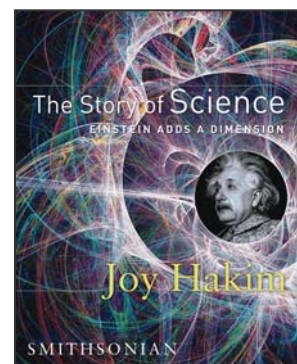


## Resources for Integration and Implementation

### Introduction

In 1996, the *National Science Education Standards* (NSES) made a bold and impassioned plea for scientific literacy, or “the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity.” Moving away from the idea that science is for the elite, the authors of NSES defined the content, skills, and attitudes that were necessary for every citizen. Under this umbrella they included language arts skills, which were almost exclusively associated with the idea of “literacy” before the Standards expanded its definition.



In the years since the publication of NSES, the inclusion of language arts literacy skills into science and across the curriculum has been heavily emphasized. There has also been an effort to assess student achievement in informational reading, often using selections from textbooks as prompts. While research reaffirms the value of reading about science, quality science literature remains a rare find. Despite the best efforts of teachers, reading about modern physics has seldom been fun or motivating—not until the publication of Joy Hakim’s series *The Story of Science*.

*Einstein Adds a New Dimension*, Hakim’s third volume, is unique in both its content and its value as an outstanding science trade book. Enjoyable reading about modern physics may seem like an oxymoron—until you open to the first page. Reviewers have called Hakim’s prose some of the most exciting and accurate in the field. This great expository writing can become the foundation of an integrated program that infuses the knowledge, skills, and attitudes of scientific literacy across the curriculum.

With inspiration from the real scientists in the story, as well as their creative biographer Hakim, you too can stand “on the shoulders of giants” as you show your students the future. Please consider the ideas that follow simply as clues that can help you expand the potential of *Einstein Adds a New Dimension* in your school program.

### Using *Einstein Adds a New Dimension* in the Classroom

The *Story of Science* series is first and foremost good literature—trade books that are designed to spark the curiosity of students. Both the biographies of scientists and the descriptions of their experiments are meant to light fires in young minds. So the first recommendation for the use of *Einstein Adds a New Dimension* is read and enjoy!

The books represent fascinating informational reading. The format and text elements lend themselves to the teaching of informational reading skills in 7th- through 12th-grade language arts courses. However, the content of *The Story of Science* is, of course, science—that is, not just a body of facts but a process and way of knowing. So the reading must be inextricably linked to exploration and inquiry. Whether the books are used as the skeleton of a program or as support, they must be accompanied by hands-on exploration.

There are also mathematics and social studies links everywhere in these books with tempting invitations to follow them to new adventures. Those unique features have made *The Story of Science* volumes very popular with schools that have developed integrated multi-subject blocks, as well as with home-school communities, where the boundaries between subjects are not as sharply defined as in traditional school programs.

The level of content and the minimal mathematics that are woven into *Einstein Adds a New Dimension* connect most easily to an integrated physical science program in grades 7 through 10, but the content in modern physics is every bit as rich as that found in most textbooks written for students in grades 11 through 13.

The materials found here are representative samples of what will soon be available for *Einstein Adds a New Dimension* in its entirety. You will find Joy Hakim’s Chapter 24, “The Fission Vision,” as well as Juliana Texley’s corresponding teacher materials and student activity pages.

Chapters in the complete guide, which will correspond exactly to the chapters of *Einstein Adds a New Dimension*, may offer the following:<sup>1</sup>

- A short synopsis of the content
- Teaching tips to clarify misconceptions and encourage further inquiry
- Activities or demonstrations that *engage* students in an inquiry-based science lesson (including answers and student activity pages)
- Methods that enable students to link big ideas and timelines from individual experiences, including charts and original writings<sup>2</sup> that can be used to *explore* concepts in greater depth
- Short lists of the most important science terms that also can be used to *explore* concepts in greater depth (Teachers are encouraged to discuss and explore other, nonscience vocabulary in the rich language of the book as well.)
- Web resources, including science applets and animations, that can be used to help *explain* the content
- Links to other activities and readings for students to *extend* their understandings through independent research
- A writing prompt that is suitable to *evaluate* understanding

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<sup>1</sup> In these components, we have referenced the “5 Es” model for an inquiry-based lesson developed in 2006 by the Biological Sciences Curriculum Study. See the report “The BSCS 5E Instructional Model: Origins, Effectiveness, and Applications.”

<sup>2</sup> Many of the translations of these passages have been taken from Stephen Hawking’s collection, *On the Shoulders of Giants* (Running Press, 2003).

The brief guide for teachers will provide selected examples of the type of innovative ideas and activities from which professionals might develop a program that meets the needs of their particular students. Activities will be selected for ease of implementation and will be limited to those that involve a minimum of expensive equipment. In addition, wherever possible, mathematics, geography, and history notes will be included so that the text can easily be integrated into subject areas other than science. Many of the activities will be interchangeable since this story of science moves back and forth through time, space, and the physical universe. How education professionals add these “new dimensions” to their school’s curriculum will ultimately depend upon the unique characteristics of their learning communities.

### **National Science Education Standards<sup>3</sup>**

*Einstein Adds a New Dimension* provides a great path to language arts literacy in the context of science. It’s important to recognize that this cluster of skills is only one component of science literacy. The text also interweaves content from a variety of areas defined by the National Science Education Standards. While many teachers will use this book successfully as part of a middle school program, most will find the book and the program built around it to contribute to achievement of these 9th- through 12th-grade standards.

<b>Area</b>	<b>Standard</b>
A. Science As Inquiry	<ul style="list-style-type: none"> <li>▪ Abilities necessary to do scientific inquiry</li> <li>▪ Understandings about scientific inquiry</li> </ul>
B. Physical Science	<ul style="list-style-type: none"> <li>▪ Structure of atoms</li> <li>▪ Structure and properties of matter</li> <li>▪ Motions and forces</li> <li>▪ Conservation of energy and increase in disorder</li> <li>▪ Interactions of energy and matter</li> </ul>
D. Earth and Space Science	<ul style="list-style-type: none"> <li>▪ Energy in the earth system</li> <li>▪ Origin and evolution of the universe</li> </ul>
E. Science and Technology	<ul style="list-style-type: none"> <li>▪ Abilities of technological design</li> <li>▪ Understandings about science and technology</li> </ul>
F. Science in Personal and Social Perspectives	<ul style="list-style-type: none"> <li>▪ Science and technology in local, national, and global challenges</li> </ul>
G. History and Nature of Science	<ul style="list-style-type: none"> <li>▪ Science as a human endeavor</li> <li>▪ Nature of scientific knowledge</li> <li>▪ Historical perspectives</li> </ul>

<sup>3</sup> National Research Council (NRC). 1996. *National science education standards*. Washington, DC: National Academy Press.