The 5E Instructional Model

The following information has been adapted for Illinois teachers of Agriculture, Food, and Natural Resources. Original information is publicly accessible from the BSCS Science Learning public website.

What is the 5E Instruction Model?
The 5E model is a framework for designing inquiry-based science and science-related curricular resources. The 5E model was designed in 1987 by BSCS Science Learning, originally Biological Sciences Curriculum Study. It outlines five sequential stages of learning. They are:
1. Engage
2. Explore
3. Explain
4. Elaborate
5. Evaluate

What is the premise of the 5E Instructional Model?
The 5E Instructional Model is a direct descendant of the Atkin and Karplus learning cycle proposed in the early 1960s and used in the Science Curriculum Improvement Study (SCIS). The Atkin and Karplus learning cycle used the terms "exploration," "invention," and "discovery." These terms were later modified to "exploration," "term introduction," and "concept application." BSCS Science Learning added an initial phase designed to engage the learner's prior knowledge and a final phase to evaluate the student's understanding. Figure 1 shows the common phases of the SCIS model and the current BSCS Science Learning 5E model side by side. Note the additional phases for the BSCS Science Learning model.

Figure 1. SCIS v. BSCS Learning Model Comparison

SCIS Model	BSCS Model
	Engagement
Exploration	Exploration
Invention (Term Introduction)	Explanation
Discovery (Concept Application)	Elaboration
	Evaluation

How are each of the five stages implemented?
The five phases of the BSCS Science Learning model can be applied at several levels in the design of curricular resources and instructional sequences. They may be applied to organizational patterns, year- or semester-long course planning, specific units, lessons, and activities. The following descriptions are adapted from the original descriptions provided by BSCS Science Learning in *New Designs for Elementary School Science and Health* (BSCS, 1989).

1. Engagement
The first phase engages students in the learning task. The students mentally focus on an object, problem, situation, or event. The activities of this phase make connections to past experiences and expose students' misconceptions; they should serve to mitigate cognitive disequilibrium.

Asking a question, defining a problem, showing a discrepant event, and acting out a problematic situation are all ways to engage the students and focus them on the instructional task. The role of the teacher is to present the situation and identify the instructional task. The teacher also sets the rules and procedures for establishing the task.

Successful engagement results in students being puzzled by, and actively motivated in, the learning activity. Here, the word "activity" refers to both mental and physical activity.

2. Exploration

Once the activities have engaged the students, they have a psychological need for time to explore the ideas. Exploration activities are designed so that the students in the class have common, concrete experiences upon which they continue formulating concepts, processes, and skills. Engagement brings about disequilibrium; exploration initiates the process of equilibration. This phase should be concrete and hands on. Educational software can be used in the phase, but it should be carefully designed to assist the initial process of formulating adequate and scientifically accurate concepts.

The aim of exploration activities is to establish experiences that teachers and students can use later to formally introduce and discuss concepts, processes, or skills. During the activity, the students have time in which they can explore objects, events, or situations. Mental and physical involvement in the activity results in the students establishing relationships, observing patterns, identifying variables, and questioning events.

The teacher's role in the exploration phase is that of facilitator or coach. The teacher initiates the activity and allows the students time and opportunity to investigate objects, materials, and situations based on each student's own ideas of the phenomena. If called upon, the teacher may coach or guide students as they begin reconstructing their explanations. Use of materials and concrete experiences is essential.

3. Explanation

The word "explanation" means the act or process in which concepts, processes, or skills become plain, comprehensible, and clear. The process of explanation provides the students and the teacher with a common use of terms relative to the learning task. In this phase, the teacher directs students' attention to specific aspects of the engagement and exploration experiences.

First, the teacher asks the students to give their explanations. Second, the teacher introduces scientific or technological explanations in a direct, explicit, and formal manner. Explanations are ways of ordering the exploratory experiences. The teacher should base the initial part of this phase on the students' explanations and clearly connect the explanations to experiences in the engagement and exploration phases of the instructional model. The keys to this phase are to present concepts, processes, or skills briefly, simply, clearly, and directly and to move on to the next phase.

Teachers have a variety of techniques and strategies at their disposal to elicit and develop student explanations. Educators commonly use verbal explanations, but there are numerous other strategies, such as videos, films, and educational courseware. This phase continues the process of mental ordering and provides terms for explanations. In the end, students should be able to explain exploratory experiences and experiences that have engaged them by using common terms. Students will not immediately express and apply the explanations — learning takes time.

4. Elaboration

Once the students have an explanation and terms for their learning tasks, it is important to involve the students in further experiences that extend, or elaborate on, the concepts, processes, or skills. This phase facilitates the transfer of concepts to closely related but new situations. In some cases, students may still have misconceptions, or they may only understand a concept in terms of the exploratory experience. Elaboration activities provide further time and experiences that contribute to learning.

Audrey Champagne (1987) provides a clear description of this phase:

> *During the elaboration phase, students engage in discussions and information seeking activities. The group's goal is to identify and execute a small number of promising approaches to the task. During the group discussion, students present and defend their approaches to the instructional task. This discussion results in better definition of the task as well as the identification and gathering of information that is necessary for successful completion of the task. The teaching cycle is not closed to information from the outside. Students get information from each other, the teacher, printed materials, experts, electronic databases, and experiments that they conduct. This is called the information base. As a result of participation in the group's discussion, individual students are able to elaborate upon the conception of the tasks, information bases, and possible strategies for its [the task's] completion. (p. 82)*

Note the use of interactions within student groups as a part of the elaboration process. Group discussions and cooperative learning situations provide opportunities for students to express their understanding of the subject and receive feedback from others who are very close to their own level of understanding. This phase is also an opportunity to involve students in new situations and problems that require the transfer of identical or similar explanations. Generalization of concepts, processes, and skills is the primary goal.

5. Evaluation

This is an important opportunity for students to use the skills they have acquired and evaluate their understanding. In addition, the students should receive feedback on the adequacy of their explanations. Informal evaluation can occur at the beginning and throughout the 5E sequence. The teacher can complete a formal evaluation after the elaboration phase. As a practical educational matter, teachers must assess educational outcomes. This is the phase in which teachers administer assessments to determine each student's level of understanding.

Figure 1. The 5E Instruction Model

Photo derived from National Atmospheric and Space Administration eClips Teacher Toolbox.