

**THE BSCS**

**5E**

**INSTRUCTIONAL MODEL**

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**CREATING  
TEACHABLE  
MOMENTS**

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# PREFACE

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Since the BSCS 5E Instructional Model was developed in the late 1980s, it has been widely implemented in places such as state frameworks and frequently used in articles in professional publications about teaching. This widespread dissemination and use of the model has been, to say the least, amazing. I have often wondered about the extensive application of the model. I have asked questions such as, “What accounts for the model’s popularity?” and “Why do teachers embrace the model?” In addition, I have asked whether the BSCS 5E Instructional Model is appropriate for contemporary teaching and learning.

Lest the reader be too surprised, I think the 5E Model’s widespread application can be explained by several observations. The first may be the most obvious: The model addresses every teacher’s concern—how to be more effective in the classroom. Second, the model has a “common sense” value; it presents a natural process of learning. Finally, the 5 Es are understandable, usable, and manageable by both curriculum developers and classroom teachers.

To my second question about contemporary use, I do believe the BSCS 5E Instructional Model is appropriate for contemporary innovations such as *A Framework for K–12 Science Education*, the *Next Generation Science Standards* (NGSS; NGSS Lead States 2013), STEM education, and 21st-century skills.

*A Framework for K–12 Science Education*, for example, sets forth policies that require integrating three dimensions—science and engineering practices, disciplinary core ideas, and crosscutting concepts. Is it possible to use the 5E Model to meet the challenge of implementing three-dimensional teaching and learning? The *Framework* and NGSS require innovations such as constructing explanations, designing solutions, and engaging in argument from evidence. Can practices such as these be addressed within the BSCS model? What about the use of contemporary technologies? Yes, the BSCS 5E Instructional Model can accommodate these contemporary innovations. I used the 5E Model for examples in *Translating the NGSS for Classroom Instruction* (Bybee 2013) and will include further discussions later in this book.

I must mention the book’s subtitle and theme—creating teachable moments. As a classroom teacher, I experienced times when students were totally engaged. They were caught by phenomena, events, or situations that brought forth a need to know and increased motivation to learn. I am sure most, if not all, classroom teachers have had similar experiences.

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When these experiences occur, classroom teachers capture the potential of these teachable moments. Teachers are pleased when this occurs. The common conception of a teachable moment is that it is random and unplanned, that it just occurs from a current event or in the context of a classroom activity, student question, school problem, or other opportunity.

What if you could provide more opportunities for teachable moments? What if teachable moments were not totally random and unplanned, and the probability of an occurrence could be increased through the structuring and sequencing of your lessons? The BSCS 5E Instructional Model described in this book provides classroom teachers with an approach to teaching that changes the emphasis within lessons and provides a sequence that increases the probability of teachable moments.

Here is some context on developing the 5E Model. In the mid-1980s, I assumed the position of associate director of the Biological Sciences Curriculum Study (BSCS). In that position, I helped create the BSCS 5E Instructional Model. At the time, a team of colleagues and I were developing a new program for elementary schools. We needed an instructional model that enhanced student learning and was understood by classroom teachers. Although the instructional model had a basis in learning theory, we avoided the psychological terms and chose to use everyday language to identify the phases of instruction as *engage, explore, explain, elaborate, and evaluate*.

When we created the 5E Model, the team and I only had a proposed BSCS program in mind. We had no idea that the instructional model would be widely applied in the decades that followed, commonly modified, and frequently used without reference to or recognition of its origins.

With the experiences of several decades, I made the connection between teachable moments and the BSCS 5E Instructional Model. While I recognized the connection and need for an in-depth discussion of the model, other professional obligations did not allow time to realize the potential in the form of a book. Now, almost three decades later, I have time, and the National Science Teachers Association (NSTA) has given me the opportunity to reflect on the BSCS 5E Instructional Model and consider its origins, history, and contemporary applications.

Before a detailed discussion of this book and the BSCS 5E Instructional Model, a few words of background seem appropriate. In developing the instructional model, we did take several issues into consideration. First, to the degree that it was possible, we wanted to begin with an instructional model that was research based. Hence, we began with the Science Curriculum Improvement Study (SCIS) Learning Cycle because it had substantial evidence supporting the phases and sequence. The additions and modifications we made to the Learning Cycle also had a basis in research.

