Inside!

At a Glance

- Offers **four full years** of introductory science, comprising one year each of **chemistry, physics, biology, and earth science**—a complete high school experience
- **Engages and motivates students** to learn science, leading them to recognize its importance in their lives and to pursue further science courses and careers
- Prepares students for AP, IB, and upper-level courses and **teaches 21st century skills**
- Based on and correlated with the **national standards**
- Provides **complete lesson plans** for teachers and extensive **teacher support**
- **Developed by Education Development Center, Inc. (EDC)**, which has 50 years of extensive experience in the improvement of science education
- Funded by the **National Science Foundation**

I have checked ... other programs and yours is years ahead.

Field-test Teacher, Calif.

A Better Approach to Teaching and Learning Science

EDC is proud to introduce *Foundation Science*, a comprehensive, progressive, and flexible new curriculum for grades 9–12, designed to engage and motivate students in the learning of science content while preparing them for life in the 21st century. Developed by a team of experienced curriculum developers, educational researchers, scientists, teachers, and assessment specialists, this program consists of four full years of standards-based science—a complete high school experience—comprising two semesters each of chemistry, physics, biology, and earth science.

The curriculum has been extensively tested—100 teachers and more than 1,700 students in urban, suburban, and rural districts across the country participated in our field test. Field-test results indicate that students are highly engaged in the materials and demonstrate significant gains in their mastery of science concepts.

Why Now?

***Foundation Science* comes to market at an important time for high school science**. Over the past several decades, society, the global economy, and employer demands have changed, but public education has not kept up with these changes. Academically rigorous content is essential for preparing students for the future, but that content alone is not enough. To prepare for life in the 21st century, students must learn to think critically and creatively, work collaboratively, and learn to take risks constructively. Students must know how to gather, sort, and synthesize information and apply it to solving real-world challenges and problems. In recognition of this need, states across the country are incorporating these 21st century skills into their educational frameworks.

I think my students had a better understanding of the "big picture" and how the content applies to them.

Field-test Teacher, Penn.

An understanding of how students learn science is also changing the face of schools and classrooms. Students learn best when they are actively involved and see the application of the content they are learning. Through hands-on activities within the context of real-world problems, students are motivated to do more than just learn science content—they recognize the role science plays in their lives and the importance of understanding how that content can be applied.

Research has also recognized that individuals have different learning styles; therefore, various teaching and learning strategies are required in the classroom to reach all students.

This book...has been an adventure. I love this book because it had real live biology that related to the world today.

Field-test Student

***Foundation Science* responds to the changing face of science education by:**

- Providing content that is academically rigorous and meets the requirements of national and state standards
- Presenting concepts that engage and retain student interest because the contexts have significance to students' lives
- Addressing students' need to develop scientific literacy and 21st century skills
- Providing a variety of instructional strategies that address different learning styles
- Offering complete lesson plans to teachers along with extensive materials to guide implementation and support inquiry-based teaching

As far as the selling points for the Foundation Science *materials..., literacy, the students are reading, interpreting, and analyzing the selections—and they are engaged in writing with a definite purpose. The selections are engaging, and students are asked to do most of the activities in groups.*

Field-test Teacher, Arizona

Why EDC?

Foundation Science was developed by Education Development Center, Inc. (EDC), in Newton, Mass., with support from the National Science Foundation. EDC has 50 years of experience writing science curricula, beginning in the late 1950s, when we developed the groundbreaking multimedia high school science curriculum *PSSC Physics*. The curriculum was successfully introduced into schools across the country and eventually in many parts of the world. Many of today's teachers likely were students of this innovative physics curriculum. Since then, EDC and its Center for Science Education (CSE) have developed exemplary science curricula and have expanded our expertise into educational research, assessments development, and work with classrooms and school districts. Counted among CSE's staff are **experts who have an almost unrivalled depth of experience in the improvement of science education preK–12**, here and abroad, and **authors who have created some of the most highly regarded science instructional materials in the field.**

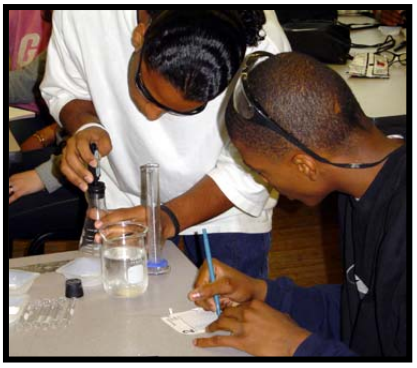
Foundation Science's team of developers, housed in CSE, has contributed its own accomplishments and expertise to this curriculum.

