

The 5-E Instructional Model
Actively Engaging Students with Science

The 5-E Instructional Model was developed by the Biological Sciences Curriculum Study (BSCS) in the mid-1980s. The catalyst for the development 5-E Instructional Model was a curriculum study funded by a grant from IBM with the goal of enhancing science instruction in American schools. The 5-E instructional model draws from earlier instructional models (e.g., Herbart, 1901; Dewey, 1933; Heiss, Obourn, & Hoffman, 1950; Atkin & Karplus, 1961) to develop an means of actively engaging students in learning science. Hence, the 5-E model is student-centered and engages students in an exploration of a scientific concept and challenges students to construct meaning while developing evidence-based explanations. The 5-E model is a departure from the traditional, teacher-centered approach to science teaching. The 5-E Instructional Model has five phases: Engagement, Exploration, Explanation, Elaboration, and Evaluation. A description of each of the phases follows:

Engagement:

The purpose of the Engagement phase is to peak student interest and make connections between the concept and everyday life make the concept meaningful for students. Revealing student ideas about the concept, their prior knowledge, and misconceptions related to the concept are other important aspects of the Engagement phase of the model.

During the Engage phase of the lesson think of peaking students' interest with a question, a magazine or newspaper article, a video, a brief activity, or an issue related to the concept at the national, state, community, or school level.

The role of the teacher during the Engagement phase includes:

- Focusing student thinking on the topic of the lesson
- Building connections between what learners are likely to already know about the topic and the learning to take place during the lesson
- Revealing students' prior conceptions or misconceptions about the topic

The engage phase should focus students on the lesson topic through the questions or brief activities that promote curiosity and elicit prior knowledge. Teachers can gain critical insight into students' ideas, level of understanding, and potential misconceptions through a carefully planned Engagement for the unit or lesson.

Exploration:

The purpose of the Exploration phase is to provide an opportunity for students to conduct an inquiry-based investigation into the topic. An exploration or investigation encourages students to collaborate with their peers to manipulate equipment, measure variables, collect data, and build common experiences which serve as a basis for developing an understanding of the concept. During this phase of the model, the teacher is the facilitator, providing equipment,

materials, and guidance to student teams but not telling students what to do or what to expect. This is an inquiry-based experience through which students learn about the concept.

The learning goals of the Exploration phase include:

- Conducting an investigation of an aspect of the lesson topic
- Learning about the concept by actively experiencing science through an investigation rather than learning passively by taking notes during a teacher-centered lecture
- Gathering and recording data during an investigation
- Building upon prior knowledge of the concept during the investigation
- Making and testing predictions of investigation outcomes

The role of the teacher during the Exploration phase includes:

- Using an investigation to explore a concept prior to introducing vocabulary terms or providing explanations about the concept
- Challenging students to make and test predictions of investigation outcomes
- Making connections between students prior knowledge of the concept and their experiences with the concept during an inquiry-based investigation
- Using questions to guide students' thinking and addressing misconceptions

The ultimate goal of the Exploration phase is for students to learn about a scientific concept by conducting an investigation into the topic prior to a formal introduction into the topic through vocabulary terms and definitions or a teacher-centered explanation. This phase is designed to be student-centered with the teacher acting as a facilitator to enhance student learning.

Explanation:

Through the Explanation phase of the model, students have an opportunity to collaborate with their peers or teams to make meaning from their experiences with the concept. As students discuss their experiences, they begin to sequence events into a logical format, think about cause and effect, and reflect upon their learning during the investigation.

The explanation phase focuses learners' attention on developing evidence based explanations based upon their observations and experience gained through investigation(s) conducted during the exploration phase.

The learning goals for the Explanation phase include:

- Collaborating on an explanation for the outcome of the investigation
- Defending their claims to peers and developing an evidence-based explanation
- Interpreting data and drawing upon the data to support claims
- Identifying the accuracy of their predictions
- Formulating new questions about the concept

The role of the teacher during the Explanation phase includes:

- Providing time for learners to share their ideas through brainstorming and discussion
- Challenge learners to explain their understanding of the concept, process, or skill
- Using videos, guest speakers, etc. to provide additional insight into the concept for students
- Teacher explanations offered at this time provide an opportunity for learners to develop a deeper understanding of the concept

It is important to note that all explanations should be supported by learner experiences and observations drawn from evidence collected during the investigation.

Elaboration:

The purpose of the Elaboration phase of the model is to allow students time to apply their new understanding of the concept to a novel scenario and develop a deeper understanding of the concept.

Through the Elaboration phase of the model, students are challenged to apply their understanding and experience with the concept to new investigations.

Learning goals for students during the Elaboration phase include:

- Reflecting upon prior learning during the Explore and Explain phase to use their new knowledge to answer novel questions related to the topic
- Collaborating with peers to make sense of their experiences with the concept

The role of the teacher during the Elaboration phase includes:

- Challenging students with new investigations through which to construct deeper understandings of the concept
- Helping students to apply their knowledge and skills to find answers to new questions

Through the challenges of elaboration, learners enhance their understanding of content, process, and skills.

Evaluation:

The purpose of the Evaluation phase of the model is for both students and teachers to reflect on the concept and determine the level of learning and understanding which has taken place. It is critical to note that evaluation should be an ongoing process. Teachers can evaluate student learning throughout the four phases of the model by asking questions, observing student facial expressions and body language, by listening to student teams discuss concepts or readings, and responding to student work (e.g., journal entries, lab reports, data charts, graphs, tables, etc.). Formative assessments are completed as the teacher provides feedback on student work and allows the student time to implement teacher suggestions into their final product. Another important consideration for formative assessments is peer assessment. Peer assessments can be very helpful as students respond to each others' work and make

suggestions for improvement. One of the benefits of peer assessment is that as students respond to the work of others they are considering their own work and thinking about ways to improve.

Critical diagnostic tools which can be used in the evaluation process include: rubrics, scoring guides, teacher observation, student interviews, portfolios, and journal entries. It is important to remember that evaluation is an ongoing process and provides opportunities for students to consider ways to improve their work.

Formative assessments are essentially designed to provide feedback to the teacher to evaluate his/her instruction and to also engage students to evaluate their own work and learning progress.

Learning goals for the Evaluation phase include:

- Provide feedback for peers and in doing so gain insight into their own learning
- Utilize rubrics to evaluate their work and make necessary improvements

The role of the teacher during the Evaluation phase includes:

- Noting student responses to questions which provides insight into their understanding and can inform instructional decisions during the lesson
- Noting student predictions to gain insight into their thinking and understanding of the concept
- Providing rubrics to support students in evaluating their own work and learning

Formative assessments are on-going and provide opportunities for teachers to evaluate their instruction as well as student to reflect upon their learning. Formative assessments also provide opportunities for students to utilize feedback from the teacher and their peers to evaluate and make improvements to their work. Whereas, summative assessments are designed to reveal student learning and provide insight into achievement of science learning objectives related to course level and grade level expectations.