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Second, we realized that the constructivist view of learning requires experiences to challenge students' current conceptions (i.e., misconceptions) and ample time and activities that facilitate the reconstruction of ideas and abilities.

Third, we wanted to provide a perspective for teachers that was grounded in research and had an orientation and purpose for individual lessons. What perspective should teachers have for a particular unit, lesson, or activity? Common terms such as *engage* and *explore* indicated an instructional perspective for teachers. In addition, we wanted to express coherence for lessons within an instructional sequence. How does one lesson contribute to the next, and what was the purpose of the sequence of lessons?

Finally, we tried to describe the model in a manner that would be understandable, usable, memorable, and manageable. All of these considerations contributed to the development of the 5E Instructional Model.

Not surprisingly, I structured this book using the 5E Model. Chapter 1 introduces the engaging theme (I hope) of teachable moments and, very briefly, the BSCS 5E Instructional Model. Chapter 2 explores the historical idea of what can be considered an instructional model. Chapter 3 is an in-depth explanation of the BSCS 5E Instructional Model. Chapter 4 reviews education research supporting instructional models, including the 5Es. Chapters 5, 6, and 7 elaborate on the model's application to *NGSS*, STEM education, 21st-century skills, and implementation in the classroom, respectively. Chapters 8, 9, and 10 present evaluations in the form of questions about the BSCS 5E Model and concluding reflections.

The audience for this book includes curriculum developers, classroom teachers, and those responsible for the professional development of teachers. I have tried to maintain a conversational tone and weave a narrative of education research, the psychology of learning, and the reality of classroom practice.

## REFERENCES

- Bybee, R. 2013. *Translating the NGSS for classroom instruction*. Arlington, VA: NSTA Press.
- NGSS Lead States. 2013. *Next Generation Science Standards: For states, by states*. Washington, DC: National Academies Press. [www.nextgenscience.org/next-generation-science-standards](http://www.nextgenscience.org/next-generation-science-standards).

## What Are Teachable Moments, and How Are They Created?

Let's begin with several questions. I ask that you take a moment or two and reflect on my questions and your answers. What is your description of a teachable moment? Have you ever experienced a time when students were highly motivated to learn? How would you describe that situation? What did you do? What did the students do? If you wanted to create another teachable moment for students, what would you say or do? Here are other questions:

What is your *primary* frame of reference for teaching?

- lesson (1 or 2 days)
- unit (2–4 weeks)
- semester (14–16 weeks)
- all of the above

What is your typical sequence of teaching?

- Present information, give examples, practice, test.
- Describe context, inform students, verify student learning, test.
- Ask a question, introduce ideas, have students apply ideas, test.
- Other (Please describe.)

Are you open to thinking differently about your teaching?

- yes
- no
- maybe

Most teachers' primary frame of reference for teaching is the daily lesson. This view is followed by the unit. This process is not unusual or bad. As a professional, you begin each day's work with the lesson. The typical sequence of teaching is some variation of "Present ideas, give examples, students practice or apply, test." Granted, there are variations based on content, difficulty, students' interest, and motivation.

Would you consider a different approach to teaching? I hope your response is yes or maybe. Assuming this is the case, we will continue.

## CHAPTER 1

This chapter introduces two themes of the book. First, there is a discussion of teachable moments. Second, I summarize the BSCS 5E Instructional Model, which will help you create teachable moments and use them as the foundation for student learning. The instructional model is a different way of thinking about teaching, and it includes lessons and expands one's perspective from lessons to an instructional sequence.

### TEACHABLE MOMENTS

Like classroom teachers at all levels and disciplines, you have probably experienced teachable moments. Teachable moments are those positive distractions from planned lessons where students are engaged and a teacher has the opportunity to explore ideas and provide an explanation or insight. These are exciting, even magical, moments for teachers. Let's look more closely at the idea of teachable moments.

#### What Is a Teachable Moment?

Most teachers know when they see them in students, but what are teachable moments? In education, a teachable moment is generally perceived as a time when students are motivated to learn. Discussions of teachable moments use terms such as *unplanned educational opportunity*, which is an unanticipated or unscheduled time when the probability of learning is greatly enhanced.

The important point is that at that moment, a student is engaged and eager to learn, and a teacher can easily teach a particular idea or skill. By the way, we all have teachable moments. There are times and situations where all of us want to learn—and do.

