe their observations, and then come up with their own explanations. Students can listen to the explanations that other students offer, and defend their own rationale. The teachers role in this phase is to ask appropriate questions, guide the students, and direct them to helpful resources.

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## 5-E Model: ELABORATE

- Students:
  - use previous information to ask questions, propose solutions, and make decisions;
  - apply concepts and skills to new situations; and
  - communicate their findings and reasoning.
- Teacher helps students broaden their understandings and extend ideas to other situations.

Adapted from Bybee, R. 2002. In *Learning Science and the Science of Learning*.



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In the elaborate phase, students use the information they've gathered to propose solutions and apply what they've learned to different situations. The role of the teacher is to help students extend their ideas to other situations so that they can come up with a much broader conclusion than what they initially found by conducting their experiment.

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## 5-E Model: EVALUATE

- Students:
  - demonstrate understanding of a concept or skills (what has been learned); and
  - evaluate own progress.
- Teachers:
  - evaluate students' and their own progress; and
  - rely on alternate strategies for assessment.

Adapted from Bybee, R. 2002. In *Learning Science and the Science of Learning*.



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In the last phase, evaluation, students can judge and evaluate their own progress as the present what it is that they have learned. Teachers may evaluate students, as well as their own progress. If necessary teachers may need to develop alternate strategies for assessment to help students focus on new information and understand the lesson in greater depth.

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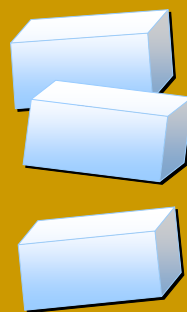
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## What might this look like?

- ENGAGE: *Why does ice, a solid, float in water?*
- EXPLORE: Students compare the weight (mass) of equal volumes of ice and water.
- EXPLAIN: Students report that the a given volume of ice is lighter than an equivalent volume of water (in other words, ice is less dense).
- ELABORATE: Students investigate densities of other materials, learn about the structures of ice and liquid water.
- EVALUATE: Students write about or report their findings as groups, or create group concept maps to represent their findings.



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A simple example of the 5-E Model start off with a question, “Why does ice float?”, which comprises the engage phase.

In the explore phase students could measure the mass of equal volumes of ice and water. They would discover that although they might have equal volume, liquid water has a greater mass than ice. This could be incorporated into the explain phase as they investigate density. In the elaborate phase students could investigate the density of other materials or learn about the structure of ice. In their evaluation students may present a report or concept map on their findings to the class to demonstrate what they have learned.

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## Elementary Inquiry Science Is Important

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- Lays a foundation for learning in later grades.
- Develops skills related to the investigation of questions, evaluation of evidence, development of an explanation; and communication of findings.
- Builds understanding of the nature of science.
  - Questions
  - Evidence
  - Measurement and tools
  - Ethics
  - Nature of scientific debate



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Elementary science lays a foundation to help students develop investigation skills which they will use later on in more advanced science. It also fosters a background in communication and critical thinking, both useful life skills.

By incorporating these different steps of scientific inquiry, students will develop a better understanding of how to investigate questions, present evidence, use different tools, and explore different ethical issues in science.

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