Dr. Jacqueline S. Miller—EDC senior research scientist, *Foundation Science* principal investigator, lead author of the *Foundation Science: Biology* course, and co-author of the *Chemistry* course—was the lead author of the *Insights in Biology* curriculum (Kendall/Hunt) and is co-developer of the NIH-supported *Exploring Bioethics* high school supplement (in press, NIH). Prior to writing curricula, Miller carried out research in molecular biology as a research scientist in the Department of Biological Chemistry, Harvard Medical School. During her time there, she taught undergraduate, graduate, and medical school courses in virology, parasitology, and the molecular basis of disease, as well as supervised the training of technicians and graduate students.

Irene Baker—EDC curriculum design associate, lead author of the *Foundation Science: Physics* course and co-author of the *Chemistry* course—co-authored *Physics that Works*, a full-year high school physics curriculum. Her experience includes years working in research labs at MIT, Massachusetts General Hospital, and the Boston University School of Medicine.

Ruth Krumhansl—EDC curriculum design associate and lead author of the *Foundation Science: Earth Science* course—worked for 27 years as a geologist and high school science teacher, most recently teaching Earth systems science and physics to 9th-grade students.

June Foster—EDC senior research scientist and *Foundation Science* project director—has 32 years of curriculum-writing experience. She co-authored *Physics that Works* and was a collaborating writer of the first Massachusetts State Framework for Science and Technology. Among the technology-enhanced science education projects she has directed are the *National Geographic Kids Network*, a telecommunications-based science inquiry project, and *Physical Science Courseware*, a microcomputer-based laboratory curriculum keyed to the needs of learning disabled students.



***Students working with* Foundation Science: Chemistry.**

What makes CSE outstanding is the conviction that all its good work starts in real classrooms first, with a genuine commitment to the students and teachers.

Dennis Bartels, Exploratorium

Our class is very interesting and never boring.... If you are enjoying something that is interesting, you will get a lot more out of it than reading something boring out of a book.

Field-test Student

Dr. Katherine Paget—EDC senior research scientist, *Foundation Science* director of assessment, and lead evaluator of the *Foundation Science* field test—was also a writer as well as senior evaluator for the Massachusetts State Framework. She has studied science teaching and learning for 18 years and has extensive experience in research and evaluation.

The *Foundation Science* curriculum has benefited from all of these experiences, which have helped the developers to better understand the needs of students, teachers, and school districts and to develop ways to address these needs in instructional materials and teacher support.

Students compare the unique arrangement of notes in a melody with the unique coded sequence in DNA.

What Makes *Foundation Science* Different?

Science learning through narrative

Foundation Science engages students through real-life case studies, stories from the history of science, and articles from popular media. These narratives are connected to students' lives, designed to capture their interest, pique their curiosity, and present a challenge or problem whose solution requires them to apply their conceptual understandings and 21st century skills.

With this curriculum, students are **motivated to learn.** And that excitement helps them become more involved in coursework, which in turn helps them retain more of what they learn.

Flexibility

We designed *Foundation Science* to be flexible. Each discipline-based course is presented in two volumes, with each volume containing materials for the equivalent of one semester. This structure provides the opportunity for students to **explore all four disciplines in the first two years of high school science** by using the first volumes in each discipline in 9th and 10th grade. For example, a school district may elect to have students take a semester each of physics and chemistry in 9th grade and biology and earth science in 10th grade. Alternatively, two volumes of a discipline could be used together to constitute a full-year, introductory course.

For working with students of different levels, this curriculum is more adaptable. You can differentiate really well with the activities for the different levels, especially the end product, what you expect out of a high-level student versus a low-level student.

Field-test Teacher, Alaska

The curriculum provides **varied instructional strategies,** which offer **multiple opportunities for students with different learning styles** to learn and demonstrate mastery of science concepts. We provide a wide **variety of activities** for exploring science concepts, including investigations, experimentation, writing, oral presentations, role playing, model building, discussion, and exploration outside the classroom. In addition, *Foundation Science* provides opportunities to assess student content knowledge and skill development in a variety of ways.

A consistent four-part teaching-learning framework™

Foundation Science is structured around a unique four-part teaching-learning framework—Consider, Investigate, Process, Extend—that provides students with consistency as they investigate a problem the way a scientist would**.** For scientists, a natural event stimulates their curiosity and the need for investigation. Through experimentation and review of the literature, scientists ultimately use new understandings to resolve the compelling question. They communicate their findings to fellow scientists and reconsider their conclusions in light of others' perspectives. These findings often lead to new investigations.

A more detailed description of how the scientific process is reflected in the *Foundation Science* framework is presented below.

Consider	The Consider section is **designed to bring students' own ideas to the forefront and provide teachers with insight into students' preconceived ideas and prior knowledge**. Each learning experience begins with a Brainstorming session, where students discuss their own ideas about the science topic to be covered. Students then read a narrative or story that describes an event or situation that engages their curiosity and sets the scene for a challenge or problem to be solved.
Investigate	The Investigate section begins by posing a challenge question, which arises from the narrative in Consider. To address this challenge question, **students work individually or collaboratively in teams; gather and synthesize information** from readings, demonstrations, and activities; **carry out research and collect and analyze data** from the Internet or libraries, and **communicate their thinking and exchange ideas** with others.
Process	During Process, students **share their solutions, communicate their logic and reasoning, listen to the ideas of others, and then reconsider their own solutions in light of the conclusions and reasoning of others.** It is during this step that students demonstrate their mastery of the key science concepts covered.
Extend	In some cases, students pursue additional investigations that either **apply the science concepts they have learned to new situations** or **extend the learning through the introduction of related concepts**.

