**Defining Inquiry**

The **American Association for the Advancement of Science** (AAAS) (1993) and the **National Research Council** (NRC) (1996) endorse science curricula that actively engage students in science using an inquiry-based approach. This approach shifted the focus of science education from the traditional memorization of facts and concepts in separate specific disciplines to inquiry-based learning in which students seek answers to their own questions. The pedagogy advocated for is an inquiry approach, in which students are actively engaged using both science processes and critical thinking skills as they search for answers. The competencies inherent in inquiry-based—reasoning, problem-solving, and creativity— build important skills that benefit the learner on an ongoing basis as they engage in projects and tasks that they will confront throughout their lives as workers and citizens in a democracy.

The **National Science Education Standards**[[1]](#endnote-1) presents scientific inquiry as:

 ... a multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and considerations of alternative explanations. (p. 23)

In the Standards, scientific inquiry refers to: the ways scientists study the natural world, activities of students, strategies of teaching, and outcomes that students should learn. The Standards use the term “inquiry” in two ways. Inquiry is **content**, which means both what students should understand about scientific inquiry and the **abilities** they should develop from their experiences with scientific inquiry. Teaching science as inquiry, the *Standards* explain, “requires imparting not only scientific information but the skills of inquiry and, more deeply, an understanding of what scientific inquiry is about.”[[2]](#endnote-2)

In 2018, the **National Science Teachers Association** issued a new position statement on scientific inquiry.[[3]](#endnote-3) The statement centers on three assertions which present scientific inquiry as three-dimensional teaching and learning in which teaching engages students in the practices of science and engineering, as students investigate phenomena to build an understanding of core disciplinary ideas.

1. Science and Engineering Practices Should Be Used to Actively Engage Students in Science Learning
2. Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts Should Be Integrated
3. Phenomena Should Be Used to Engage Students in Three-Dimensional Instruction

To make the transition from conflicting notions of scientific inquiry to three-dimensional teaching, NSTA recommends stakeholders:

* make explaining phenomena and/or designing solutions to problems the central focus of science instruction.
* choose phenomena carefully based on learning goals or curriculum and encourage the observation of phenomena both inside and outside the classroom.

Another definition defines inquiry-based teaching as:

“the art of developing challenging situations in which students are asked to observe and question phenomena; pose explanations of what they observe; devise and conduct experiments in which data are collected to support or contradict their theories; analyze data; draw conclusions from experimental data; design and build models; or any combination of these.”[[4]](#endnote-4)

**Other definitions characterize inquiry-based learning as**

* “more than asking a student what he or she wants to know. It’s about triggering curiosity. Inquiry-based learning begins with curiosity [that leads to] **real engagement and understanding of the subject matter at hand.”[[5]](#endnote-5)**
* “cultivates the natural curiosities of students and plant the seeds of life-long learning.”[[6]](#endnote-6)
* “a student-centered, problem-solving process where inquiry or research guides student learning.” [[7]](#endnote-7)
* “an environment in which students use a wide range of resources to collaborate with others to solve authentic problems by thinking critically, actively create content, and communicate with a wide audience.”[[8]](#endnote-8)
* “an activity in which students participate in knowledge construction by addressing germane problems that evolve from personal experience and observation.”[[9]](#endnote-9)
* Allows Students to Take Ownership of Their Learning and develop as autonomous learners.[[10]](#endnote-10)
* Develop students’ sense of competence, involve **realizing the role of the self as agent in the learning process** must be recognized for students to assume their role as engaged and self-directed learners

**Outcomes and Benefits of Inquiry Based Learning**

In addition to the above, research into inquiry-based learning has revealed several important benefits and outcomes:

* **Improved Attitude Toward Science**

Students who experience an inquiry approach (rather than traditional approaches) express improved attitude toward science and interest in science careers and report “feeling like a scientist.”[[11]](#endnote-11) These findings are significant because students who show an interest in science are more likely to study science and choose a scientific career.

* **Develops Science Process Skills and an Understanding of the Nature of Science**

Students experience inquiry-based learning in their science classes engage in the processes and procedures important for scientific work, developing the scientific process skills.[[12]](#endnote-12) With its emphasis on experience, questioning, searching for evidence, analysis, interpretation, and communication of results (explanation), inquiry learning develops the skills utilized by scientists in their careers. Students construct scientific explanations, realize the existence of experimental errors, view experimental data as evidence to support their claims, and develop richer understanding about the nature of scientific questions.[[13]](#endnote-13)

* **Deepens Understanding of Science Concepts**

A diverse and wide body of research suggests that inquiry-based approaches to learning, which encourage students to directly engage with the subject matter by asking questions, developing hypothesis, and conducting experiments, promote student achievement in science[[14]](#endnote-14) and has a positive impact on students’ understanding of scientific concepts.[[15]](#endnote-15)

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