#### When Does a Teachable Moment Occur?

The short answer: anytime. This is why common definitions use words such as *unplanned* and *unscheduled*. That said, from a student's perspective, a key factor in teachable moments is that they occur when an experience has significant personal meaning—that is, the event is important, has consequences, or causes puzzlement for the student. This, then, is a key difference between the content of state and local curriculum frameworks, many lessons, and students' interests and motivation to learn.

#### Why Does a Teachable Moment Occur?

Teachable moments occur when individuals experience something they recognize and that has meaning, but they cannot formulate an explanation for the phenomenon or experience. The experience is within their cognitive grasp but beyond their full understanding. The verbal evidence of this situation is use of words that express puzzlement, questions, or curiosity, such as *why*, *what*, and *how*, followed by the individual's expression of the phenomenon, event, or situation. An example might be a child's response to an earthquake and



the subsequent question, “What causes earthquakes?” Children are especially interested in understanding the world around them and ask questions that present teachable moments.

At a slightly deeper level, the student is expressing cognitive disequilibrium with phenomena in the classroom, school, or environment. In short, the student’s current knowledge and understanding do not provide an explanation for something he or she has experienced.

### How Can You Create Teachable Moments?

As a classroom teacher, you do not have to wait for something out of the blue; you can create teachable moments by using a sequence of lessons that includes engaging experiences and activities for students, but the experiences should be beyond students’ immediate grasp. Imagine using an instructional sequence that begins with an experience of high interest but is beyond students’ understanding, and then the lessons provide opportunities for students to sort out their ideas and try to explain the initial situation as the sequence continues.

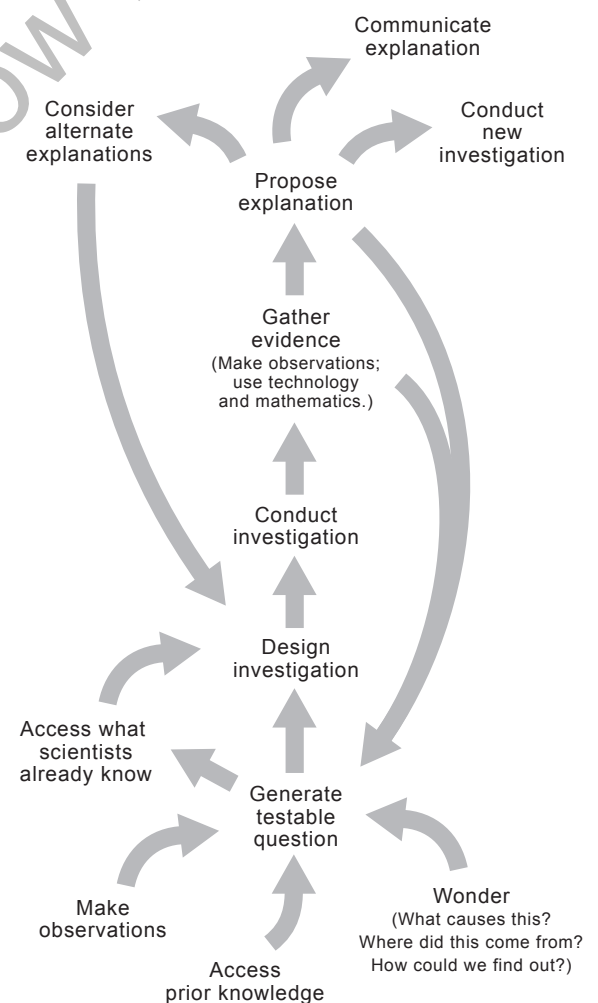
This leads you to the moment to help students gain knowledge and understanding of the experience. Then, you provide a situation where students have to apply their new knowledge to another situation. Finally, students and the teacher conclude with an assessment. Figure 1.1 shows how this process can work.

I have just used general terms to describe the BSCS 5E Instructional Model, an approach to teaching that centers on important content and abilities and that increases the opportunities for teachable moments.

In the next section, I describe the BSCS 5E Instructional Model in detail so you will have a context for the background, connections, and implications I make in subsequent chapters on the history of instructional models, education research, the *Next Generation Science Standards (NGSS)*, STEM education, and 21st-century skills.

Next, I present an introduction to the BSCS 5E Instructional Model.

**Figure 1.1. The Process of a Teachable Moment**



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