The students enjoyed the discussions and perceive science more as a process of research and communication and discussion.

Field-test Teacher, Rhode Island

I was impressed at how even my quiet students, who are usually not interested in science, really participated in the design process and then were not afraid to share ideas during the presentations.

Field-test Teacher, Penn.

Rigorous, standards-based content

Foundation Science offers a rigorous learning experience that includes traditional chemistry, physics, biology, and Earth science content, as well as recent discoveries, keeping the curriculum current and "real" for students. Content is based on science education standards including the ***National Science Education Standards*, *Benchmarks for Science Literacy*, and several state frameworks.** The learning experiences are designed such that conceptual understanding builds on the prior knowledge students bring to *Foundation Science* and connects to the content students learned in previous *Foundation Science* learning experiences. Major concepts are explored in depth and revisited as important ideas that undergird the discipline. Connections are also made among concepts that transcend the four disciplines in this program, such as energy and the nature of matter.

Teaching "big book" chemistry, students don't retain much. Foundation [Science]: Chemistry *is superior. It has rigor with heart.*

Field-test Teacher, Oregon

Extensive teacher support

Foundation Science provides extensive support for teachers in the use of the materials as well as the development of new approaches to teaching. The materials provide teachers with pedagogical approaches for helping students master science content; strategies for helping students develop their skills in reading, writing, and discourse; alternative activities for teaching in a variety of settings; and up-to-date science background.

My teaching practices were changed by the students' discussions. I learned to ask better questions.

Field-test Teacher, N. Dakota

A print Teacher's Edition provides the support for implementation; it includes steps for facilitating discussions and activities, teaching strategies for different kinds of learners and situations, possible responses to the different questions that students are asked to answer, and much more.

Foundation Science provides further teacher support online. We developed two multi-session courses to **deepen teachers' understanding of inquiry teaching** and to **promote their instruction of 21st century skills**. The courses are structured to be used by individuals at their own pace or by groups, with guided discussions and reflections. Resources include links to standards and research literature on learning and cognition for the adolescent learner.

The curriculum helped me to reflect on my teaching.

Field-test Teacher, Mass.

The program also offers a unique online professional development tool designed to support teachers in extending their **content knowledge.** A knowledge inventory helps teachers recognize where they need particular content support. The tool then directs them to resources within the site that will address these deficiencies. Resources include readings, simulations, and scientist-developed content presentations. The tool's goal is to **keep teachers at least one step ahead of students as they progress through the curriculum.**

Foundation Science
Has Something for Everyone

Students felt they were reading highly current and relevant information.... [They] enjoyed the discussions and perceive science more as a process of research and communication and discussion, as well as affecting people's lives in everyday ways more than before.

Field-test Teacher, Rhode Island

This book will be a savior for kids like me, who don't do well with the original textbook; rather, [they will] have something else to look forward to.

Field-test Student

The strengths of the curriculum included the requirement of students thinking, analyzing, and questioning rather than just memorizing stuff. Overall, our Ohio Graduate Test results were higher than in the past.

Field-test Teacher, Ohio

Students…

- Gain an understanding of major conceptual ideas in each discipline and how key concepts connect the disciplines
- Develop a scientific approach to solving problems and making sense of the natural and human-made world
- Recognize that science plays important roles in their everyday lives
- Develop skills that lead to success in college or on the job, including reading and writing; collaborating; and thinking critically, creatively, and logically
- Gain deeper science understanding by taking part in activities, readings, and labs set within the context of solving a specific science challenge
- Encounter challenging social issues (e.g., genetic testing) that help prepare them for life beyond school

Teachers…

- Spend less time researching and designing their materials because the curriculum offers complete lesson plans that include alternative activities and teaching strategies
- Are teaching students who are engaged and motivated to learn
- Gain access to an extensive Teacher's Edition and online support materials
- Incorporate new pedagogical approaches and varied and innovative teaching and learning strategies into their practice
- Feel satisfied that their students are leaving high school with all of the skills and knowledge they need to be science-literate adults

Schools and Districts…

- Ensure that their curricula meet the national standards
- Prepare students for AP, IB, upper-level courses and exams, and state tests
- Provide a science curriculum that can be used with all learning levels of students.
- Equip students with 21st century skills
- Graduate more science-literate students, who are more likely to seek college courses and, ultimately, careers in science
- Have the flexibility to offer students all four science disciplines in grades 9 and 10 or four full years of science in a consistent format

FOR MORE INFORMATION
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