

THE NATURE OF TECHNOLOGY

TECHNOLOGY AND SCIENCE (3A)

Technology has been a powerful force in the development of civilization, all the more so as its link with science has been forged. Because of students' greater exposure to technology, it is especially important for them to understand its connection to science.

Like the scientific disciplines, the boundaries between science and technology are often blurred, so a clear distinction between them is not the point. Rather, students should understand how technology draws on science and contributes to it.

The map is organized around three strands—*effect of technology on science*, *effect of science on technology*, and *effect on society*. The progression of understanding begins in the elementary grades with a focus on using tools and appreciating their value, not just in science class but in everyday life. Later grades emphasize contributions of various technologies to society and kinds of interactions among science and technology.

Because technology and science are so closely related to mathematics, users of this map will find it helpful to refer to the **NATURE OF MATHEMATICS** map. Specific technologies described in maps from Chapter 8: **THE DESIGNED WORLD** can be used to illustrate the ideas on this map. Additionally, middle-school benchmarks that are part of the **GALAXIES AND THE UNIVERSE** map in *Atlas 1* can provide contexts for learning about how technology affects science. At the high-school level, maps in Chapter 10: **HISTORICAL PERSPECTIVES** describe discoveries and developments involving technology and science that provide interesting contexts for all three strands on this map.

NOTES

The strand *effect of technology on science* is designed to show how students might advance beyond the common notion of “technology as handmaiden to science” and begin to understand the synergistic nature of the relationship between the two disciplines. Although the map alludes to the telescope—and the discoveries it makes possible—as an example of the impact of technology on science, a variety of other examples such as imaging technologies and computer modeling may be used to help students appreciate that technology impacts *all* of science. Several historical episodes, such as **THE INDUSTRIAL REVOLUTION**, are mapped in Chapter 10 and can be used to illustrate that technological advances contribute directly to scientific progress. The new 9-12 benchmark in the *effect of science on technology* strand is from *Science for All Americans*. High school benchmarks on the **SPLITTING THE ATOM** and **DISCOVERING GERMS** maps can also contribute to an understanding of the contribution of scientific knowledge to technological discovery.

The 9-12 benchmark in the *effect on society* strand indicates that students are to understand the different roles of science and technology and their somewhat different effects on society. These distinctions are developed in more depth in the **SCIENCE AND SOCIETY** map in this volume and in the **INTERACTION OF TECHNOLOGY AND SOCIETY** map in *Atlas 1*.

RESEARCH IN BENCHMARKS

Even in middle school, students typically do not distinguish between an engineering model of experimentation, where the goal is to produce a desirable outcome, and the scientific model of experimentation, where the goal is to understand the relation between causes and effects (Carey et al., 1989; Schauble et al., 1991). Some research suggests that students can understand and use the engineering model before they can the scientific model—that is, that students inevitably will think about producing desirable outcomes before they are able to do the more analytic form of thinking involved in scientific inquiry (Schauble et al., 1991).

High-school students do not distinguish between the roles of science and technology unless explicitly asked to do so (Fleming, 1987). This is evidenced, for example, by students' view that science serves the public interest. More generally, some students believe science affects society in more positive ways than does technology. That is partly because students associate science with medical research but associate technology with pollution or weapons. Students appear to understand the impact of science on technology, but they do not always appreciate the impact of technology on science (Fleming, 1987).

